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Contents

Jet Aircraft

Turboprop Aircraft

Piston Aircraft

Helicopters

Hot Air Balloons

Near Collision

Jet aircraft

Smoke and fumes event involving Boeing 787, N36962

What happened

Boeing 787, N36962

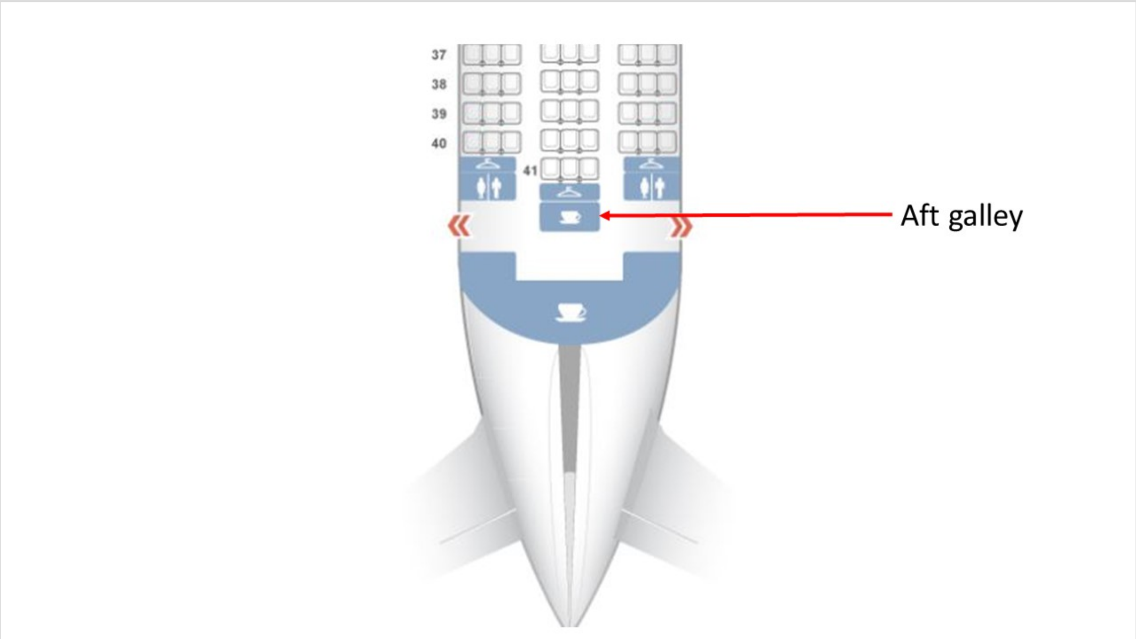
Source: John Richard Thomson

On 17 April 2016, a Boeing 787-9, registered N36962, operated by United Airlines as flight UAL870, departed Sydney, New South Wales (NSW), for San Francisco, United States. On board were 4 flight crew, 11 cabin crew and 238 passengers. During the departure, cabin crew switched on the aft galley ovens (Figure 1) in preparation for meal services.

After the two ovens were switched on, there was a short burst of smoke, which set off a fire alarm in a nearby toilet for about one minute. One of the ovens displayed a “FAILURE” message. Several cabin crew detected a strong chemical odour and an electrical smell, as well as a blue haze. Other crew described it as an ozone smell. The oven interactive screen displayed a ‘Critical Error- Broken Fuse’ message.

The crew immediately pulled all relevant circuit breakers, and switched off all electrical sources to the aft galley. The inflight service manager (ISM) advised the captain. The ISM and a relief pilot from the cockpit arrived at the aft galley with fire extinguishers. By this stage, the smoke had dissipated, but the odour persisted. As it could not be confidently ascertained that the ovens were the sole source of the problem, the captain contacted the ground-based technical operations maintenance controller (TOMC) by satellite phone.

Figure 1: Rear section of a B787-9 depicting aft galley



Source: SeatGuru modified by the ATSB

The discussion with the TOMC involved all flight crew and the ISM. It was agreed that the safest option was to return the aircraft to Sydney. The captain advised ATC by a PAN[1] call. ATC initiated an INCERFA[2] phase. About 110 km east of Port Macquarie, NSW, the crew commenced a return to Sydney. As the aircraft was well in excess of its allowed landing weight, fuel was dumped during the descent.

The aircraft landed without incident in Sydney at 1258 Eastern Standard Time (EST) with emergency services in attendance.

Post-incident engineering report

A post-engineering inspection quarantined the suspect oven, and after an inspection, a fuse was replaced. After appropriate testing, the aircraft was released back to service.

Boeing and the oven manufacturer investigated the cause of the 'Critical Error' fault displayed on the oven screen (Figure 2).

The manufacturer individually tested all oven components. They reported that all individual components worked correctly, however, an additional measurement of the oven motor current detected that the motor did not run smoothly. The motor temperature was also above normal, most likely from insufficient airflow. This known fault had been rectified with a new oven software release.

Boeing reported that the oven manufacturer is working with United Airlines to update the software in all relevant ovens in their fleet.

The exact cause of the odour could not be determined.

A second similar occurrence

United Airlines have advised the ATSB of a second similar occurrence involving another B787 aircraft. On 2 June 2016, a United Airlines B787 aircraft, N35953 experienced an electrical/heat odour in the mid B galley. The flight crew dumped excess fuel and returned safely to Melbourne. On this occasion, no emergency was declared.

Maintenance were able to isolate one oven, and confirmed the error was a broken fuse. The oven was removed and replaced, and the aircraft returned to service.

Figure 2: Error message from oven on N35953

ATSB comment

As part of the investigation, the ATSB obtained reports from the flight crew and cabin crew on board during the incident.

It was evident that all emergency procedures were carried out efficiently and effectively. The captain involved all relevant crew members and the TOMC prior to making a decision to return the aircraft to Sydney.

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1 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.

2 INCERFA is an uncertain ty phase when doubt exists as to the safety of the aircraft and its occupants

Safety message

This incident highlights the correct management of an abnormal situation with effective crew coordination. Each crew member responded effectively and the situation was professionally managed by the captain.

General details

Occurrence details

Date and time:	17 April 2016 – 1048 EST	
Occurrence category:	Incident	
Primary occurrence type:	Smoke and fumes	
Location:	110 km E of Port Macquarie Airport (BEADS IFR)	
	Latitude: 31° 36.18' S	Longitude: 154° 00.30' E

Aircraft details

Manufacturer and model:	Boeing 787-9	
Registration:	N36962	
Operator:	United Airlines	
Serial number:	35880	
Type of operation:	RPT – High Capacity	
Persons on board:	Crew – 15 crew	Passengers – 238
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Smoke event involving Airbus A380, VH-OQD

What happened

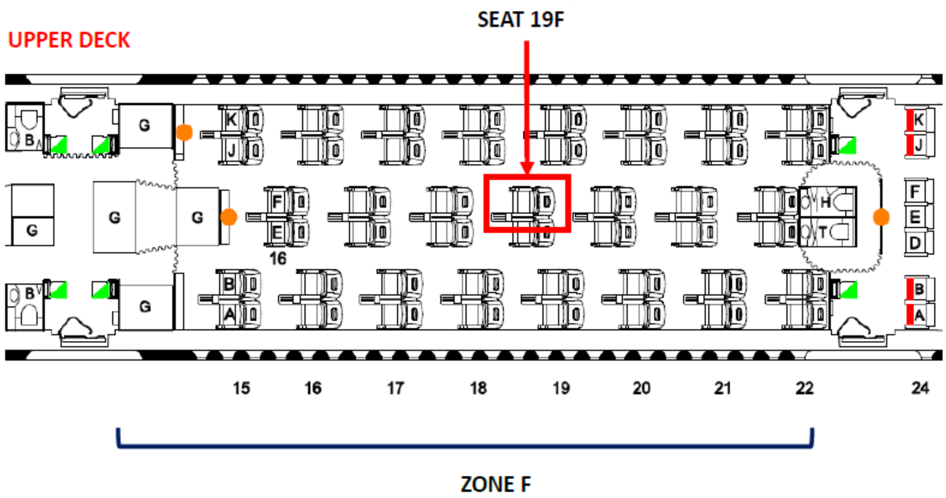
On 15 May 2016, a Qantas Airways Airbus A380 aircraft, registered VH-OQD, operated flight QF7 from Sydney, New South Wales to Dallas-Fort Worth, Texas, United States.

About two hours prior to the aircraft's arrival in Dallas-Fort Worth, a passenger alerted the cabin crew to the presence of smoke in the cabin. The cabin crew then initiated the basic fire drill procedure.

Two of the cabin crew proceeded to the source of the smoke with fire extinguishers. At the same time, the customer services manager (CSM) made an all stations emergency call on the aircraft interphone to alert flight crew and other cabin crew to the presence of smoke.

The cabin crew located the source of the smoke at seat 19F, in Zone F, on the upper deck (Figure 1). The crew removed the seat cushions and covers from seat 19F while the CSM turned off the power to the centre column of the seats. When the seat was further dismantled, the crew found a crushed personal electronic device (PED) wedged tightly in the seat mechanism. The cabin crew assessed that the crushed PED contained a lithium battery.

Figure 2: Cabin diagram showing the seat from where the smoke emanated



Source: Qantas, modified by ATSB

By that time, the PED was no longer emitting smoke, however, a strong acrid smell remained in the cabin. The crew then manoeuvred the seat and freed the PED (Figure 2). The crew placed the PED in a jug of water, which was then put in a metal box and monitored for the remainder of the flight.

The flight crew did not receive any abnormal indications or warnings.

No passengers were injured and the aircraft was not damaged in the incident.

Figure 2: Crushed PED after removal from seat

Source: Qantas

Operator comments

The aircraft operator commented that it has been estimated over one billion lithium batteries are transported by air every year, with potentially hundreds carried on single sectors on large aircraft. As such, both cabin crew and passenger education remains a key component to managing these events. Raising passenger awareness of the potential hazards of PEDs commences at check-in, through to the pre-flight safety demonstration, and aims to minimise the risk of PED thermal runaway events.

Qantas Airlines' basic fire drill is based on a teamwork approach, with the division of duties between three central crew and as many supporting crew as available and required. This division of duties allocates the responsibilities of fighting the fire, retrieving equipment and ensuring lines of communication with the flight deck remain uninterrupted.

ATSB comment

Similar occurrences

The ATSB has received 17 notifications of similar incidents of lithium battery thermal events in aircraft over the past 6 years.

The ATSB investigation AO-2014-082 details an example where a short circuit between lithium batteries initiated a fire in an aircraft cargo hold.

Safety message

This incident provides an excellent example of an effective response to an emergency situation. The crew were able to quickly implement the basic fire drill procedure which defined the roles and responsibilities of the responding crew. This enabled a rapid and coordinated response to the smoke event using all available resources. The effective implementation of this procedure also ensured the flight crew were kept informed as the situation developed.

