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Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Contents

Jet aircraft

Piston aircraft

Helicopters

Remotely piloted aircraft systems

Jet aircraft

Data input error involving a Boeing 737, VH-XZI

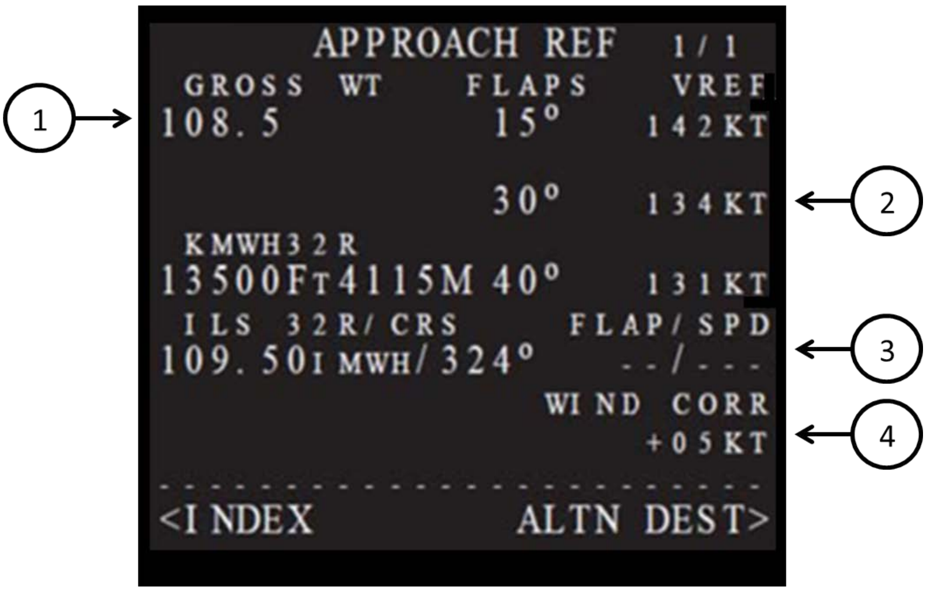
What happened

On 12 October 2014, at about 1517 Central Daylight-saving Time, the flight crew operating a Qantas Airways B737 aircraft, registered VH-XZI, were preparing for the approach and landing into Adelaide, South Australia. The aircraft had departed about one and a half hours earlier from Alice Springs, Northern Territory, with the captain as the pilot flying (PF) and the first officer as the pilot monitoring (PM).

During descent preparations, air traffic control (ATC) issued arrival instructions which the crew loaded into the flight management computer (FMC)[1] via the control display unit (CDU)[2] (Figure 1). In accordance with company procedures, the PM calculated the expected landing weight. After obtaining confirmation from the PF that his calculations were valid, he entered this figure into the aircraft gross weight (Gross WT) section of the approach reference page (Figure 1). However, according to the post-flight data obtained from the quick access recorder (QAR), a figure of 52 tonnes (T) had been inadvertently entered instead of the predicted landing weight of 62 T.

To complete the manual selections, the PM stated he verbalised, and then selected, the flap 30 field on the CDU (Table 1).

Figure 1: An example of a CDU Approach Reference page



Source: Qantas Flight Crew Training Manual

1 The FMC used information entered by the crew, aircraft systems data, and navigation and performance databases, to provide auto-flight and auto-throttle guidance and control.

2 The Control Display Unit (CDU) is the interface between the flight crew and the FMC.

Table 1: Approach reference page expanded information

No.	Item	Function / notes	Detail
1	Aircraft Gross WT	Normally displays the FMC calculated aircraft Gross WT.	Manual entry of Gross WT is allowed. **Leaving and returning to this page replaces a manually entered weight with FMC computed Gross WT.**
2	Vref	FLAPS – VREF	Displays landing Vref for three flap settings as computed by the FMC. Speeds are based on displayed gross weights. Vref once selected, will not be updated. To obtain an updated speed, the current speed must be deleted, or a different Vref selected or entered.
3	Flap/Speed (FLAP/SPD)	Displays selected approach reference flap and speed setting.	Manual input of desired flap and/or speed settings may be made.
4	Wind Correction	Displays current wind correction for approach.	Default is +5 kt

Source: Qantas

Following the inadvertent landing weight data entry error, the FMC calculated the flap speed schedule and the landing reference speed (Vref), based on this lower weight. With each stage of flap selection, the magenta bug[3] moved and pointed to the new command speed on the airspeed indicator. With the selection of flap 30, the command speed became Vref plus any wind correction factor entered by the crew[4] (Figure 2).

The captain briefed, then flew, the arrival and approach onto runway 23 in clear conditions and mild, westerly winds. At about 1,500 ft above mean sea level, the aircraft was fully configured for landing with the gear down and flap 30. The captain disconnected the autopilot and hand flew the remainder of the approach and landing.

During the approach, the PM made a verbal reference about the airspeed being ‘wrong’. The PF reported he did not clearly hear what the PM had said, nor did he understand what message the PM was trying to convey. The captain assumed that the PM may have been making a comment in relation to a relatively new company procedure[5] used to calculate the approach speed. All the instrumentation presented to him looked normal, so he made the assumption that it was not something critical, and continued to focus on aircraft flight path management.

The PF continued to make adjustments to the thrust levers to allow for changes in wind. As was their normal procedure, the PF used the head-up guidance system (HGS) during the flight.[6] The PF reported that after the Flap 30 selection, he noted that the speed bug (‘magenta’ bug) moved a greater distance down the speed tape than normal, but he was not unduly concerned and continued to focus on flight path management.

At a height of about 200 ft, the PM reported he called ’speed’ when he noticed the magenta speed bug on the primary flight display (PFD) airspeed indicator (ASI) reduce to within close proximity of the top of the amber band (Figure 2); however the PF reported not hearing this call.

3 Speed bug (magenta) pointed to the command airspeed. This is calculated from the information inputted to the CDU; whereas the manoeuvring margin amber band is responding to the actual aircraft weight as calculated by the FMC (based on what information was given to the FMC prior to take-off).

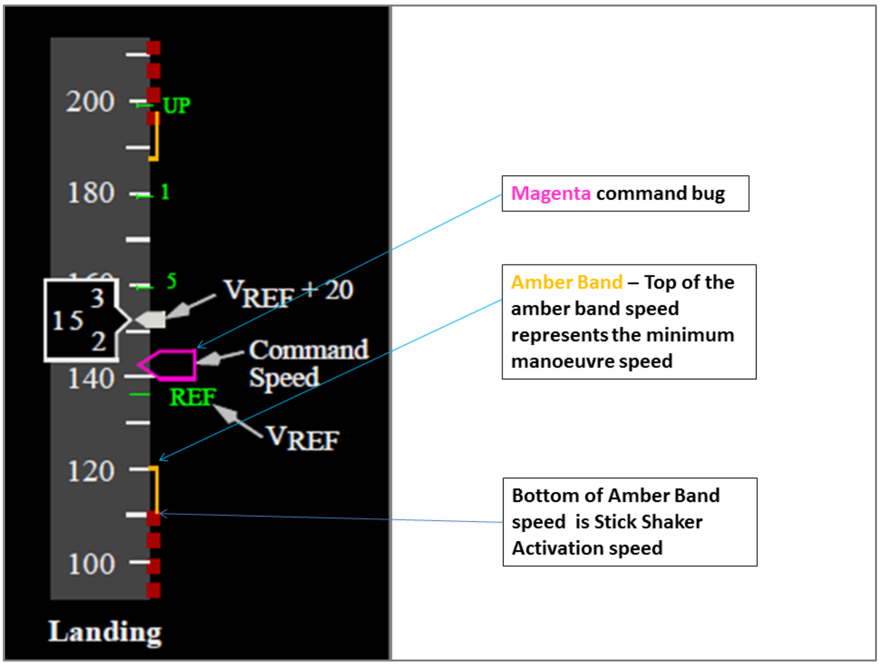
4 Minimum of Vref +5 to a maximum of Vref +20 (Boeing Approach Speed Calculation)

5 In July 2014, Qantas aligned the company procedure for Vref calculation with the Boeing recommended, Boeing Approach Speed Calculation.