This incident also highlights the hazards of transporting lithium-ion battery powered PEDs. The Civil Aviation Safety Authority web page *Travelling safely with batteries* and pamphlet *Is your luggage safe?* provide information on the safe carriage of lithium-ion batteries and lithium-ion powered devices aboard aircraft.

General details

Occurrence details

Date and time:	16 May 2016 – 1535 UTC	
Occurrence category:	Serious incident	
Primary occurrence type:	Smoke event	
Location:	1,500 km WSW of Dallas-Fort Worth Airport, United States	
	Latitude: 28° 59.48’ N	Longitude: 111° 36.39’ W

Aircraft details

Manufacturer and model:	Airbus A380	
Registration:	VH-OQD	
Operator:	Qantas Airways	
Serial number:	0026	
Type of operation:	Air transport high capacity – Passenger	
Persons on board:	Crew – 24	Passengers – Unknown
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Turboprop aircraft

Runway incursion involving Hawker Beechcraft Corporation 200, VH-FDG, and vehicle

What happened

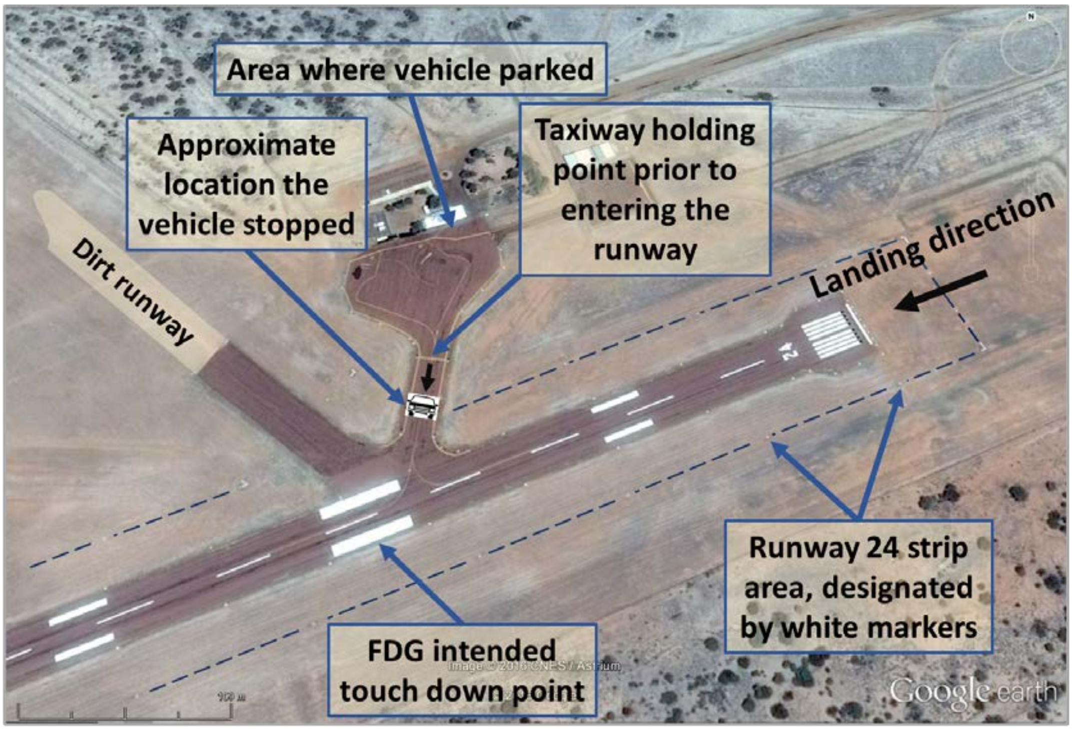
On the night of 28 February 2016, at about 0230 Eastern Standard Time (EST), a Hawker Beechcraft Corporation B200 aircraft, registered VH-FDG (FDG), was on descent to Blackall Airport, Queensland. The pilot, a doctor and a nurse were on board the aeromedical flight.

Earlier at about 0220, an ambulance driver was dispatched to Blackall Airport by the ambulance coordination centre to meet FDG and facilitate the transportation of a patient. The ambulance driver was the only occupant of the vehicle.

The pilot conducted a RNAV instrument approach to runway 24 at Blackall Airport. On descent, the pilot tried to contact the ambulance driver on the UHF channel but was unsuccessful. The ambulance driver arrived at the airport at about 0231 and noticed that the runway 24 lights were on (the pilot activated the runway lights at about 25 NM using the pilot activated lighting system),[1] and looked to see if the aircraft could be seen or heard, looking for the aircraft in both directions of the runway.

At about 4.5 NM from Blackall, the pilot noticed the stationary ambulance flashing lights close to the terminal building. The terminal building was located about 90 meters from the runway holding point and about 190 m to the runway centre line (Figure 1).

Figure 1: Blackall airport runway 24



Source: Google earth, modified by the ATSB

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1 Pilot activated runway and taxiway lighting is activated by a series of timed transmissions using the aircraft's very high frequency radio, on either a discrete or the local airport communication frequency.

As the ambulance driver did not see or hear the aircraft, and was of the understanding that a runway inspection for animals was required to be completed before the aircraft arrived, they drove quickly down the taxiway towards the runway.

As FDG passed over the threshold of runway 24, and the pilot noticed the flashing lights of the ambulance on the taxiway passing through the holding point, and traveling at speed toward the anticipated touch down point of the aircraft. The pilot initiated a missed approach[2] and climbed out at about 20 ft above the runway.

At about the same time as the pilot initiated a missed approach, the ambulance driver saw the aircraft and stopped the ambulance near the runway white gable markers for runway 24 (Figure 1). The ambulance driver returned the vehicle back to the terminal and parked near the terminal building under the terminal floodlights with the vehicles flashing lights on.

The pilot climbed the aircraft to circuit height and was unable to contact the ambulance driver on the UHF channel, so contacted the ambulance coordination centre using the aircraft's SAT phone. On the downwind leg of the circuit, the pilot was unable to see the ambulance, so elected to climb and enter a hold pattern about 5,000 ft above the airport to extend the SARTIME[3] on the HF radio.

The coordination centre contacted the ambulance driver and instructed them to contact the pilot on a VHF channel[4] (the vehicle VHF radio was not capable of being set to the common traffic advisory frequency (CTAF)). After about 10 minutes, the driver determined that they needed to contact the pilot on the UHF radio, and then was able to communicate with the pilot.

After the ambulance driver conducted the runway strip inspection, as requested by the pilot, the pilot descended the aircraft, and landed without incident.

Pilot comment

The pilot reported that there was a low moon and a clear night with good visibility and turbulence below 5,000 ft. There was about 25 knots crosswind from the left of runway 24. As the wind was coming from the left, the right wing of the aircraft obscured the vehicle traveling toward the runway until the pilot levelled the aircraft for a landing. The last time the pilot saw the vehicle it was stationary at the terminal.

The pilot indicated that it is not normal to request a strip run at Blackall Airport, as a high fence around the perimeter of the airport seems to keep the kangaroos out.

Ambulance driver comment

The driver indicated that some of the airport buildings may have obscured the approaching aircraft and as the airport lights are very bright, they may have made it more difficult to see the aircraft from where the ambulance was located.

The ambulance driver reported that all the external lights of the ambulance were on including the red and blue flashing lights, red rotating beacon and vehicle headlights. The ambulance may have been difficult to see by the pilot after the missed approach, as the driver parked the vehicle close to the terminal under the bright terminal lights, where the driver believed (at the time) the vehicle would be easy to see.

The vehicle was equipped with a UHF and a VHF radio, a SAT phone, and a portable handset. The ambulance driver commented that in some placements the UHF radio is not needed or rarely used so it was easy to forget that there was a UHF radio fitted to the vehicle.

The driver was informed during a one-day induction course, three days prior to the incident, that a strip run was needed to be performed before the aircraft could land at night.

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2 An approach to land that is aborted for any reason, followed by a go around.
3 Time nominated by a pilot for the initiation of search and rescue action if a report from the pilot has not been received by the nominated unit.
4 Audio communications transcript provided by ambulance operator.

Aircraft operator comment

The aircraft operator conducted an investigation into the occurrence and noted the following:

- Blackall is a security-controlled airport. All persons wishing to access the airport 'airside' are required to undertake an airport induction program prior to access.
- Blackall airport has standard low intensity runway lighting for runway 06/24, spaced at 60 m intervals each side of the runway. The pilot had activated the lights remotely using the pilot activated lighting system. Blue sideline lights are provided for the taxiway and the apron has floodlighting.
- The instrument approach to runway 24 was being carried out not due to poor weather, but to facilitate a stable arrival and a runway aligned approach. The approach ensures terrain clearance and provides slope guidance during the approach to the runway.
- Blackall is a certified airport. All vehicles entering the flight strip are required to both listen out for air traffic, and broadcast intentions, on the CTAF prior to entering the flight strip, and again once clear of the flight strip.
- The ability to communicate with a vehicle operating 'airside' enables the pilot to confirm that the vehicle will be clear of the runway prior to landing, and to pass any specific instructions as required, for example an instruction to douse vehicle headlights and flashing hazard lights. Other information may be exchanged, for example confirmation that an airstrip has been inspected and is clear of animals.
- Night operations at regional, rural, and remote airstrips present a significant animal strike hazard. To mitigate the risk, the operator prefers that all aerodromes that present an animal hazard are inspected prior to the aircraft landing. A request by the pilot for a driver to conduct a strip check is communicated through the coordination centre and not directly to the driver. This removes the opportunity for the pilot to brief the driver directly.
- There is an internal publication listing details of many unregistered aerodromes and private airstrips in Queensland. The publication contains some entries warning of animal hazards, but does not specify the appropriate person or organisation to carry out an inspection at each location.

Ambulance operator comment

The ambulance operator conducted an investigation into the occurrence and noted the following:

- A company induction was conducted on the driver's day off prior to commencing work for the first time at Blackall. There was a lot of information to cover during the allocated one-day induction schedule.
- An airport operator induction program existed that should be completed by anyone accessing the Blackall Airport. The program had not been made available to the driver at the time of the incident. The person who the driver had replaced had been based at Blackall for about 13 years and had indicated that they had not conducted an airport induction course.
- The driver was not informed, or aware, that when the runway lights were on at night that the arrival of the aircraft was imminent.
- The conduct of strip inspections for animals at Blackall was not based on a written agreement.
- Blackall Airport is a certified airport and required that vehicles accessing the taxiway, runway, and/or runway strip have a VHF radio suitable for use on the CTAF. The ambulance had a UHF and VHF radio but the VHF radio was not capable of accessing the CTAF. At the time of the incident, the UHF radio was not turned on.

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 are taking the following safety actions:

- Runway strip inspections will continue for night operations at aerodromes with known or suspected animal hazard, where appropriate ground personnel can safely conduct the inspections.
- Formal procedures will be developed in conjunction with the ambulance operator detailing safety procedures for those rural/regional stations where a request for a runway inspection is likely.
- Appropriate procedures will be developed for requesting airstrip inspections, including advice on the different requirements for CTAF and non-CTAF aerodromes, for incorporation in the airstrip data manual.
- Closer safety liaison between the respective ambulance and operator safety departments.

Ambulance operator

As a result of this occurrence, the ambulance operator has advised the ATSB that they are taking the following safety actions:

- Staff that undertake work at the Blackall Airport will attend the airport operator induction program.
- Establish consultative arrangements with key stakeholders.
- Review the local UHF/VHF radio communications procedures between the operation centre, aircraft operator, airport operator, and ambulance attending the airport.
- Review of induction programs for staff in consultation with the aircraft operator and the airport operators to ensure that the induction consists of specific guidance material that covers all aviation safety requirements for staff who may undertake work at the airport. All new and existing staff will participate in the revised induction program.
- Review induction workbooks to ensure that the workbook reflects all aviation safety requirements for staff who may undertake work at an airport or aerodrome. Once the workbook has been reviewed, all new and existing staff will be provided with a copy of the workbook.
- Conduct a review of the Blackall standard operating procedures to ensure that the procedures cover all aviation safety requirements.

Safety message

The International Civil Aviation Organization (ICAO) has identified runway safety as one of its priorities and has been working with countries and aviation organisations globally to reduce runway safety accidents. ICAO has developed a runway safety website, which offers a range of information and products to assist the aviation community to improve runway safety.

In addition, ICAO has published a *Manual on the prevention of runway incursions* (Doc 9870 AN/463), available from the ICAO website. The manual includes information on the prevention of runway incursions. The manual discusses that deficiencies in design, training, technology, procedures, regulations and human performance can result in a system breakdown and safety being compromised.

Additional information on runway safety is also available from the Airservices Australia webpage Runway safety.

In addition, Airservices Australia has published a guide for airside drivers, *The airside drivers guide to runway safety*, which focuses on four aspects of operating safely on an aerodrome:

1. *planning your airport operation*
2. *airport procedures*
3. *communications*
4. *airport markings, signs and lights.*

General details

Occurrence details

Date and time:	28 February 2016 – 0236 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	Blackall Airport, Queensland	
	Latitude: 24° 25.67' S	Longitude: 145° 25.72' E

Aircraft details – VH-FDG

Manufacturer and model:	Hawker Beechcraft Corporation 200	
Registration:	VH-FDG	
Serial number:	BB-2012	
Type of operation:	Aerial work - EMS	
Persons on board:	Crew – 3	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Damage:	Nil	

Piston aircraft

Hard landing involving Maule MT-7, VH-DRS

What happened

On 16 May 2016, the pilot of a Maule MT-7-235 aircraft, registered VH-DRS, conducted a private flight from Greenfields airstrip (near Noosa), Queensland, with two passengers on board.

The aircraft departed Greenfields airstrip at about 1220 Eastern Standard Time (EST) and flew to Gympie ALA, where the aircraft was refuelled. The aircraft then departed from Gympie and flew north towards Maryborough before returning to Greenfields along a coastal route.

The aircraft joined the circuit at Greenfields on the downwind leg for runway 09. The pilot turned on to the final approach at about 800 ft above ground level, with an airspeed of about 70 kt. The pilot noticed they were getting low on the approach and at about 500 ft, they increased the power to regain their approach path. The pilot subsequently assessed that the aircraft was too high and lowered the nose to re-intercept the approach path.

The pilot flared the aircraft for landing, the aircraft landed heavily and bounced into the air. As the aircraft landed again, the nose wheel touched down first (before the main landing gear) with sufficient force that the nose wheel strut fractured. The nose landing gear and propeller then dug into the ground and the aircraft rotated over its nose and slid a short distance inverted before coming to rest.

The pilot and one passenger were uninjured, the other passenger sustained minor injuries, and the aircraft sustained substantial damage (Figure 1).

Figure 3: Accident site showing damage to VH-DRS

Source: Aircraft owner

Pilot comments

The pilot provided the following comments:

- they taxied the full length of the strip before departure from Greenfields and noted the grass surface was in good condition
- they had flown about five flights, totalling about 20 hours in the last 12 months
- the pilot's previous flight was about 4 to 5 weeks prior to the accident flight

- the pilot had not operated the Maule aircraft with more than one passenger on board prior to the accident flight
- the pilot thought that the higher all-up-weight of the aircraft with an extra passenger on board contributed to a higher sink rate on final than they expected
- the pilot commented that they should have performed a go-around, rather than continuing with the landing manoeuvre.

ATSB comment

Currency versus proficiency

At the time of the accident the pilot was current for passenger-carrying operations, having conducted at least three take-offs and three landings in the last 90 days. However, it was more than one month since their last flight, which was also a local area scenic flight. The take-off and landing phases of flight are critical phases of flight, since the aircraft is operating closer to the stall speed and with less height to recover from a control problem, relative to cruise flight. The requirement for three take-offs and three landings in the last 90 days is a regulatory requirement of currency, but this does not guarantee proficiency. When flying infrequently, proficiency in take-offs and landings can be improved by dedicating a portion of the flight to practicing circuits. The United States Federal Aviation Administration safety briefing September/October 2010 described this as ‘imbuing the quantity of all your flying, however limited, with quality.’

Safety message

Go-around

The pilot commented that conducting a go-around could have prevented an unstable approach and initial bounce from escalating to an accident. General aviation pilots should set their own criteria for when to conduct a go-around manoeuvre, so that they can recognise and respond to the conditions in a timely manner. This will assist pilots to develop a mindset, which the Flight Safety Foundation (FSF) refers to as ‘go-around-prepared’. FSF Approach-and-landing Accident Reduction (ALAR) briefing note 6.1 emphasises the need to be ‘go-around-prepared’ or ‘go-around-minded’ because the execution of a go-around is an infrequent manoeuvre. FSF ALAR briefing note 7.1 provides further information on unstable approaches and how to develop personal lines of defence.

General details

Occurrence details

Date and time:	16 May 2016 – 1545 EST	
Occurrence category:	Accident	
Primary occurrence type:	Hard Landing	
Location:	Greenfields airstrip, 18 km NW of Noosa ALA, Queensland	
	Latitude: 26° 17.60' S	Longitude: 152° 57.80' E

Aircraft details

Manufacturer and model:	Maule Aircraft Corporation	
Registration:	VH-DRS	
Serial number:	18091C	
Type of operation:	Private – Pleasure/travel	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – 0	Passengers – 1 (Minor)
Aircraft damage:	Substantial	

Loss of control and collision with terrain involving Cessna 206, VH-NTK

What happened

On 5 June 2016, the pilot of a Cessna 206 floatplane, registered VH-NTK, was taking off from the Southport Broadwater about 6 km south-east (SE) of Southport Airport, Queensland, for a charter flight with two passengers on board.

The wind was blowing from the west-north-west (WNW) at about 18 kt, with gusts of variable speed. The take-off direction to the north-west (NW) was too restrictive due to the presence of boats in the area, so the pilot elected to begin the take-off towards the south-west (SW) (Figure 1). Taking off to the SW would be through a jet-ski course and a crosswind from the right. Once clear of the jet-ski course, the pilot intended to veer right onto a more westerly (into wind) heading to complete the take-off.

The pilot set 20° flap and left the water rudders[1] in the down position to assist with directional control at the start of the take-off run. The pilot applied full power to start the take-off run and the aircraft pitched[2] backwards into the plowing position.[3] The pilot retracted the water rudders about five seconds into the take-off run, and about two seconds later, pitched the aircraft forward from the plowing position into the step position.[4] As the aircraft pitched forward onto the step it veered to the left onto a south-south-west (SSW) heading (this increased the crosswind experienced – see textbox 4 in Figure 1). The pilot maintained the aircraft on this heading until they sighted barrels in the water that were used to mark the jet-ski course.

The pilot could not prevent the veer to the left, even with full right rudder, so after sighting the jet-ski course barrels, the pilot pitched the aircraft backwards into the plowing position to improve directional control on the water.[5] The pilot then alternated pitching the aircraft between the plow and step position in order to gradually veer to the right onto a more westerly heading (textbox 5 in Figure 1).

As the aircraft was passing a SW heading and was turning towards WSW, the right wing lifted and the aircraft rolled[6] to the left. The roll continued, despite the application of full right aileron by the pilot, until the left wing impacted the water. The aircraft rotated to the left through about 270° and the nose and propeller ploughed into the water. The aircraft then came to a stop in an upright position, facing in a westerly direction (Figure 1).

The pilot assessed the condition of the aircraft and elected not to evacuate the passengers. The aircraft was then towed to shore by a jet-ski. There were no injuries and the aircraft was substantially damaged (Figure 2 and 3).

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1 Retractable control surfaces on the back of each float that can be extended downward into the water to provide more directional control when taxiing. They are attached by cables and springs to the air rudder and operated by the rudder pedals in the cockpit.

2 The term used to describe the motion of an aircraft about its lateral (wingtip-to-wingtip) axis.

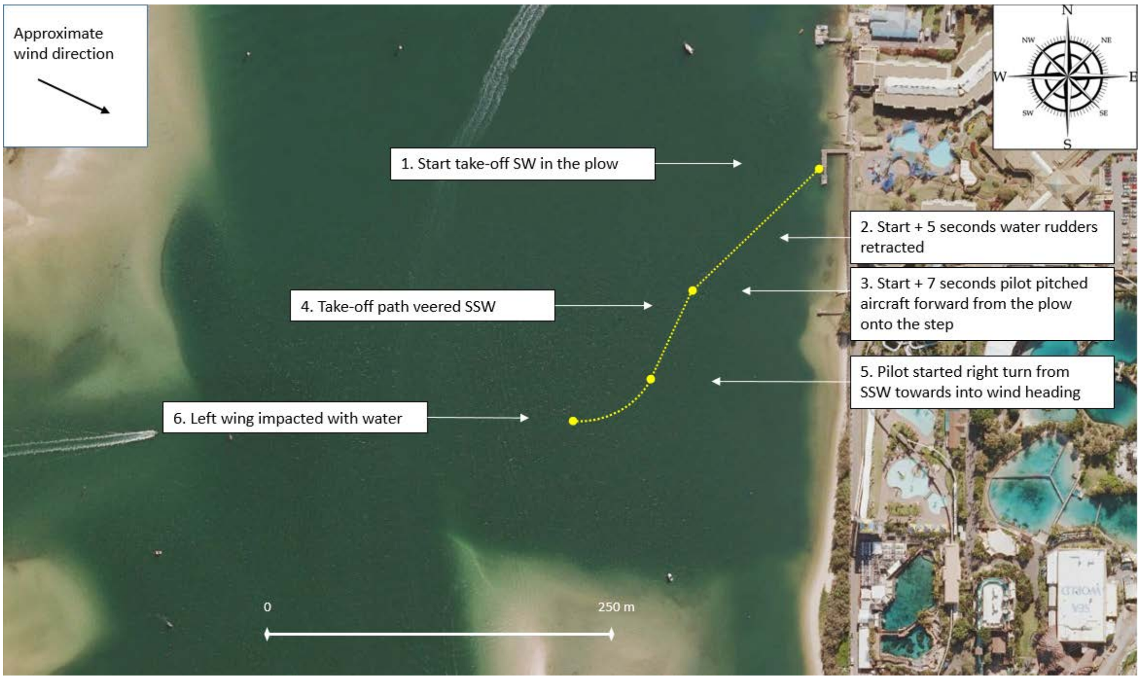
3 A nose high, powered taxi characterised by high water drag and an aftward shift of the centre of buoyancy. The weight of the floatplane is supported primarily by buoyancy, and partially by hydrodynamic lift.