6 The HGS gave a representation of the information of the PFD, but is seen as a monochrome green by the user. Different symbology is given with each different mode selected.

During touchdown, both crew noted that the aircraft's pitch attitude was higher than usual. The aircraft had a nose-up pitch of 7.5°; whereas a normal nose-up pitch was 3.5-3.75°. The remainder of the landing was normal and there were no injuries and no damage to the aircraft.

Figure 2: Sample B737 primary flight display airspeed indicator



Source: Adapted from Boeing 737 FCTM

Captain's comments

The captain commented that with a non-VNAV approach, the crew set the approach speed into the mode control panel speed window (MCP). However, as in this case with a VNAV approach, the speed window is blank, the FMC selects the speed bug as the crew select the flap. This removed an opportunity for the crew to detect the speed mismatch.

The captain stated that in hindsight the aircraft nose attitude must have been higher than normal on the approach,[7] however he did not notice it during the occurrence.

First officer (PM) comments

When the PM noted that the magenta bug was closer than normal to the manoeuvring margin amber band on the PFD airspeed indicator, he thought the 'moving' amber band may have reached a higher airspeed due to the increased g loading in the gusty conditions, until he also noted the discrepancy on the CDU from the flaps 30 Vref calculated earlier during the preparation for descent phase.

The PM reported that when he made a reference about the airspeed being 'wrong', to the PF, he believed the call was clear and concise; he also added the instruction to fly a certain airspeed. He believed this was a safer option that going "head down" and reselecting the landing Vref on the CDU.

As noted in Table 1 – note 1, once the crew left the approach reference page on the CDU and then returned to it, the page defaulted back to the FMC calculated (higher) GW and (higher) Vref for Flap 30. This realisation prompted the PM to say that the 'speed's wrong' to the captain. When the PM saw the captain advance the thrust levers (for the gusty conditions) he thought this was a response to his comment.

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[7] In the landing configuration, a lower speed requires a higher angle of attack (higher nose attitude) at any given weight

Operator report

The operator conducted an investigation into the incident. Their report detailed the following:

- The data entry error was made when entering the expected landing weight into the FMC Approach Reference page; this figure was not reconciled against the final load sheet
- As the PM had only just started to comprehend the speed disparity, this led to the non-assertive comment. [note PM comment under First Officer comments regarding this aspect]
- The Boeing Speed Calculation method may have contributed to a reduced level of recognition by the Captain of the significance of the position of the magenta bug and the amber band. This method varied from the previous Reference Ground Speed (RGS) method used to allow for changes in wind between when the aircraft was on approach and the wind experienced during touchdown
- It is likely that the advancement of the thrust levels at the time the PM started to recognise a speed disparity led to a level of confirmation bias that the speed disparity was being addressed
- The predicted landing weight was printed on the final load sheet given to the flight crew just prior to departure, however this figure did not allow for variations in fuel burn experienced in flight. The load sheet estimated landing weight was often used as a gross error check by flight crew, but it was not part of the company standard operating procedures. On this occasion, the crew did not conduct a gross error check using the load sheet figure, nor were they required to do so.

Non-technical skills training (NTS)

The operator reported that ‘flight crews undergo extensive non-technical skills training and recurrence during initial and cyclic training sessions. As part of this training, various levels of assertion are regularly highlighted in the event that a disparity in aircraft performance is recognised. Key indicators of uncertainty were observed in this occurrence around error recognition and confirmation. It is likely that this uncertainty resulted in a breakdown of the expected levels of assertion and a reduction in the preventative control’.

Recovery controls

The operator also noted that recovery controls would have been effective had the speed reduced to a critical amount. The head up guidance system provides visual caution/warning to the captain in the event that a tail strike pitch angle or rate is approaching, or has been exceeded. The head-up guidance system also indicates the angle of attack and normal angle of bank as a visual cue to the captain.

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.

Flight operations

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

Action taken by Qantas

As a result of this incident, the operator intends to revise the flight crew operations manual (FCOM) descent procedures. The procedures will include an item requiring the PM to compare the landing weight entered into the Approach Reference page during descent preparation, with the load sheet estimated landing weight.

Safety message

Data entry errors

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is data input errors.

Although having a primary focus on data input errors in preparation for take-off, the message is common. Errors can occur irrespective of pilot experience, operator, aircraft type, location and take-off [or landing] performance calculation method.

An ATSB research study titled *Take-off performance calculated and entry errors: A global perspective* is a research paper which focused on such incidents and accidents in the 20 years prior to 2009. A consistent aspect was the apparent inability of flight crew to perform 'reasonableness checks' to determine when parameters were inappropriate for the flight.

Also the ATSB have produced a short YouTube video on Safety concerns in regard to data input errors.

Crew communication

This incident highlights the importance of effective crew communication. The PM attempted to communicate his uncertainty to the PF, but the PF did not understand the specific nature of the PM's concerns.

Non-technical skills (NTS) previously known as cockpit resource management (CRM) training has developed over many years to promote team work among pilots and to lead to a reduction in human error. Two studies conducted by Fischer, U., and Orasanu, J., published in 1999 looked at language and communication strategies between two groups of captains and first officers from three major US airlines. Of interest, the studies found that the strategies pilots indicated they would use to mitigate pilot errors, may not be the most effective ones. Also, there was a considerable difference between the captains' and the first officers' communication strategies.

General details

Occurrence details

Date and time:	12 October 2014– 1545 CDT	
Occurrence category:	Incident	
Primary occurrence type:	Incorrect configuration	
Location:	Near Adelaide Airport, South Australia	
	Latitude: 34° 56.70' S	Longitude: 138° 31.83' E

Aircraft details

Manufacturer and model:	Boeing 737-838	
Registration:	VH-XZI	
Operator:	Qantas Airways	
Serial number:	39364	
Type of operation:	Air Transport High Capacity - Passenger	
Persons on board:	Crew – 2 flight crew	Passengers – Unknown
Injuries:	Crew –Nil	Passengers – Nil
Damage:	None	

Piston aircraft

Engine failure involving a de Havilland Canada DHC-1 (Chipmunk), VH-RVY

What happened

VH-RVY

Source: New South Wales Police Force

On 14 November 2014, at about 1230 Eastern Daylight-saving Time (EDT), a de Havilland Canada DHC-1 (Chipmunk) aircraft, registered VH-RVY (RVY), departed from Luskintyre Airfield, New South Wales, for a post-maintenance flight with the pilot and one passenger on board. The flight plan was to conduct the flight near the airfield and at a safe altitude. The aircraft had a history of ongoing problems with both the engine revolutions per minute (RPM) governing system as well as the rear vertical speed indicator (VSI). The passenger who was seated in the rear seat was to monitor and report any engine RPM fluctuations and observe the VSI indication.

After about 10 minutes of straight and level flight, as well as climbs and descents, with no fluctuations in the engine RPM, the pilot commenced some gentle aerobatics. These aerobatics were to ensure the selected engine speed was maintained through a range of flight attitudes and airspeeds. As everything appeared to be functioning correctly, the pilot then progressed to some more advanced aerobatic manoeuvres.

As the aircraft was exiting the bottom of a modified loop manoeuvre, at around 140 kt indicated airspeed (IAS), the engine began to over speed without warning.[1] The pilot reduced the engine power and commenced trouble shooting the problem.