4 The attitude of the floatplane when the entire weight of the aircraft is supported by hydrodynamic and aerodynamic lift, as it is during high-speed taxi or just prior to take-off. This position, which is also referred to as the planing position, produces the least amount of water drag.

5 When on the step position the keel of the floats tend to resist turning motion.

6 Term used to describe movement of an aircraft about its longitudinal axis.

Figure 4: Approximate take-off path and key events



Source: Google earth modified by ATSB

Figure 2: VH-NTK left wing damage

Source: Owner

Figure 3: VH-NTK rear strut fracture (view of the left float facing forwards)

Source: Owner

Pilot comments

The pilot provided the following comments:

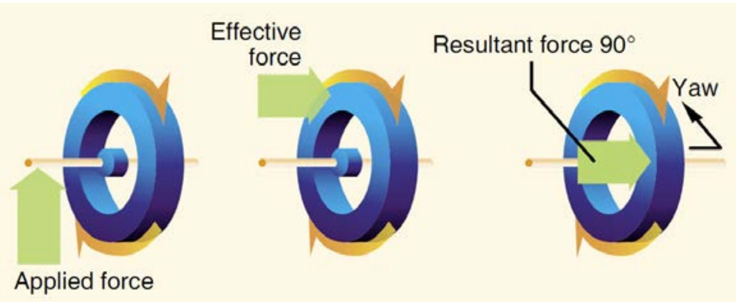
- the force that veered the aircraft to the left occurred when they pitched the aircraft forward from the plow position to the step position
- they were turning the aircraft right through SW towards WSW when it rolled
- they were holding full into wind (right) aileron control and therefore expected the left wing to lift prior to the right wing
- when they rolled to the left they were 'shocked' by the crosswind and 'surprised' they could not control the floatplane
- they estimated the strength of the gust that lifted the right wing was about 8–10 kt
- they had about 110 litres of fuel in the left wing tank and about 60 litres in the right wing tank, which may have contributed to the left roll
- the floatplane rolled left at about 30–35 kt airspeed
- the crosswind limit is 20 kt
- the take-off speed is 41 kt with 20° flap set.

Left turn effect

There are four distinct propeller forces, each of which produce a left turning force on an aeroplane, as follows:

- Torque effect: As the engine internal parts and propeller rotate clockwise, as viewed by the pilot, an equal force tries to rotate the aircraft in the opposite direction. This force places more weight and consequently more hydrodynamic drag on the left float of a floatplane.
- Slipstream effect: The clockwise spiralling motion of the propeller slipstream means that the slipstream strikes the left side of the vertical fin. This produces a yawing[7] moment to the left.
- P-factor: In a nose high attitude the 'bite of air' of the downward moving blade of the propeller is greater than the 'bite' of the upward moving blade, which moves the centre of thrust to the right side of the propeller disc. This also produces a yawing moment to the left.
- Gyroscopic effect: The rotating propeller behaves like a gyroscope. As such, any time a force is applied to deflect the propeller from its plane of rotation, the resultant force is 90° ahead in the direction of rotation, and in the direction of the effective force (Figure 4). As such, the gyroscopic effect results in a yawing motion to the left when the aircraft is pitched forward from the plow position to the step position.

Figure 4: Gyroscopic effect



Source: FAA pilot's handbook of aeronautical knowledge

Additional information is available from the United States Federal Aviation Administration (FAA) *Pilot's handbook of aeronautical knowledge*, chapter 4: Aerodynamics of flight.

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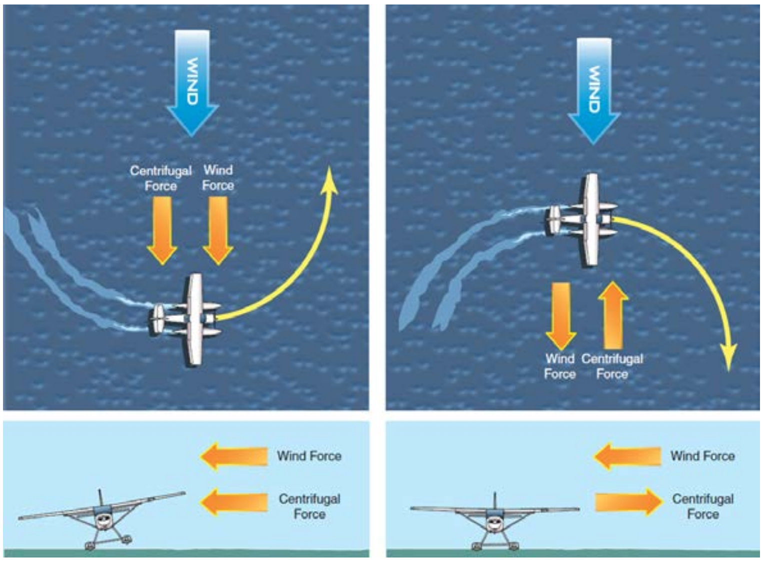
7 Term used to describe the motion of an aircraft about its vertical or normal axis.

Crosswind take-off

According to the FAA *Seaplane operations handbook*, crosswinds can present special difficulties for floatplane pilots. If the aircraft turns towards the wind during a crosswind take-off, then centrifugal force will combine with the wind force to produce a rolling moment in the opposite direction to the turn (Figure 5). If strong enough, the combination of wind and centrifugal force may lift the upwind wing and submerge the downwind float, rolling the aircraft until the downwind wingtip strikes the water. This is known as a water-loop (Figure 6).

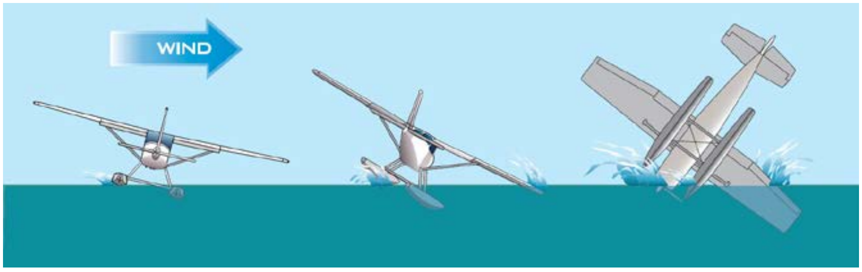
Centre of gravity[8] location also affects the floatplane's handling characteristics on the water. If the centre of gravity is located to one side of the centre-line, such as a fuel imbalance between the tanks, one float must support more weight and therefore displace more water than the other float, resulting in more water drag on that side (Figure 7).

Figure 5: Effect of wind force and centrifugal force



Source: FAA seaplane operations handbook

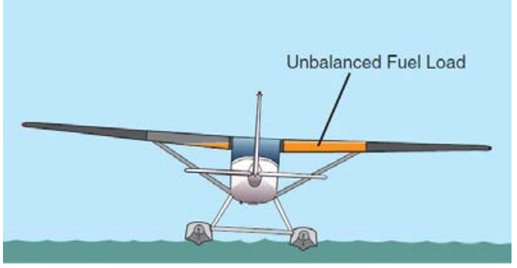
Figure 6: Water-loop



Source: FAA seaplane operations handbook

8 Point through which resultant force of gravity acts, irrespective of orientation; in uniform gravitational field, centre of mass.

Figure 7: Effect of fuel imbalance on centre of gravity



Source: FAA seaplane operations handbook

ATSB comment

The pilot reported that it was the force from the forward pitching motion of the aircraft from the nose-high plowing position to a nose-level step position that resulted in the aircraft veering left from the planned take-off path. The force that produces this motion is the gyroscopic effect. At the time of the uncommanded roll to the left the aircraft was turning right with a strong crosswind from the right and more fuel distributed in the left tank than in the right tank. These factors probably combined to elevate the risk of submerging the downwind float and lifting the upwind wing, resulting in a water-loop.

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.

Operator

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

Changes to operating procedures

The operator is updating their operations manual to incorporate the following procedural changes:

- The channel at the operating base is orientated north-south, which restricts movements orientated east-west, therefore if the wind is forecast to gust more than 20 kt from the west, or within 30° either side of west, the take-off must be rejected.
- If the aircraft veers to the left during the take-off run and requires full control inputs, then reject the take-off.

Safety message

This accident highlights the risk of a water-loop event during a crosswind take-off in a floatplane. The combined forces acting on a floatplane have the potential to significantly reduce the margin of control available to the pilot. The FAA *Seaplane operations handbook* provides several recommended crosswind take-off techniques, including the considerations associated with arcing manoeuvres during take-off. If an arcing manoeuvre is to be attempted then the FAA handbook recommends placing the centrifugal force and wind force on opposite sides, and reducing the radius of the arc as the floatplane speed increases.

Refer to the FAA *Seaplane operations handbook* for a detailed explanation of the recommended crosswind take-off techniques.

General details

Occurrence details

Date and time:	5 June 2016 – 1335 EST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	6 km SE of Southport Airport, Queensland	
	Latitude: 27° 57.60’ S	Longitude: 153° 24.87’ E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company U206G	
Registration:	VH-NTK	
Serial number:	U20605862	
Type of operation:	Charter - passenger	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Substantial	

Collision with terrain involving de Havilland DH-82, VH-BJE

What happened

On 3 April 2016, the pilot of a de Havilland DH-82 aeroplane, registered VH-BJE, conducted a 30-minute scenic flight from Redcliffe Airport, Queensland, with one passenger on board. The weather was fine, with wind was from the east-northeast at less than 8 kt, no precipitation, and the runway was dry.

On returning to Redcliffe, the pilot elected to join the circuit on a mid-field crosswind leg for runway 07. The pilot reported that the approach was normal.

As the aircraft landed, the pilot reported the tail was slightly higher than normal, but the aircraft's speed was normal. The aircraft wheels touched down at the pilot's aiming point, about half way along the grass strip to the right of the sealed runway. The pilot reported that the wheels seemed to dig in. The aircraft nose pitched down, the propeller struck the grass runway, and the aircraft rolled over forwards, coming to rest inverted (Figure 1).

The pilot and passenger were uninjured. The aircraft sustained substantial damage.

Figure 5: Accident site showing damage to VH-BJE

Source: Ron Ennis – modified by the ATSB

Pilot comments and experience

At the time of the accident, the pilot had a total of 259.3 hours of aeronautical experience, including 7.9 hours on the aircraft type. The pilot held tailwheel and aerobatic endorsements, obtained in an American Champion/Bellanca Citabria aircraft.

The pilot commented that the ground was a bit soft where the wheels had touched down, but that they had landed there twice previously that day without incident. In future, the pilot would land with a slightly higher nose attitude.

General details

Occurrence details

Date and time:	3 April 2016 – 1415 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	Redcliffe Airport, Queensland	
	Latitude: 27° 12.40' S	Longitude: 153° 04.07' E

Aircraft details

Manufacturer and model:	de Havilland Aircraft DH-82A	
Registration:	VH-BJE	
Serial number:	A17-97	
Type of operation:	Charter - Passenger	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Substantial	

Collision on ground involving Cessna 172, VH-EWZ, and Cessna 172, VH-SYH

What happened

On 13 May 2016, the student pilot of a Cessna 172S aircraft, registered VH-EWZ (EWZ), was conducting solo circuits at Moorabbin Airport, Victoria. The runway in use was runway 35 right (35R), and the wind was west to north-westerly at 10 to 20 kt. At the same time, the pilot of a Cessna 172R aircraft, registered VH-SYH (SYH), was also conducting circuits. SYH was the aircraft immediately ahead of EWZ in the circuit.

The student pilot of EWZ completed eight circuits. During that time, the wind, in particular the crosswind, increased and was subsequently reported as 9 to 15 kt from the left of runway 35R.

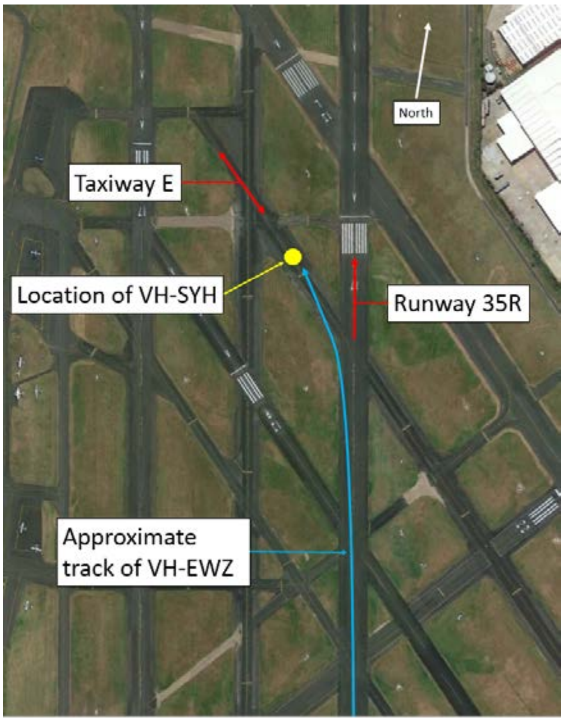
At the completion of their circuit training, the pilot of SYH landed and taxied clear of runway 35R, stopping on taxiway E facing north-west (Figure 1). Soon after SYH landed, at about 1059 Eastern Standard Time (EST), EWZ was on the final approach for another touch-and-go landing.[1]

The pilot reported that during the landing, EWZ touched down heavily to the left of the runway centreline.[2] The pilot then applied full power to continue the take-off. As the power increased, the aircraft yawed to the left and ran off the runway. At that time, the pilot of EWZ sighted SYH on the taxiway, reduced the power to idle and applied full right rudder in an effort to avoid SYH.

1 Touch-and-go landing is a manoeuvre which is common when learning to fly fixed-wing aircraft. It involves landing on a runway and taking off again without coming to a full stop. Usually the pilot then circles the airport in a defined pattern known as a circuit and repeats the manoeuvre. This allows many landings to be completed in a short time.

2 The ATSB obtained recorded data from the incident flight for EWZ. The data showed the aircraft touched down slightly to the right of the runway centreline.

Figure 1: Moorabbin Airport showing location of collision



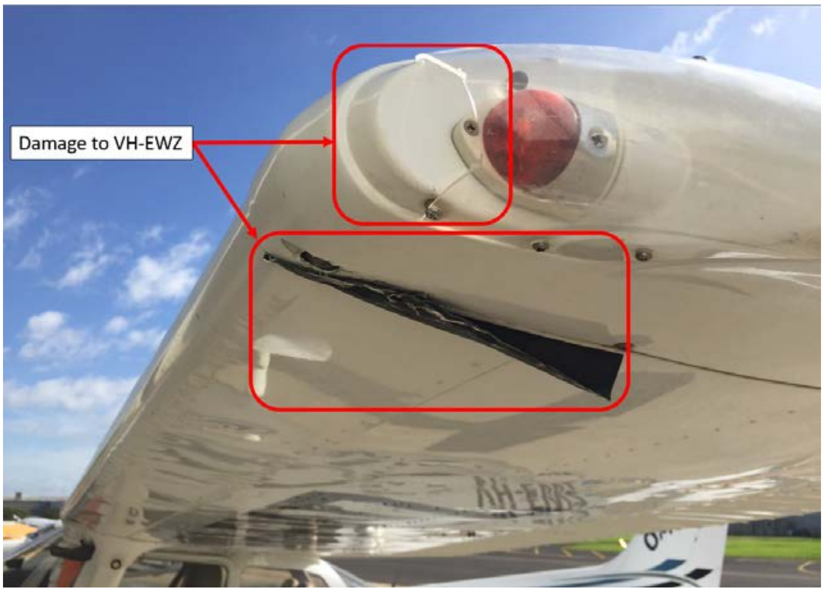
Source: Google earth – annotated by ATSB

The underside of the left wing of EWZ contacted the top of the right wing of SYH (Figure 2). EWZ came to a stop on the grass to the left of runway 35R. Both aircraft sustained minor damage and the pilots were uninjured (Figure 3).

Figure 2: Damage to right wing of VH-SYH

Source: Aircraft operator

Figure 3: Damage to left wing of VH-EWZ



Source: Aircraft operator

Pilot comments

Pilot of VH-EWZ

The pilot of EWZ provided the following comments:

- In the previous circuits, they had conducted a go-around[3] when they were not comfortable with the approach. On the accident circuit, they assessed that the approach was normal, and elected to continue to land.
- As they applied power to take-off, the aircraft yawed[4] left. They assessed that they may not have applied sufficient rudder input to counter the yaw effect of the increase in power.
- They were using a higher power setting than normal on final approach to maintain the desired approach path due to the crosswind.

Operator comments

Operator of VH-SYH

The operator of VH-SYH provided the following comment:

- In their experience on this aircraft type, yaw induced by crosswind has the potential to be significantly greater than left yaw induced by propeller effects. They suggested that the left yaw induced by the reported crosswind from the left, coupled with not so strong left yaw from propeller effects, combined to create the strong left yaw reportedly experienced.

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 safety action in response to this occurrence.

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[3] A go-around, the procedure for discontinuing an approach to land, is a standard manoeuvre performed when a pilot is not completely satisfied that the requirements for a safe landing have been met. This involves the pilot discontinuing the approach to land and may involve gaining altitude before conducting another approach to land.

[4] Term used to describe the motion of an aircraft about its vertical or normal axis.

Operator of VH-EWZ

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

Company instructors have reviewed the landing technique they were using and teaching. A video demonstration of approach and landing technique was recorded, both for staff training purposes and as a training tool.

Safety message

This incident highlights the importance of knowing your own limits. Pilots should use a ‘personal minimums’ checklist to help control and manage flight risks through identifying risk factors including weather conditions that may affect aircraft handling.

This incident also underlines the importance of applying correct technique during all phases of flight, including take-off and landing. The *CAA NZ – Flight Instructor Guide - Crosswind Circuit* provides useful information for crosswind operations.

General details

Occurrence details

Date and time:	13 May 2016 – 1059 EST	
Occurrence category:	Serious Incident	
Primary occurrence type:	Collision	
Location:	Moorabbin Airport	
	Latitude: 37° 58.55' S	Longitude: 145° 06.13' E

Aircraft details: VH-EWZ

Manufacturer and model:	Cessna Aircraft Company 172	
Registration:	VH-EWZ	
Serial number:	172S10389	
Type of operation:	Flying Training	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Minor	

Aircraft details: VH-SYH

Manufacturer and model:	Cessna Aircraft Company 172	
Registration:	VH-SYH	
Serial number:	17280356	
Type of operation:	Flying Training	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Minor	

Helicopters

Loss of control involving Robinson R22, VH-WGB

What happened

On 12 May 2016, the pilot of a Robinson R22 Beta II helicopter, registered VH-WGB, was conducting aerial work at a property about 221 km east-north-east (ENE) of Port Hedland, Western Australia.

The pilot was observing two other helicopters engaged in aerial mustering for the benefit of the pilot's own learning experience. The pilot's attention was divided between flying the helicopter at about 200 ft above ground level and observing the mustering helicopters, which were operating between ground level and about 200 ft.

At about 1030 Western Standard Time (WST), while manoeuvring the helicopter to observe the mustering operation, the pilot commenced a level 180° turn to the left into wind. At the time the helicopter entered the left turn, it was flying at about 40 kt airspeed with about a 15 kt tailwind component.

Just prior to exiting the turn, the pilot felt the helicopter 'kick'. The helicopter then yawed[1] rapidly to the right and pitched nose down. The pilot applied left pedal in an attempt to counteract the yaw, however, the helicopter did not respond normally to pedal[2] or cyclic[3] control inputs. The pilot also lowered the collective[4] and reduced the throttle. The helicopter pitch attitude[5] oscillated between a steep nose-down and a level attitude as the helicopter rotated towards the ground. As the helicopter neared the ground, the pilot applied aft cyclic, increased the throttle and raised the collective, which levelled the helicopter attitude and reduced the rate of descent.

The helicopter collided with the ground in a level attitude. The helicopter skids and seat collapsed following ground contact. During the accident sequence, the main rotor blades severed the tail boom. The pilot's helmet struck the cyclic and the pilot sustained minor injuries. The aircraft was substantially damaged (Figure 1).

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1 Term used to describe motion of an aircraft about its vertical or normal axis.

2 A primary helicopter flight control that is similar to an aircraft rudder. Pedal input changes the tail rotor thrust to provide heading control in the hover and balanced flight when the helicopter is in forward flight.

3 A primary helicopter flight control that is similar to an aircraft control column. Cyclic input tilts the main rotor disc varying the attitude of the helicopter and hence the lateral direction.

4 A primary helicopter flight control that simultaneously affects the pitch of all blades of a lifting rotor. Collective input is the main control for vertical velocity.

5 Pitch attitude is the angle between the vehicle longitudinal axis and defined reference plane, in this case the local horizon.

Figure 6: Accident site showing damage to VH-WGB

Source: Aircraft Operator

Pilot comments

The pilot provided the following comments:

- the wind was steady at about 15 kt from the south-east with occasional gusts to 20 kt
- the pilot was not sure what the ‘kick’ was, but thought it was due to the wind
- the pilot did not recognise a low gravity (weightless) situation and may have applied incorrect cyclic technique, resulting in the main rotor striking the tail boom
- the pilot thought that the tail boom was severed shortly after the kick because there was no response from the pedals to counteract the yaw and the helicopter immediately entered a nose down spiral
- the pilot’s helmet was damaged during the collision, when it struck and broke the cyclic (Figure 2)
- wearing the helmet probably prevented a more serious injury from occurring.