At the time, RVY was about 1 km north of Luskintyre Airfield (Figure 1), heading east at about 3,000 ft above ground level (AGL). The westerly wind was reported to be gusting at around 20-30 kt. The pilot joined downwind for a landing on runway 30, noting the groundspeed was around 150-160 kt. While on downwind, the pilot advanced the throttle lever and noted that at about 1/3 lever movement the engine speed was at about 3,000 RPM (maximum continuous RPM at sea level pressure altitude is 2,700). Despite the engine speed, the aircraft was not able to maintain altitude. In an attempt to ‘get back’ to the airfield the pilot turned from a slightly extended downwind onto a ‘base leg’. As the aircraft turned, the engine stopped producing power. The pilot unsuccessfully attempted to restart the engine.

When RVY turned onto a final approach, the aircraft was still descending. At about 500 ft AGL, the pilot determined that they would not make the runway, so he elected to land in a paddock about 500 m east of the airfield (Figure 1). During this manoeuvre, the right wing stalled and dropped slightly. To recover, the pilot lowered the nose of the aircraft to gain more airspeed. The pilot reported that due to the high outside air temperature and gusting wind, the conditions were quite turbulent near the ground. The pilot flared the aircraft in preparation for landing and noted airframe buffeting, with little to no response from the elevator. The aircraft landed heavily, travelling through an electric fence before the aircraft stopped on a drive way just short of the selected landing area (Figure 1).

The pilot exited the aircraft quickly as the right wing fuel tank had ruptured during the landing and fuel had spilt onto the ground. The pilot tried to assist the passenger, but due to the pilot’s injuries

[1] An engine overspeed is a condition in which an engine is allowed or forced to rotate beyond its design limit.

he was unable to provide any physical assistance. After a short time, the passenger exited the aircraft. The pilot and passenger sustained serious injuries and the aircraft was substantially damaged (Figure 2).

Figure 1: Accident location

Source: Google™ earth, annotated by the ATSB

Figure 2: VH-RVY

Source: New South Wales Police Force

Aircraft information

The aircraft was manufactured in the United Kingdom in 1951 and was first registered in Australia in 1954. The aircraft had been modified by the previous owner, between 1978 to 1983, where the de Havilland Engine Company Gipsy Major engine and fixed pitch propeller instillation was replaced with a Lycoming IO-360A1B6 engine, constant speed propeller, propeller governor and an accumulator installation.

Pilot comment

The pilot worked for the maintenance organisation and had flown the aircraft after its last maintenance in 2013. The pilot indicated that at the annual maintenance inspection in 2013, small fluctuations in the selected engine RPM had been reported. Both the propeller and propeller governor were sent to be overhauled and reinstalled on the aircraft, however there continued to be slight RPM fluctuations. After the annual inspection conducted just prior to the accident, it was found that there was about a 100 engine RPM fluctuation, during gentle climbing and descending. The propeller governor and accumulator were again sent to be overhauled. The components were returned serviceable with no defects found. The pilot reported that during the overhaul some adjustments were made to the internal operating pressures of the propeller governor. The components were reinstalled on RVY and ground tested with no defects found.

The pilot believed that coming out of the modified loop manoeuvre the propeller had gone into full fine pitch, resulting in the engine entering an “overspeed” condition.

The pilot reported that apart from the strong gusty winds, the temperature was about 39°C.

Owner investigation

An investigation was conducted on behalf of the owner that found the following:

After the accident, the engine, propeller, propeller governor and accumulator were removed from the aircraft and were inspected and tested to identify any defects.

- The engine was functionally tested on an engine test truck and no defects were found.
- The propeller was inspected at a propeller overhaul facility and did not find any evidence of damage or failure within the propeller that would explain an uncommanded movement to fine pitch.
- The propeller governor was functionally tested at an aircraft component overhaul facility and no defects were identified.
- The accumulator was functionally tested at an aircraft component overhaul facility and no defects were identified. The engineering order that approved the installation of the accumulator was reported to specify an accumulator air charge pressure of about 250 PSI. The overhaul facility test equipment was only capable of testing the accumulator to about 100 PSI.

The investigation determined that there was no conclusive reason why the engine suffered an overspeed and ceased to operate. It was suggested that the overspeed may have been a result of lack of oil pressure to the propeller when the engine of RVY was inverted, during the aerobatic manoeuvre resulting in the propeller moving to fine pitch.

Safety message

Engine failure in flight

This accident is a timely reminder to pilots to consider the effect an in-flight engine failure at different altitudes and in the given conditions can have on the options available to manage that failure and to identify a suitable forced landing area. The combination of two people on board and the high temperature would have adversely affected the aircraft’s performance on the day.

The ATSB booklet *Avoidable Accidents No. 3 - Managing partial power loss after take-off in single-engine aircraft* contains information that is also relevant to a complete engine power loss.

The booklet highlights the importance of:

- pre-flight decision making and planning for emergencies and abnormal situations for the particular aerodrome including a thorough pre-flight self-brief covering the different emergency scenarios.
- taking positive action and maintaining aircraft control either when turning back to the aerodrome or conducting a forced landing until on the ground, while being aware of flare energy and aircraft stall speeds.

General details

Occurrence details

Date and time:	14 November 2014 – 1245 EST	
Occurrence category:	Accident	
Primary occurrence type:	Engine failure	
Location:	near Luskintyre, New South Wales	
	Latitude: 32° 40.25' S	Longitude: 151° 25.57' E

Aircraft details

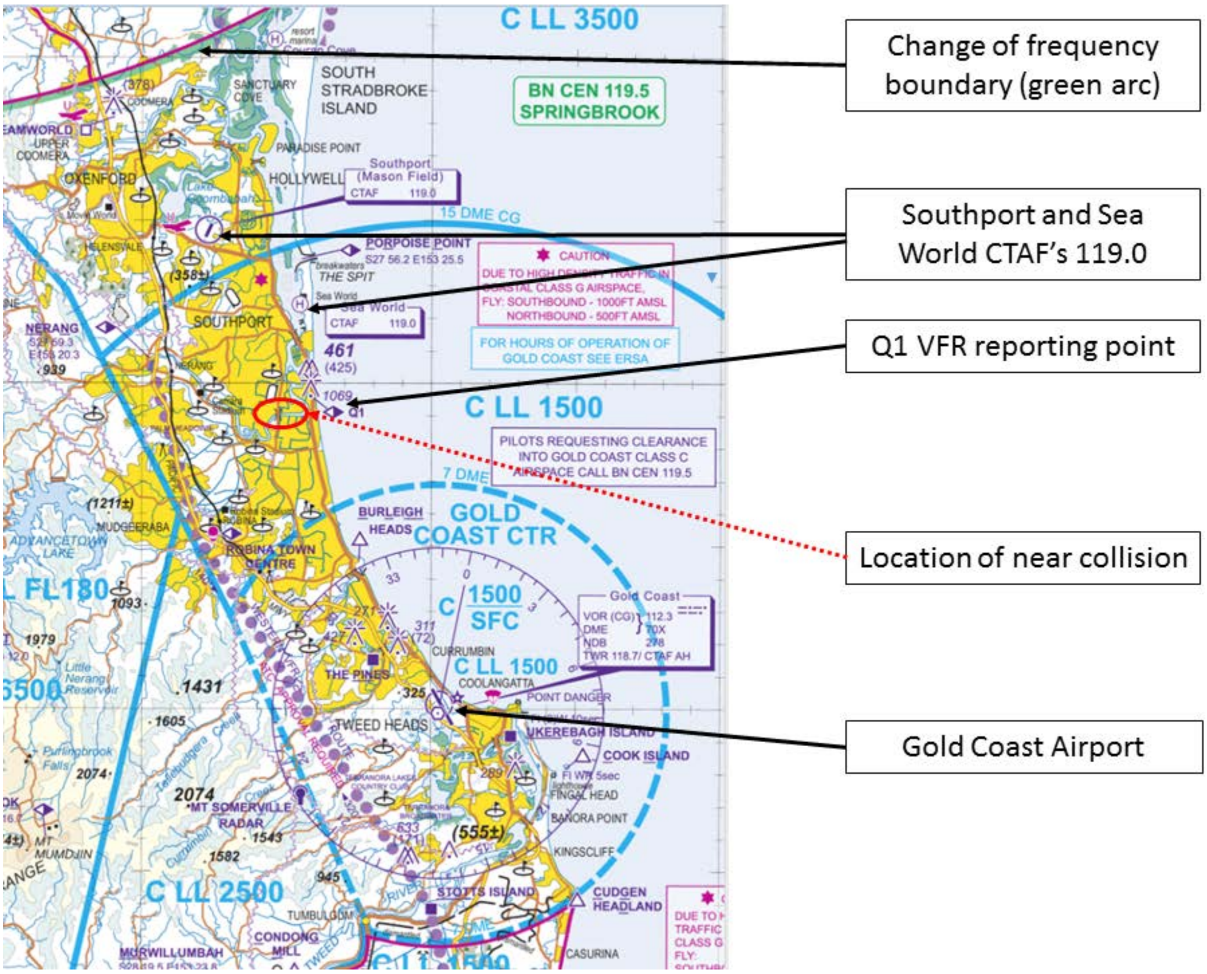
Manufacturer and model:	DeHavilland Canada DHC-1	
Registration:	VH-RVY	
Serial number:	DHB-F336	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – 1	Passengers – 1
Damage:	Substantial	