Figure 2: Damage to pilot's helmet

Source: Helicopter pilot

Loss of tail rotor effectiveness

The United States Federal Aviation Administration (FAA) Helicopter flying handbook

The FAA Helicopter flying handbook chapter 11: Helicopter emergencies and hazards stated that loss of tail rotor effectiveness (LTE) is an uncommanded rapid yaw towards the advancing blade and is an aerodynamic condition caused by a control margin deficiency in the tail rotor. Tail rotor thrust is affected by numerous factors, including relative wind, forward airspeed, power setting and main rotor blade airflow interfering with airflow entering the tail rotor. There are several wind directions, relative to the nose of the helicopter which are conducive to LTE, including the following:

- 285–315°, which can lead to turbulent airflow from the main rotor disc interfering with the tail rotor
- 210–330°, which can lead to the development of unsteady airflow through the tail rotor.

The FAA handbook warns that a combination of factors in a particular situation can lead to more anti-torque required from the tail rotor than it can generate. In addition, low speed flight activities are a high risk activity for LTE. The FAA handbook provided the following recovery technique for a sudden unanticipated yaw:

- apply forward cyclic control to increase airspeed
- if altitude permits, reduce power
- as recovery is affected, adjust controls for normal forward flight.

Robinson Helicopter Company safety notice SN-42: Unanticipated yaw

The Robinson Helicopter Company advised that to avoid an unanticipated yaw, pilots should be aware of conditions (a left crosswind, for example) that may require large or rapid pedal inputs. They recommend practising slow, steady-rate hovering pedal turns to maintain proficiency in controlling yaw.

Low gravity (G) conditions

The FAA Helicopter flying handbook

The FAA handbook chapter 11 stated that semirigid rotor systems are especially susceptible to hazards from manoeuvres involving low accelerations of gravity (low-G or weightless) because the helicopter is designed to be suspended from the main rotor. In a low-G condition, such as abruptly pushing the cyclic forward, the helicopter airframe is not supported by the main rotor mast, which may allow the main rotor blades to exceed their normal flapping limits and contact the airframe.

The FAA handbook advised that in a low-G situation the pilot should first apply aft cyclic to return the lift and weight forces to balance and always adhere to the manufacturer's manoeuvring limitations and advisory data.

Robinson Helicopter Company safety notice SN-11: Low-G pushovers – extremely dangerous

The Robinson helicopter company issued safety notice SN-11 in October 1982, which stated:

> *Pushing the cyclic forward following a pull-up or rapid climb, or even from level flight, produces a low-G (weightless) flight condition. If the helicopter is still pitching forward when the pilot applies aft cyclic to reload the rotor, the rotor disc may tilt aft relative to the fuselage before it is reloaded.*

ATSB comment

When the pilot manoeuvred the helicopter into wind, it flew through two relative wind directions conducive to an LTE event. The pilot commented that they entered the turn at about 40 kt airspeed, but was actively scanning between flying the helicopter and observing the aerial mustering activity. It is likely that during the turn, the airspeed combined with the relative wind direction to initiate an LTE event. The recommended actions to recover from an LTE include the application of forward cyclic to increase airspeed. This could place the helicopter into a low-G condition if an abrupt forward cyclic input is made, and increase the risk of striking the tail boom if the forward cyclic input is followed by an abrupt and/or large aft cyclic input.

Safety message

Loss of tail rotor effectiveness and low-G conditions

To avoid the conditions which could lead to main rotor blade/fuselage contact accidents, the Robinson R22 Pilot's operating handbook recommends the following procedures for pilots:

- maintain cruise airspeeds between 60 kt and less than 0.9 V_{NE}[6], but no lower than 57 kt
- use maximum power on revolutions per minute at all times during powered flight
- avoid sideslip during flight and maintain in-trim flight at all times
- avoid large, rapid forward cyclic inputs in forward flight, and abrupt control inputs in turbulence.

Effectiveness of helmets in helicopter operations

The United States Army referenced two United States Army Aeromedical Research Laboratory studies of helmet effectiveness in USAARL report 93-2. The first study from the period 1957–1960 found that fatal head injuries were 2.4 times more common among unhelmeted occupants of potentially survivable helicopter accidents than among occupants wearing the army's APH-5 helmet. The second study from the period 1972–1988 found that the risk of fatal head injury was 6.3 times greater in unhelmeted occupants of potentially survivable helicopter accidents than among occupants wearing the army's SPH-4[7] helmet.

In a separate study (report 98-18) the Army Aeromedical Research Laboratory reviewed 459 accidents in the period 1990–1996 where helmet visor use was verified. They found that visor use was attributed to preventing facial injury in 102 (22.2%) accidents and reducing injury in 13 (2.8%) accidents.

6 Never exceed speed.
7 SPH-4 was the newer model helmet in use at the time period of the second study.

This accident highlights the effectiveness of wearing a helmet to prevent a more serious injury. ATSB report AO-2014-058 provides an account of a serious head injury to an R22 pilot who was not wearing a helmet. In a later ATSB report, AO-2015-134, the operator commented that the pilot of an R22 accident would have suffered more serious head injuries if he was not wearing a helmet.

General details

Occurrence details

Date and time:	12 May 2016 – 1030 WST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	221 km ENE of Port Hedland Airport, Western Australia	
	Latitude: 19° 46.30' S	Longitude: 120° 38.30' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R22 Beta	
Registration:	VH-WGB	
Serial number:	3326	
Type of operation:	Aerial work - other	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (Minor)	Passengers – 0
Aircraft damage:	Substantial	

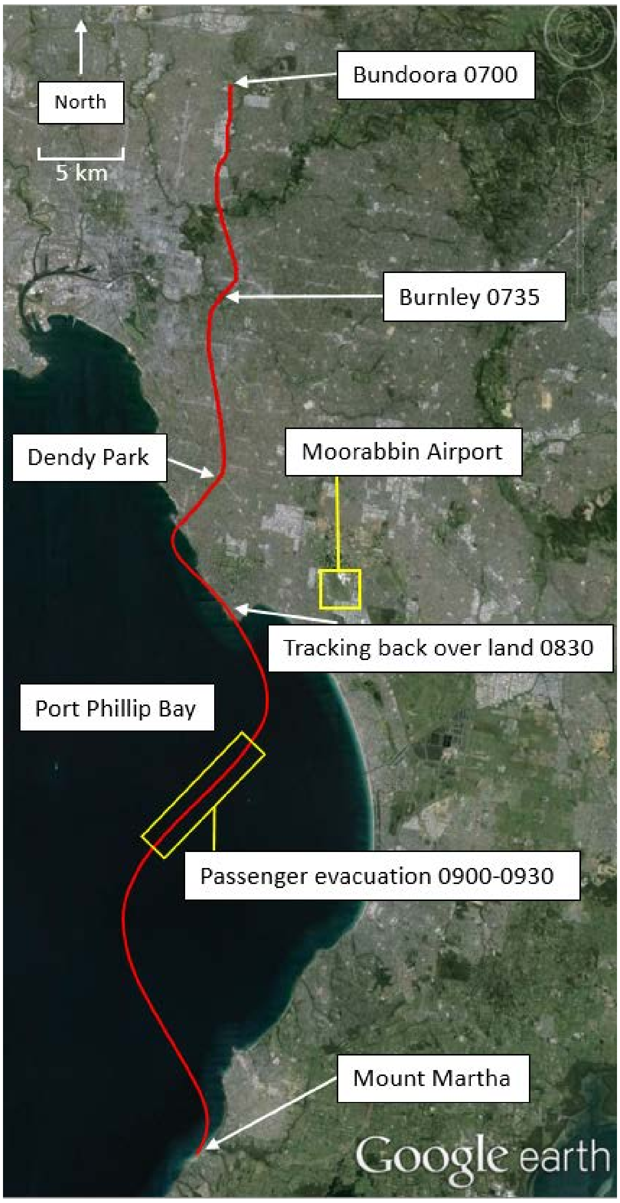
Hot Air Balloons

Navigation event involving Kavanagh Balloons E-240, VH-VBM

What happened

On 21 May 2016, the pilot of a Kavanagh Balloons E-240, registered VH-VBM (VBM), planned to conduct a one-hour scenic flight from Bundoora, Victoria (Vic.) with nine passengers. Prior to commencing the flight, the pilot obtained the relevant weather forecasts and observations. The wind was from the north to north-west at 5 to 10 kt. The pilot therefore assessed the balloon would track in a southerly direction and nominated potential landing sites at Burnley and Dendy Park in Brighton (Figure 1).

Figure 7: Approximate track of VH-VBM and relevant locations[1]



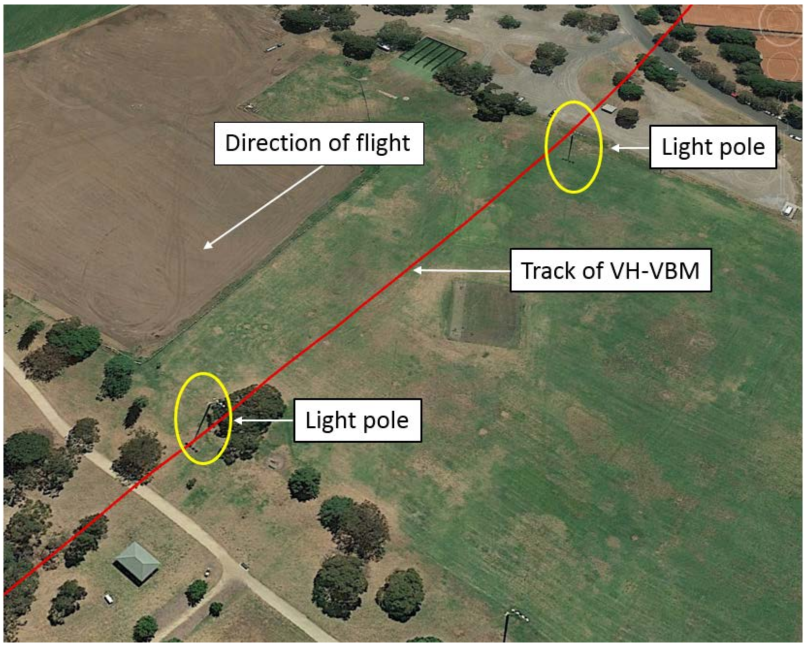
Source: Google earth, annotated by ATSB

[1] Approximate track based on GPS and radar data.

At about 0700 Eastern Standard Time (EST), the balloon departed Bundoora in company with five other balloons. About 35 minutes later, the balloon arrived overhead Burnley. The pilot of VBM elected to continue to Dendy Park, along with another balloon from the same operator, to extend the flight to one hour. At that time, the pilots of four other balloons, which had been operating in company with VBM, elected to climb into a more westerly wind to track to Moorabbin Airport, Vic.

At about 0800, the balloon in company with VBM landed safely at Dendy Park. The wind speed was about 10 kt as VBM approached Dendy Park. As the balloon descended to land, the pilot sighted a light pole directly in the balloon's path (Figure 2). The pilot then lit the balloon's burners to climb over the pole, however, a second light pole stood directly in the balloon's path on the far side of the available landing area. Due to the balloon's height and the wind, the pilot assessed that the balloon may collide with the second pole if the pilot attempted a landing and therefore elected not to land in the park.

Figure 2: Dendy Park showing light poles



Source: Google earth, annotated by ATSB

The pilot then attempted to land in a golf course beyond the park, but the balloon did not track towards a safe landing area. The balloon continued at low level over parkland, however, the pilot also assessed this area to be unsafe for landing.

At about 0820, the balloon crossed the coast and tracked out over Port Phillip Bay. The pilot commenced a climb into a more westerly wind to track towards land. At about 0825, the pilot contacted air traffic control (ATC) and requested a clearance to climb to 5,000 ft. About 90 seconds later, the pilot advised that they were now at 4,000 ft and may require emergency assistance. At that time, the pilot stated that the balloon had an estimated 30 minutes of fuel remaining.

At about 0830, the balloon tracked back over land. The pilot advised ATC that in the 5 minutes it would then take to descend and land, the balloon would track back over water. The pilot elected to descend to conserve fuel and prepared for a water landing. The pilot briefed the passengers and descended about 1 km from shore. The pilot then enacted the company emergency procedures. Air traffic control recordings showed that at 0841, when asked by ATC if it was their 'intention to ditch the balloon at the moment', the pilot confirmed that it was.

At about 0845, the pilot established contact with the crew of a nearby vessel. The pilot coordinated with the crew of the vessel to arrange the evacuation of passengers. The passengers evacuated one or two at a time onto the vessel over the next 30 minutes (Figure 3).

After evacuating the passengers, the pilot conducted a climb to about 2,000 ft back into more favourable winds and subsequently landed safely at Mount Martha, Vic. (Figure 1).

The pilot and passengers were uninjured and the balloon was not damaged.

Figure 3: Evacuation of passengers from VBM to vessel

Source: ABC News

Pilot comments

The pilot provided the following comments:

- The ground crew assisting the balloon which landed before VBM, were available to assist the landing at Dendy Park. The pilot felt that a successful landing could not be assured even with the assistance of ground crew.
- The company emergency procedures for conducting a water landing were available and clear. This greatly reduced stress and ensured the pilot and passengers were well prepared for a possible water landing.
- It was not their sole intention to ditch the balloon. Ditching was one possible scenario and the pilot was preparing the balloon and passengers for that situation should it eventuate.
- If they encountered similar weather conditions in future, the pilot would launch from further east. The north-easterly surface wind experienced was not forecast. In the future, the pilot would look for indicators of this wind prior to selection of a launch site.
- Landing in a 10 kt wind is normally manageable, however, the light pole was in the balloon's path (at Dendy Park).
- At the time the emergency was declared, the estimated endurance was 30 minutes. Once the passengers had been evacuated the balloon endurance was greatly increased.[2]

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2 The reduced weight of the balloon without passengers on board required less fuel use to remain aloft, resulting in an increase in endurance.

Carriage of life jackets

No life jackets were carried on board VBM for this flight.

As the planned flight, including the expected departure and approach paths, did not include an over water component, there was no requirement to carry life jackets based on Civil Aviation Order 20.11.

Civil Aviation Safety Authority (CASA) comments

CASA provided the following comments:

- While the evacuation was conducted in an appropriate manner, the locality of a suitable vessel with competent crew may have had a significant positive effect on the safe rescue, which under the circumstances, was a fortunate rather than a well-planned emergency procedure.
- The company's operations manual requires that, as soon as the balloon crosses the coastline, the ground crew be contacted and an emergency telephone call made. Immediately after this, a MAYDAY[3] is to be declared. This did not occur until the balloon was 1km out over the bay. As the pilot did not did not make a PAN or MAYDAY call as required, ATC did not have notice to apply the appropriate degree of severity to the incident. This was confirmed by Victoria Police during their incident debrief where it was highlighted that there was no communication or coordination between ATC and ground-based emergency services.

Safety message

This incident provides a good example of the value of effective emergency procedures. Despite having completed thorough pre-flight planning and preparation including weather and field selection, a number of factors combined to create a difficult situation for the pilot. Thorough emergency procedures along with regular training greatly reduced workload in the incident and assisted the pilot in achieving a safe outcome.

Declaring an emergency early, through the use of standard phrases such as 'MAYDAY' is vital in clearly communicating a requirement for emergency assistance or advising of an emergency situation. This enables ATC to provide assistance and coordinate emergency services without delay. The Airservices Australia safety bulletin *What happens when I declare an emergency?* provides further information on the actions taken by ATC once an emergency is declared.

3 MAYDAY is an internationally recognised radio broadcast for urgent assistance.

General details

Occurrence details

Date and time:	21 May 2016 – 0830 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Navigation - other	
Location:	near Moorabbin Airport (Black Rock), Victoria	
	Latitude: 37° 58.55' S	Longitude: 145° 06.13' E

Aircraft details

Manufacturer and model:	Kavanagh Balloons E-240	
Registration:	VH-VBM	
Serial number:	E240-448	
Type of operation:	Charter - Passenger	
Persons on board:	Crew – 1	Passengers – 9
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

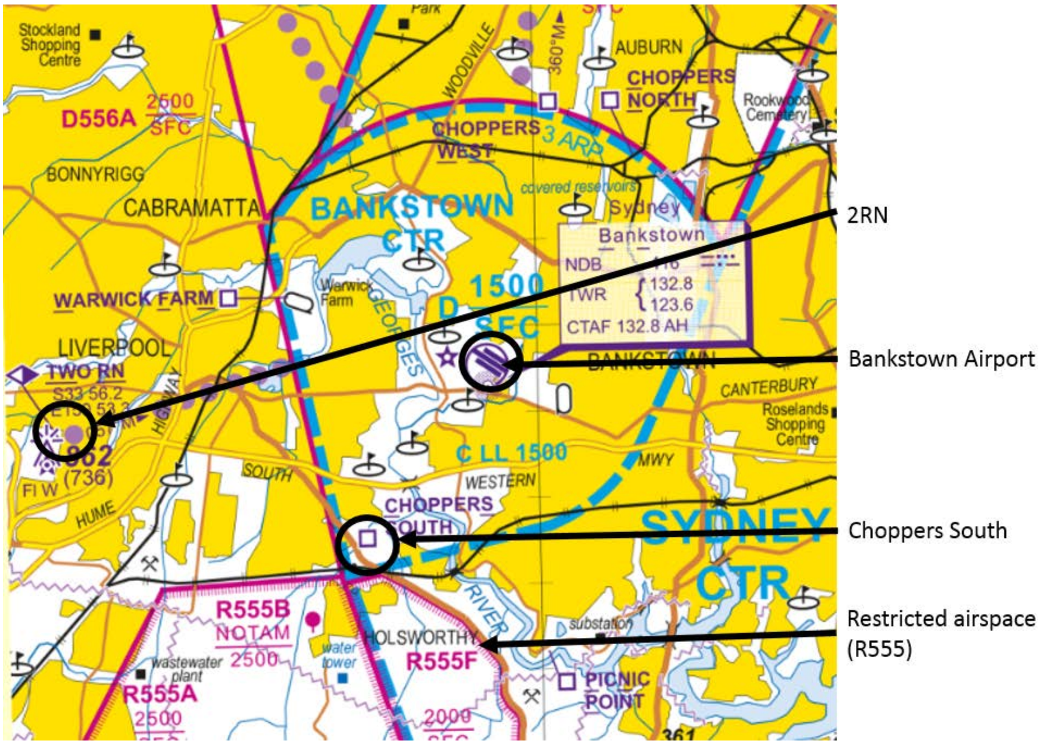
Near Collision

Near collision involving Piper PA-28, VH-MJT, and Airbus Helicopters EC 130, VH-ZVO

What happened

On 20 May 2016, the pilot of an Airbus Helicopters EC 130 T2 helicopter, registered VH-ZVO (ZVO), was conducting a ferry flight from Port Kembla to Bankstown Airport, New South Wales, with an engineer, who was also a crewmember, on board. At about 1437 Eastern Standard Time (EST), the pilot of ZVO contacted Bankstown Tower air traffic control (ATC), advising they were at 2RN approach point at 1,000 ft and inbound to Bankstown (Figure 1). The aerodrome controller (ADC) cleared ZVO to track to Bankstown via the Choppers South approach point at 500 ft.

Figure 1: Bankstown Airport and Choppers South



Source: Airservices Australia, annotated by the ATSB

At the same time, an instructor and student of a Piper PA-28-181 aeroplane, registered VH-MJT (MJT), were conducting circuit training on runway 29 left (29 L) at Bankstown Airport. At about 1438, the instructor advised the ADC that they were on the downwind circuit leg for a glide approach,[1] and a touch-and-go landing. The ADC cleared MJT for the touch-and-go landing in response. Soon after, the instructor set the throttle to idle to simulate an engine failure, and the student commenced a glide approach.

At about 1439, the pilot of ZVO called at Choppers South at 500 ft and the ADC cleared ZVO to overfly the runways midfield (which included crossing all three runways – 29 left, centre and right), at 500 ft and then to join the circuit on the downwind leg for a landing at taxiway N1 (Figure 2). The ADC also advised the pilot of ZVO of traffic, which was another helicopter then overhead the

1 Throttle set to idle to simulate an unpowered approach.

runways and outbound via Choppers South. The pilot of ZVO saw, and reported sighting, that helicopter.

The ADC reported that they then observed MJT on final approach, about 100 m short of the runway threshold, and assessed that they were on a normal approach path. The ADC also observed ZVO pass the outbound helicopter and then, concerned about the outbound helicopter's proximity to restricted airspace (R555), had a brief look at the tower situational awareness display (TSAD) to check their track.

The instructor of MJT reported that as the aeroplane approached the runway threshold on final approach, it was still at about 400–500 ft above the runway, which they assessed as too high to safely complete the landing. The student therefore commenced a go-around[2] procedure, applied full power, and moved to the left of the runway centreline. The radar data showed MJT descended to about 300 ft during final, and an off-duty controller who observed the incident, estimated MJT then continued to descend to between 100 and 200 ft on short final before conducting a go-around.

The controller looked up from the TSAD and sighted MJT in the go-around. The controller estimated that MJT was at about 250–350 ft above the runway and about 250–300 m beyond the runway threshold.

As ZVO crossed the airport boundary, the engineer sighted the aeroplane (MJT) and alerted the pilot. The pilot then saw MJT in the go-around, at the same height as ZVO, and immediately conducted a left turn to increase separation between the helicopter and the aeroplane. MJT was about midfield (half way along the runway) when the instructor sighted the helicopter (ZVO) taking avoiding action.

At about 1441, the controller advised the pilot of ZVO of MJT as relevant traffic, and watched as the helicopter turned through 360° and passed MJT.