Near collision between a Beech 76 aircraft, VH-ZUA and a Eurocopter AS350 helicopter, VH-SWX

What happened

On 4 January 2015, the pilot of a Beechcraft 76 aircraft, registered VH-ZUA (ZUA), commenced a ferry flight from Archerfield to the Gold Coast, Queensland. The private flight was conducted under the visual flight rules (VFR), and the pilot was the sole person on board. The aircraft departed Archerfield at about 1200 Eastern Daylight Time (EDT), and climbed to a planned cruising level of 1,500 ft above mean sea level.

Figure 1: Gold Coast VTC



Source: Airservices Australia: Visual Terminal Chart modified by the ATSB

At about 1210, as ZUA approached the change of frequency boundary (Figure 1) just north of Dreamworld, the pilot changed to the area frequency (119.5 MHz) on COMM 1[1] with the Southport CTAF frequency (119.0 MHz) in the standby section of the Garmin 530. As he

1 COMM 1 (Garmin 530) COMM 2 (Garmin 430) were the very high frequency (VHF) radios fitted to the aircraft allowing an active and a standby frequency in each box

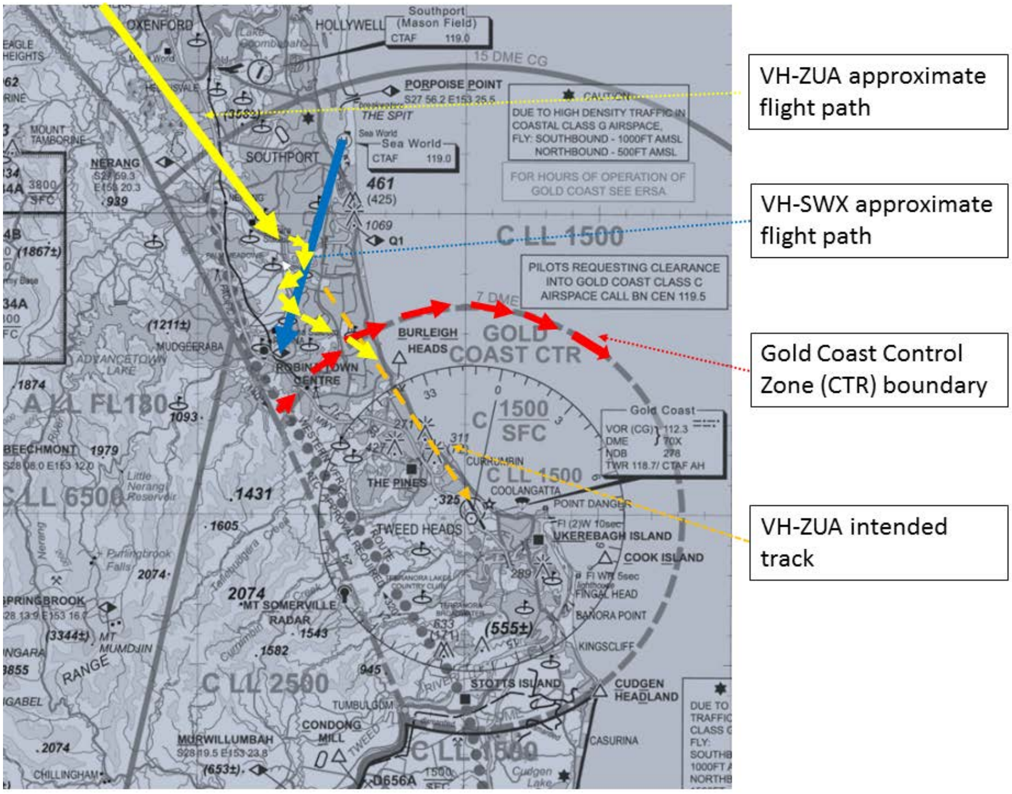
approached Southport airport, the pilot moved the standby frequency (119.0 MHz) into the active box and as required, broadcast the aircraft's position and intentions. The CTAF frequency is common to both Southport Airport and the nearby Sea World helipad (Figure 1).

At about 1212, the pilot of an AS350 helicopter, registered VH-SWX (SWX) prepared to depart from Sea World, Queensland, for a 15 minute local commercial scenic flight. The first sector was from Sea World to overhead the Robina shopping centre (Figure 2). On board were the pilot and 5 passengers.

The pilot obtained the Gold Coast automatic terminal information service (ATIS) prior to becoming airborne at about 1215 and broadcasting his intentions on the Sea World CTAF frequency of 119.0 MHz (the same frequency as the Southport CTAF). As a small sector of the scenic flight was to be conducted in the Gold Coast control Zone, the pilot obtained a transponder code from Gold Coast Ground air traffic control soon after the helicopter had departed.

At about 1220, as ZUA neared the Q1 VFR reporting point (Figure 1), the pilot requested and obtained a clearance from the Gold Coast tower controller to enter the control zone. The pilot acknowledged and read back the clearance, which was to track from his present position direct to the Gold Coast airport at 1,500 ft. Soon after, the tower controller issued the pilot a Safety Alert, advising of traffic in his 10 o'clock position[2], 2 NM and tracking west (toward ZUA) at an unverified level of 1,400 ft (Table 1). The pilot acknowledged the Safety Alert, advising the tower controller that the traffic was in sight.

Figure 2: Approximate flight path of ZUA and SWX



Source: Airservices Visual Terminal Chart modified by ATSB

2 The clock code is used to denote the direction of an aircraft or surface feature relative to the current heading of the observer's aircraft, expressed in terms of position on an analogue clock face. Twelve o'clock is ahead while an aircraft observed abeam to the left would be said to be at 9 o'clock

Table 1: Summary of radio communication by ZUA and SWX

Time	Action	Frequency MHz	Content
1215	SWX departed helipad for a 15 minutes scenic flight	CTAF 112.3 CTAF 119.0 GC Ground (SMC) 121.8	COMM 2 (Obtained ATIS from Gold Coast) COMM 1 Airborne Sea World; on climb to 1,500 tracking for Robina. (COMM2 was tuned to Gold Coast Ground to obtain a transponder code for the sector of the flight which transited through controlled airspace).
1219.58	Approaching Q1, ZUA to TWR	118.7	Advised TWR that ZUA was approaching Q1, 1,500 inbound and in receipt of the current ATIS and requested a clearance to enter the Control Zone.
1220.14	Gold Coast TWR to ZUA	118.7	Cleared ZUA direct to the Gold Coast, 1,500 with an expectation for a straight in approach to RWY 14.
1220.22	ZUA to TWR	118.7	Pilot read back the clearance
1220.28	TWR to ZUA	118.7	Issued ZUA with a SAFETY ALERT for traffic in their 1000 position, 2 NM and tracking west unverified level 1,400 ft
1220.51	ZUA to TWR		PIC reported traffic sighted
1221.18	Centre to ZUA	119.5	Issued ZUA with a SAFETY ALERT for traffic in their 10 o'clock position same level, and half a mile. Centre called twice but did not receive a response from the PIC of ZUA.
1221.29	Centre to TWR		Issued a SAFETY ALERT to TWR. TWR advised that the pilot of ZUA had been issued a SAFETY ALERT for traffic
1221.42			Near Collision
1221.57	ZUA to TWR	118.7	Reported to TWR that he had just taken evasive action to avoid the helicopter, and was now tracking to the Gold Coast again
1223.40	SWX to TWR	118.7	PIC obtains clearance to enter the Gold Coast control zone and also requests further information about ZUA
1224.00	SWX to TWR	118.7	PIC advised TWR that a fixed wing aircraft [ZUA] had passed from behind about 30 ft over the top of the helicopter. He had made two calls on 119.0 to make contact with the pilot but had not received a reply

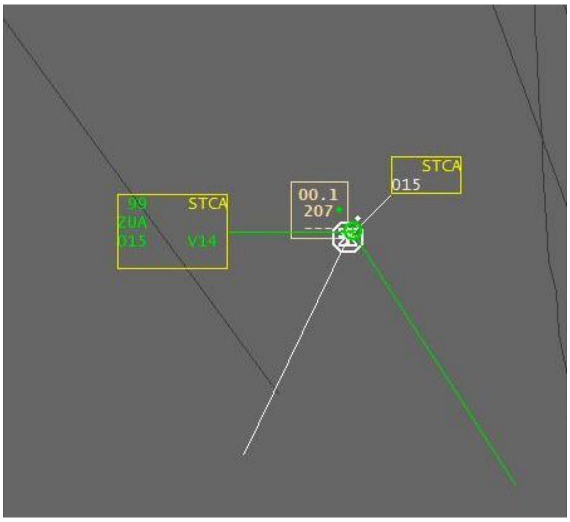
Source: Airservices Australia

Also noticing the short term conflict alert (STCA) (Figures 3 and 4) on the air situation display, the Brisbane Centre controller twice attempted to make contact with ZUA which was still in uncontrolled airspace; but there was no response. The controller then contacted the Gold Coast tower controller via the internal coordination line, to confirm that a safety alert had been issued. The tower controller advised the Brisbane Centre controller that a safety alert had already been issued and the situation was under control.

Soon after, while distracted by entering and changing frequencies on both COMM 1 and COMM 2, the pilot of ZUA had lost sight of SWX and turned his attention to visually re-acquire the helicopter. The pilot then realised that the helicopter was not flying parallel to his course as he had initially thought; but was on a collision course with ZUA and at a similar altitude. The pilot initiated a short climb and a steep right turn in ZUA. He did not see SWX during this evasive manoeuvre, so turned left and continued to the Gold Coast as cleared, and advised the tower controller of the conflict and subsequently landed.

Figures 3 and 4: Radar surveillance data

Figure 3

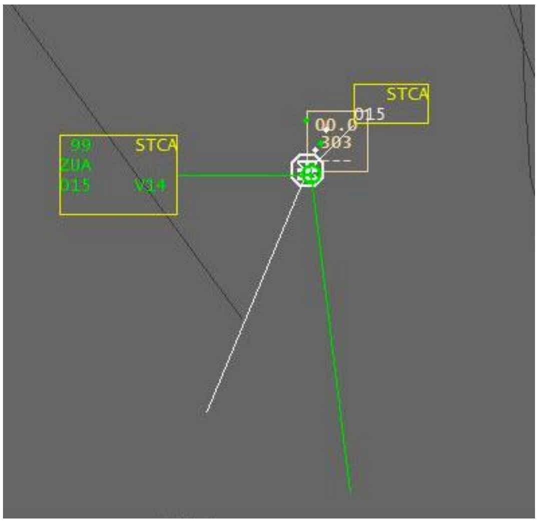


Time: 2.21.37 ZUA at 1,500 ft; SWX 1,500 ft ; about 100 m horizontally

STCA – Short term conflict alert

Source: Airservices Australia

Figure 4



Time: 2.21.42 Near collision

ZUA at 1,500 ft; SWX 1,500 ft; Nil horizontal distance showing on radar

The traffic collision avoidance system (TCAS) on board the helicopter did not alert the pilot to the potential conflict, possibly because ZUA overflew the helicopter from behind, which may have shielded the TCAS aerial.

VH-ZUA radio equipment

ZUA had Garmin 530 and Garmin 430 units installed.

VH-SWX radio equipment

SWX had two communication navigation (COMM NAV) units installed, also allowing the pilot to have two active and two standby radio frequencies selected. SWX also had a terrain collision avoidance system (TCAS) fitted.

VH-ZUA pilot experience and comments

The pilot had around 270 hours total time, with about 38 hours on the B76 type aircraft. He had been undergoing training for a multi-engine command instrument rating (MECIR), and this positioning flight was his first solo flight in the aircraft.

He recalled being advised about conflicting traffic by the Gold Coast tower controller, and recalled having responded 'traffic sighted'. He reported when he first sighted SWX, he incorrectly thought it was tracking parallel to ZUA, and did not appear to be getting any closer. Hence he turned his attention to trying to reset the CTAF of 119.0 MHz on COMM1, to enable him to communicate with the helicopter. At this stage, he had changed the selected frequencies to having the Gold Coast tower frequency on COMM 1, and the ATIS and CTAF on COMM 2. Then he changed COMM 2 to have the Gold Coast Ground frequency selected in preparation for taxi after landing.

During the process of entering, changing and selecting frequencies on the two COMM sets, his attention had shifted from keeping the helicopter in sight, to attempting to communicate with it and arrange clearances.

He reported that at this stage SWX appeared to have 'turned toward him'[3] and as he watched it he realised it was heading directly at ZUA. He commenced evasive action by initiating a brief climb and a steep turn to the right. His intention was to parallel the track of the helicopter and keep it in sight.

Additionally, he reported that his sleep the night before had been disturbed.

VH-SWX pilot experience and comments

The pilot held a Commercial licence (Helicopter) and had around 6,500 hours flying experience. The pilot commented that the first awareness of ZUA was when it passed over the helicopter from behind.

Safety message

This incident highlights the importance of having the correct radio frequencies planned and correctly set up prior to and during flight and the need for vigilance when keeping conflicting traffic in sight. Pre-flight preparation is an essential part of safe flying operations and can prevent a loss of situational awareness and avoid the pilot's attention being focused for long periods inside the cockpit.

- CASA has developed the *Look out! Situational awareness* DVD for pilots to learn more about the safety-critical skills that makes up situational awareness. There is a strong emphasis on the need to prepare and plan for every flight. The DVD gives a definition of situational awareness of "what's happened, what's happening and what might happen".

The CASA DVD is available from the CASA online store http://shop.casa.gov.au/products/look-out-situational-awareness-dvd

General details

Occurrence details

Date and time:	4 January 2015 – 1221 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	325 M 20 km Gold Coast	
	Latitude: 27° 59.77' S	Longitude: 153° 25.28' E

Aircraft details

Manufacturer and model:	Beech Aircraft Corporation B76	
Registration:	VH-ZUA	
Serial number:	ME-351	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – N/A
Damage:	None	

3 SWX was on a direct track to overhead Robina town centre. Hence the potential conflict and alert by ATC. The pilot of ZUA has incorrectly assessed the helicopter as previously paralleling ZUA's track and then turning toward him.