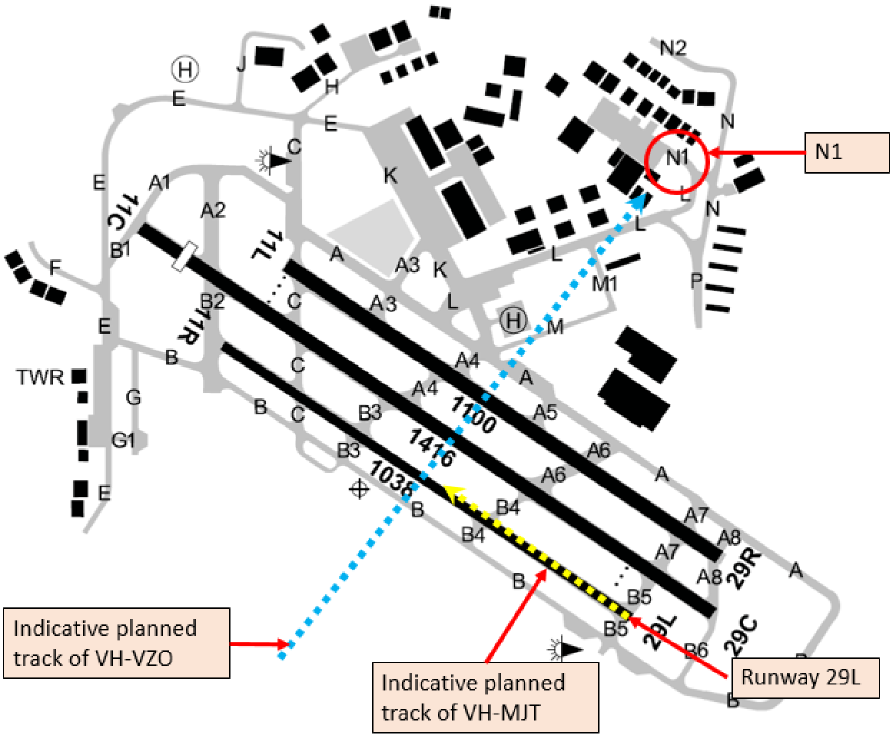
At that time, the instructor of MJT reported that they broadcast, stating that they were going around. On the recorded audio from the ADC frequency, about 8 seconds after the ADC advised ZVO of MJT, the instructor of MJT can be heard to start to broadcast, but was then over-transmitted by another radio broadcast.

The instructor of MJT estimated that the helicopter was within about 30–50 m horizontally and at the same height as MJT. The pilot of ZVO estimated the aeroplane was about 200 m away, and the ADC estimated the proximity to be about 120 m.

ZVO then continued to land at N1 as cleared. MJT continued to conduct circuits.

[2] A flight path taken by an aircraft after an aborted approach to landing.

Figure 2: Bankstown Airport showing indicative tracks



Source: Airservices Australia, annotated by the ATSB

Aerodrome control and radio frequencies

There were two tower frequencies and ADC positions at Bankstown, with ADC1 having responsibility for arrivals and departures on runways 29 right/11 left and 29/11 centre; ADC2 was responsible for the training circuit with runway 29 left/11 right. However, these were combined when the traffic volume allowed. When not combined, the two aerodrome controllers were required to coordinate with each other if helicopters were operating inbound or outbound via Choppers South and therefore crossing the circuit traffic midfield over the runways.

The two Tower frequencies at Bankstown were combined at the time of the incident, and one controller occupied the ADC position. When combined, pilots of aircraft operating on either the circuit Tower frequency or the other Tower frequency would have been able to hear transmissions on the other frequency. Although the pilots of ZVO and MJT had different radio frequencies selected, they were combined such that the transmissions on both frequencies could be heard on either.

Pilot comments

Instructor of VH-MJT

The instructor of MJT commented that they were not aware of ZVO before sighting it after the pilot of ZVO had taken avoiding action and the ADC had issued the traffic alert. Despite having heard a couple of radio calls regarding helicopters, they were not aware of ZVO tracking via Choppers South or that they would be crossing the runways at 500 ft.

There was a tailwind component, which may have contributed to the aircraft being high on final. The automatic terminal information service (ATIS) current at the time indicated an occasional downwind of 4 kt. The ATIS was changed about 10 minutes after the incident, and the runway direction changed to 11, with the wind reported to be from 150° at 8 kt.

The instructor stated that if an approach is unstable,[3] conducting a go-around is standard procedure. The instructor also stated that it would be valuable for aircraft in the circuit to be advised by ATC if a helicopter is approaching from Choppers South and crossing midfield at 500 ft. Additionally, advising the helicopter pilot when there is an aircraft on final would be valuable information.

After the incident, the instructor spoke to the Tower controller by telephone, and reported that they were advised that to avoid a similar situation, pilots should broadcast that they are going around before commencing the go-around. The instructor commented that a pilot's priority is to aviate first and control the aircraft, then to communicate later.

The instructor also commented that at a non-towered aerodrome, there would not be an aircraft passing across the midfield at 500 ft (without a broadcast). The procedure could be addressed such that either the helicopters do not pass directly through the circuit, or the aircraft on final approach and the helicopter pilot are both given traffic information regarding each other.

Pilot of VH-VZO

The pilot of VZO provided the following comments:

- They did not hear any call from the pilot of the aeroplane, nor was there any call from Tower that the aeroplane was conducting a go-around.
- Even if a pilot broadcasts conducting a go-around, sometimes the aircraft can be hard to see on finals. They did not see the aeroplane at first, but their passenger saw it going around. They do not expect to see another aircraft at the same height when crossing the runways at 500 ft.
- They were not aware of the other aircraft at all before they saw it – they had not heard a call and were not aware of any aircraft in the training circuit. They did not know to look there for other aircraft traffic.

Controller comments

The aerodrome controller reported that they were monitoring an outbound helicopter on the TSAD when MJT commenced the go-around. As soon as they sighted the potential conflict, VZO had commenced a left turn and the ADC gave MJT as traffic to VZO.

An off-duty controller, who was in the ATC tower at the time of the incident, commented that in Class D airspace, pilots have responsibility to see and avoid VFR aircraft and ATC has a responsibility to provide relevant traffic information to assist them to do that. In normal circumstances, an aircraft in the circuit and a helicopter tracking across the runway at 500 ft would not need to know where each other was as they are 'segregated'. Additionally, providing traffic information that was not useful, may lead pilots to switch off to essential information. However, in the go-around procedure, they were relevant traffic and the controller would pass the traffic. Usually their response would be to pass traffic to the helicopter first as they were generally in a stage of flight with a lower workload and are more manoeuvrable than fixed wing aircraft.

En Route Supplement Australia

The ERSA entry for Bankstown included the following under the heading Class D:

'CAUTION: HELICOPTERS OVERFLY RUNWAYS MIDFIELD AT 500FT.'

[3] An unstabilised approach is an approach during which an aircraft does not maintain at least one of the following variables stable: speed, descent rate, vertical/lateral flight path and in landing configuration, or receive a landing clearance by a certain altitude.

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 Airservices internal investigation into the occurrence, a Standardisation Directive (SD) has been developed for publication on 28 June 2016. The SD aims to educate controllers on the key lessons learned from the occurrence.

Specifically the SD Clarifies that

- an aircraft cleared to land is also cleared to conduct a go-around
- helicopter tracking which crosses an operational runway as described in ERSA must not be relied on to assure segregation of overflying helicopter traffic from the possible go-around or missed approach of aircraft using the runway
- where the possible go-around or missed approach path of a landing aircraft is in potential conflict with a helicopter overflying, controllers are required to provide traffic to both aircraft in anticipation of the possible go-around or missed approach rather than in response to the go-around or missed approach.

Operator of VH-MJT

As a result of this occurrence, the operator of MJT has advised the ATSB that they are taking the following safety actions:

Induction training amendment

Company induction training will be expanded to cover more details with regards to helicopter activities at each base.

Safety message

The possibility that an aircraft will go around from an approach should always be considered by ATC and pilots, with respect to the separation of air traffic.

The adage 'aviate-navigate-communicate' remains a fundamentally effective prioritisation guide for pilots. Nonetheless, under some circumstances, it may be prudent to broadcast intentions early, particularly when those intentions vary from an expected or anticipated course of action. This may be particularly important where the potential for a conflict with other traffic is elevated, such as in an area of high traffic density. Timely broadcasts provide greater opportunity for other pilots to focus their lookout, and for ATC to react to the changing circumstances.

The Civil Aviation Safety Authority booklet, *Class D airspace*, advises pilots that when operating in Class D airspace, they must sight and maintain separation from other aircraft. Pilots and ATC have a dual responsibility to maintain situational awareness of other traffic.

General details

Occurrence details

Date and time:	20 May 2016 – 1441 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	Bankstown Airport, New South Wales	
	Latitude: 33° 55.47' S	Longitude: 150° 59.30' E

Aeroplane details

Manufacturer and model:	Piper Aircraft Corporation PA-28	
Registration:	VH-MJT	
Serial number:	28-7790256	
Type of operation:	Flying training – dual	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Helicopter details

Manufacturer and model:	Airbus Helicopters EC 130	
Registration:	VH-ZVO	
Serial number:	8186	
Type of operation:	Business – Test & Ferry	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Australian Transport Safety Bureau

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; 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.

Purpose of safety investigations

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. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

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 also receives a lesser number of similar occurrences in the Rail and Marine transport sectors. It is from the information provided in these notifications that the ATSB makes a decision on whether or not to investigate. While some further information is sought in some cases to assist in making those decisions, resource constraints dictate that a significant amount of professional judgement is needed to be exercised.

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

The Short Investigation Team gathers additional factual information on aviation accidents and serious incidents (with the exception of 'high risk operations), and similar Rail and Marine occurrences, where the initial decision has been not to commence a 'full' (level 1 to 4) investigation.

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 what safety action may have been taken or identified as a result of the occurrence.

These reports are released publically. In the aviation transport context, the reports are released periodically in a Bulletin format.

Conducting these Short investigations has a number of benefits:

- Publication of the circumstances surrounding a larger number of occurrences enables greater industry awareness of potential safety issues and possible safety action.
- The additional information gathered results in a richer source of information for research and statistical analysis purposes that can be used both by ATSB research staff as well as other stakeholders, including the portfolio agencies and research institutions.
- Reviewing the additional information serves as a screening process to allow decisions to be made about whether a full investigation is warranted. This addresses the issue of 'not knowing what we don't know' and ensures that the ATSB does not miss opportunities to identify safety issues and facilitate safety action.
- In cases where the initial decision was to conduct a full investigation, but which, after the preliminary evidence collection and review phase, later suggested that further resources are not warranted, the investigation may be finalised with a short factual report.
- It assists Australia to more fully comply with its obligations under ICAO Annex 13 to investigate all aviation accidents and serious incidents.
- Publicises ***Safety Messages*** aimed at improving awareness of issues and good safety practices to both the transport industries and the travelling public.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Short Investigations

Aviation Short Investigations Bulletin Issue 50
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