Aircraft details

Manufacturer and model:	Eurocopter AS.350B2	
Registration:	VH-SWX	
Serial number:	9053	
Type of operation:	Charter – Scenic Flight	
Persons on board:	Crew – 1	Passengers – 5
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Separation issue involving a Cessna 208, VH-LNH, and a Cessna 207, VH-WOX

What happened

On 15 May 2015, at about 0600 Western Standard Time (WST), a Cessna 207 aircraft, registered VH-WOX (WOX), departed Kununurra Airport, Western Australia, for a local scenic charter flight with a pilot and four passengers on board. A few minutes later, a Cessna 208B (Caravan) aircraft, registered VH-LNH (LNH), also departed Kununurra for a local scenic charter flight, operated by another company, with a pilot and 12 passengers on board. Three other Cessna Caravan aircraft from that company departed at around the same time, with LNH the third of the four Caravans in sequence.

The pilot of WOX reported maintaining visual and listening awareness of the other aircraft throughout the scenic flight. On returning to Kununurra, the company procedure for WOX was to overfly the airfield at 2,000 ft then descend about 5 NM to the north before returning and joining the circuit on base leg for runway 12. The company procedure for LNH was to approach the airfield from the south and join the circuit on the crosswind leg for runway 12. While conducting aerial work to the north of the field, the pilot of WOX heard the pilots of the first two of the Caravans broadcast inbound calls on the common traffic advisory frequency (CTAF).

At about 0812,[1] when about 5 NM from the airfield on an extended base leg, the pilot of WOX broadcast that they had completed airwork and were tracking to join on base for runway 12 (Figure 1). At the time, the first of the Caravans had landed and the pilot of the second Caravan, then ahead of WOX, had broadcast turning base. About 10 seconds later, LNH broadcast joining midfield crosswind. Eight seconds after the broadcast from LNH, the pilot of WOX reported being about 2 NM from the runway, on base leg. The pilot of WOX then broadcast that they had both the aircraft ahead on final approach, and LNH abeam WOX and turning downwind, in sight.

The pilot of LNH reported conducting an oval-shaped circuit pattern, flying a curved base leg with a constant left turn from the downwind leg to the final leg for runway 12. After commencing the turn, the pilot of LNH reported hearing the broadcast from WOX stating they had LNH in sight. The pilot of LNH did not sight WOX and assumed the pilot would sequence to join the circuit behind LNH.

At about 0813, the pilot of WOX turned onto final for runway 12 and broadcast doing so. The Caravan ahead had landed and cleared the runway. LNH did not broadcast turning base and the pilot of WOX assumed that LNH was then still well behind WOX. When about three quarters of the way through the continuous left turn from downwind and approaching the final leg, the pilot of LNH configured the aircraft for landing and selected full flap. At that time, the pilot of LNH reported hearing WOX broadcast turning final. A few seconds later, the pilot of LNH sighted WOX ahead, to the right, slightly above, and in close proximity to LNH. The pilot of LNH then continued a steeper left turn to increase separation with WOX. As the aircraft turned to the north-east, the pilot of LNH sighted a company aircraft on downwind and at about 0815, broadcast conducting a left orbit. The pilot of LNH also asked the pilot of the following aircraft to conduct an orbit to increase separation between those two aircraft.

At that time, WOX was on late final approach to runway 12. The pilot of WOX assumed LNH had conducted the orbit to increase separation and ensure WOX would be clear of the runway. The

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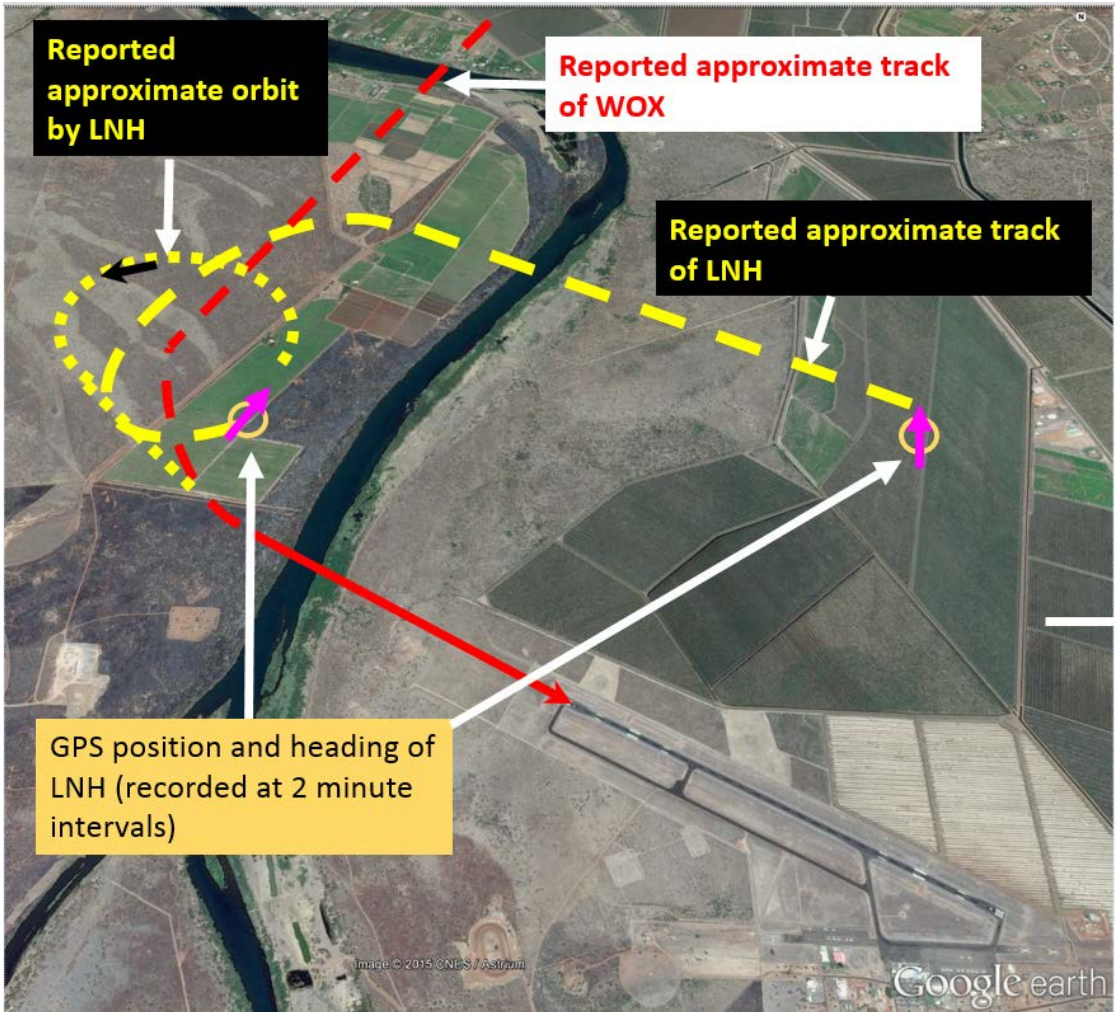
[1] The ATSB obtained copies of the recorded CTAF broadcasts. The timestamps of the CTAF recordings appeared to differ from the GPS ‘Spidertracks’ obtained from VH-LNH by about 3 minutes. All times are therefore approximate.

pilot of WOX was not aware of the separation issue subsequently reported by LNH. Both aircraft landed safely without further incident.

Figure 1: Kununurra aerodrome with the approximate aircraft tracks



Source: Google earth annotated by the ATSB

Pilot comments

Pilot of VH-WOX

The pilot of WOX provided the following comments:

- The aircraft that landed ahead of WOX had completed a normal square base leg and the pilot assumed that LNH would therefore do the same.
- The aircraft ahead of WOX was closer to WOX than LNH was, when the pilot joined base. The pilot assessed that there was sufficient distance for adequate separation from the aircraft ahead and from LNH, and therefore did not ask the pilot of LNH to confirm they had WOX in sight.

Pilot of VH-LNH

The pilot of LNH provided the following comments:

- The pilot had not sighted WOX when the pilot broadcast joining base, and assumed it would join behind LNH.
- As the wind was about 15 kt from the south-east, the downwind leg of the circuit was completed in relatively short time.

- The pilot of LNH had previously worked for the company that operated WOX. While flying for that company, the pilot joined an offset base leg to intercept the final leg at about 2.5 to 3 NM. The pilot believed that WOX would have conducted a similar joining procedure. From this procedure, the pilot assumed that WOX would therefore sequence behind LNH, which was already in the circuit.

Operator comments

The operator of LNH provided the following comments:

- Joining the circuit on base was not a standard procedure. Pilots of aircraft joining the circuit in a non-standard manner were required to give way to aircraft established in the circuit.
- There was never a formal nor an informal company procedure to conduct an oblong circuit. The use of a constant turn from downwind to final has subsequently been removed from pilot training and that change communicated to all company pilots.

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 of VH-LNH

The operator of LNH issued a safety notice to company pilots titled *Circuit Operations*. The notice included the following:

- Pilots were directed to fly a standard rectangular base leg to enable greater visibility of aircraft in the circuit area. The practice of conducting a curved approach was to cease immediately.
- Pilots were reminded to complete all cockpit checks early when joining the circuit. This was to maximise the time available for pilots to scan outside the aircraft and to avoid distractions.
- Pilots were reminded to make position reports in a timely manner and acknowledge radio calls where required. A double-click of the radio transmitter was not deemed to be an acceptable means of a read-back.

Operator of VH-WOX

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

- Company aircraft are to track for a 3 NM final when there is other traffic in the circuit.
- Company pilots are to confirm with other aircraft that they have visual confirmation of the location of their aircraft. If they do not, then the pilot is to ensure they maintain separation.

Safety message

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is safety around non-controlled aerodromes.

As detailed in the booklet *A pilot's guide to staying safe in the vicinity of non-controlled aerodromes*, ATSB research found that, between 2003 and 2008, there were 709 airspace-related events at, or in the vicinity of non-towered aerodromes. This included 60 serious incidents and six accidents (mid-air and ground collisions). Most of the 60 serious incidents were near mid-air collisions.

Issues associated with unalerted see-and-avoid have been detailed in the ATSB research report Limitations of the See-and-Avoid Principle. The report highlights that unalerted see-and-avoid relies entirely on the pilot's ability to sight other aircraft. Broadcasting on the CTAF is known as radio-alerted see-and-avoid, and assists by supporting a pilot's visual lookout for traffic. An alerted search is more likely to be successful as knowing where to look greatly increases the chances of sighting traffic. The report *Limitations of the See-and-Avoid Principle* is available at the ATSB website.

This incident highlights the importance of broadcasting an aircraft's position and of other pilots in the vicinity then ensuring they have the aircraft sighted following the broadcast.

General details

Occurrence details

Date and time:	15 May 2015 – 0815 WST	
Occurrence category:	Incident	
Primary occurrence type:	Separation issue	
Location:	near Kununurra Aerodrome, Western Australia	
	Latitude: 15° 46.68' S	Longitude: 128° 42.45' E

Aircraft details: VH-LNH

Manufacturer and model:	Cessna Aircraft Company, 208B	
Registration:	VH-LNH	
Serial number:	208B0590	
Type of operation:	Charter - passenger	
Persons on board:	Crew – 1	Passengers – 12
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Aircraft details: VH-WOX

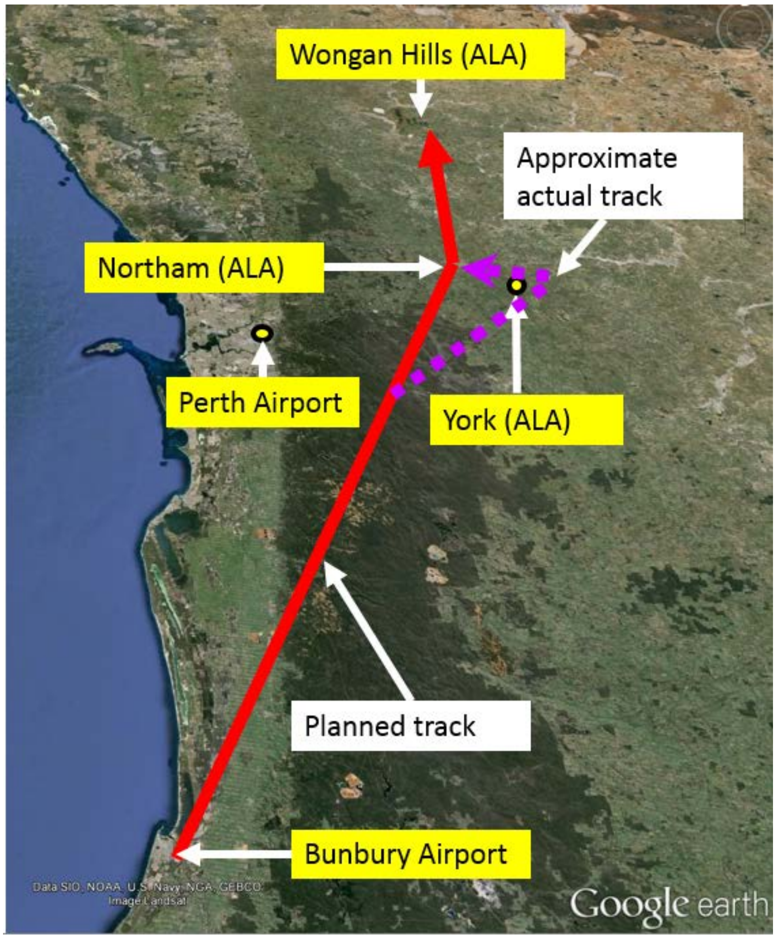
Manufacturer and model:	Cessna Aircraft Company, 207	
Registration:	VH-WOX	
Serial number:	20700130	
Type of operation:	Charter - passenger	
Persons on board:	Crew – 1	Passengers – 4
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

VFR into IMC involving a Beech A36, VH-ANX

What happened

On 19 May 2015, the pilot of a Beech A36 aircraft, registered VH-ANX, conducted pre-flight preparations for a private flight from Bunbury Airport to Wongan Hills aeroplane landing area (ALA), Western Australia (Figure 1). The pilot assessed that based on the weather forecast, they would be able to conduct the flight in visual meteorological conditions (VMC).[1] The pilot submitted a flight plan for the flight under the visual flight rules (VFR).[2] The pilot planned to track via Northam ALA at 3,500 ft above mean sea level (AMSL), in accordance with VFR cruise altitudes. The pilot also planned to remain clear of Perth air traffic control zone. At about 1525 Western Standard Time (WST), the aircraft departed from Bunbury, with full fuel on board.

Figure 1: The pilot's planned route from Bunbury to Wongan Hills via Northam (red) and the approximate actual track, via York (purple)



Source: Google earth annotated by ATSB

1 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.

2 Visual flight rules (VFR) are a set of regulations which allow a pilot to only operate an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.

When approaching abeam Perth, the pilot observed significant cloud in the Perth area. The pilot reported seeing cloud to the left and right, but could see a clear path ahead. They then descended to about 3,000 ft to remain clear of cloud, and continued on the planned route.

When about 10 NM south-west of York ALA, the pilot observed the cloud start to close in, and build to the west. The pilot made multiple diversions to the right of the planned track, but the cloud continued to close in. The pilot then commenced turning back, but the cloud had closed in behind the aircraft. The pilot climbed the aircraft to 3,500 ft and elected to enter the cloud and continue towards Northam.

At about 1547 WST, when about 1 NM east of York ALA and at 3,500 ft AMSL, the pilot contacted Perth air traffic control (ATC) and requested assistance. The pilot advised that the flight was operating under a VFR flight plan, had entered cloud, and was instrument rated. The controller identified the aircraft on radar, then at 3,700 ft. The controller asked whether the pilot was able to remain in instrument meteorological conditions (IMC),[3] and the pilot responded in the affirmative. The controller then advised that the lowest safe altitude in the area was 3,300 ft, and asked whether the pilot wanted to continue the flight under the instrument flight rules (IFR),[4] to which the pilot replied 'I have no choice I am in IMC'.

The controller then allocated the aircraft a unique transponder code, asked how many people were on board and the fuel endurance remaining. The controller also asked whether the pilot wanted to divert to Jandakot Airport and be provided with the radar lowest safe altitude. However, the pilot responded by asking for advice regarding the weather to the north.

As the aircraft was outside the Perth control area, the controller then coordinated[5] with the Melbourne centre controller to hand the aircraft over. The controller also requested an update on the weather be provided to the pilot. The controller then advised the pilot that the aircraft was now indicating an altitude of 2,800 ft and the pilot responded 'just climbing back up'.

At about 1552 WST, the pilot communicated with the Melbourne centre controller, and advised that they were now visual and would continue tracking to Northam at about 2,400 ft AMSL. The aircraft landed at Wongan Hills ALA at about 1630 WST, without further incident.

Pilot experience

The pilot had about 800 hours total flying time, attained an instrument rating about 2 years prior to the incident, and had completed 82 hours of instrument flight time. The pilot had completed an instrument flight in the simulator three weeks prior to the incident, and was therefore current (and qualified) for flight under the instrument flight rules.

The aircraft was IFR approved and equipped.

Pilot comments

The pilot was not aware it was possible to contact ATC and request change from VFR to IFR flight while airborne. They had not set up any navigation aids prior to entering IMC, and reported that they were navigating primarily by reference to the directional indicator while in cloud.

The pilot could not recall why the aircraft descended below the applicable lowest safe altitude during the flight. They thought it was possibly because they were distracted by responding to ATC's request for the aircraft's fuel endurance, or checking the aircraft's position on their iPad.

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3 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.

4 Instrument flight rules (IFR) permit an aircraft to operate in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules. Procedures and training are significantly more complex as a pilot must demonstrate competency in IMC conditions, while controlling the aircraft solely by reference to instruments. IFR-capable aircraft have greater equipment and maintenance requirements.

5 Coordination is the process of obtaining agreement on clearances, transfer of control, advice or information to be issued to aircraft, by means of information exchanged.

The pilot assessed their own workload to be moderate, and only slightly increased when the aircraft entered cloud.

Weather forecast

The area forecast (ARFOR)[6] for area 60, current at the time of the incident, for the subdivision south of a line joining Cue and Geraldton, included:

Table 1: Area forecast for area 60

Cloud cover	Cloud type	Cloud base	Cloud tops	Weather
Broken[7]	Stratus	1,000 ft AMSL (2,000 ft inland)	2,000 ft AMSL (3,000 ft inland)	
Broken	Cumulus/stratocumulus	2,000 ft AMSL (3,000 ft inland)	8,000 ft AMSL	Showers of rain

The terminal aerodrome forecast (TAF) current for Perth included scattered cloud with base at 3,500 ft above ground level.

ATSB comment

During flight, pilots are able to request ATC amend their flight plan from VFR to IFR, or vice versa. When requesting a change from VFR to IFR while in flight, the aircraft should remain at a VFR level and in VMC, until the IFR clearance is received. The details required by ATC include:

- aircraft callsign and type
- departure and destination points
- current location
- number of people on board
- fuel endurance.

Safety message

Pilots are encouraged to make conservative decisions when considering how forecast weather may affect their flight. If poor weather is encountered en route, timely and conservative decision making may be critical to a safe outcome. VFR pilots are encouraged to familiarise themselves with VMC criteria detailed in *Aeronautical Information Publication (AIP) Australia*. Where forecast or actual conditions are such that continued flight in VMC cannot be assured, pilots should assess all available options. Unplanned flight into conditions of limited visibility can rapidly lead to loss of orientation and loss of aircraft control.

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is Flying with reduced visual cues.

If the pilot and aircraft are rated and certified for instrument flight, and weather conditions may not be suitable for flight under the VFR, it may be judicious to be prepared for an IFR flight. During the flight, if the pilot is not assured that VMC conditions can be maintained, the pilot may then request changing to IFR flight. When amending from a VFR to IFR flight en route, it is important to have

6 An area forecast issued for the purposes of providing aviation weather forecasts to pilots. Australia is subdivided into a number of forecast areas.

7 Cloud cover is normally reported using expressions that denote the extent of the cover. The expression few indicates that up to a quarter of the sky was covered, scattered indicates that cloud was covering between a quarter and a half of the sky. Broken indicates that more than half to almost all the sky was covered, while overcast means all the sky was covered.

the necessary details ready and contact ATC for an IFR clearance prior to entering IMC. Ensuring all available navigation aids are set up correctly even for a VFR flight will reduce the pilot's workload when changing to instrument flight.

General details

Occurrence details

Date and time:	19 May 2015 – 1554 WST	
Occurrence category:	Incident	
Primary occurrence type:	VFR into IMC	
Location:	1 NM E of York (ALA), Western Australia	
	Latitude: 31° 51.98' S	Longitude: 116° 48.17' E

Aircraft details

Manufacturer and model:	Beech Aircraft Corporation, A36	
Registration:	VH-ANX	
Serial number:	E-1675	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Collision with terrain involving a Cessna 182, VH-AHC

What happened

On 5 July 2015, the pilot of a Cessna 182 aircraft, registered VH-AHC, conducted a local flight from a private airstrip about 100 km south-west of Bourke, New South Wales. The aircraft took off towards the west. After a flight of about 15 to 20 minutes, the aircraft returned overhead the airstrip. Based on the indicated wind, the pilot elected to conduct an approach to land towards the south.

When on final approach to land, at about 5 ft above ground level, the aircraft sank rapidly. The aircraft landed heavily and the nose wheel detached from the aircraft. The aircraft then bounced into the air, touched down for a second time, and dug into soft ground. The aircraft flipped over and came to rest inverted, resulting in substantial damage (Figure 1). The pilot and two passengers sustained minor injuries.

Pilot comments

The pilot reported that the property had received about 100 mm of rain over a period of 2 weeks, which had stopped about 7 days prior to the incident. Cold weather in the intervening period had prevented the soil from drying. Prior to taking off, the pilot had driven over the runway surface and assessed the surface to be suitable for landing. However, below the runway surface, there was a soft layer of earth. This layer extended about 500 mm down and was not evident during the runway inspection.

The pilot was unsure what caused the aircraft to sink faster than usual. The wind was light and variable. The additional sink and high rate of descent combined with the soft surface led to the aircraft landing gear digging in and flipping the aircraft over.

Figure 1: Accident site of Cessna 182, VH-AHC

Source: Aircraft owner

Safety message

This incident highlights the importance of the identification and management of risks associated with unsealed airfields. Potential hazards such as changes in the runway surface following rain can be hard to detect. Changes in the runway surface can adversely affect the outcome of a hard landing.

The ATSB report regarding a similar incident is available on the ATSB website at AO-2015-038.

General details

Occurrence details

Date and time:	5 July 2015 – 1530 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	100 km SW of Bourke, New South Wales	
	Latitude: 30° 43.48' S	Longitude: 145° 16.57' E

Aircraft details

Manufacturer and model:	Cessna Aircraft Corporation 182	
Registration:	VH-AHC	
Serial number:	18260495	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – 1 (Minor)	Passengers – 2 (Minor)
Damage:	Substantial	

Helicopters

Tail rotor malfunction involving a Robinson R22, registration VH-HPH

What happened

VH-HPH

Source: Helicopter operator

On 18 November 2014, at about 1728 Central Standard Time (CST), a Robinson R22 helicopter, registered VH-HPH (HPH), departed from La Belle Downs Station, Northern Territory, for a local flight to check the progress of a bush fire, with the pilot and one passenger on board.

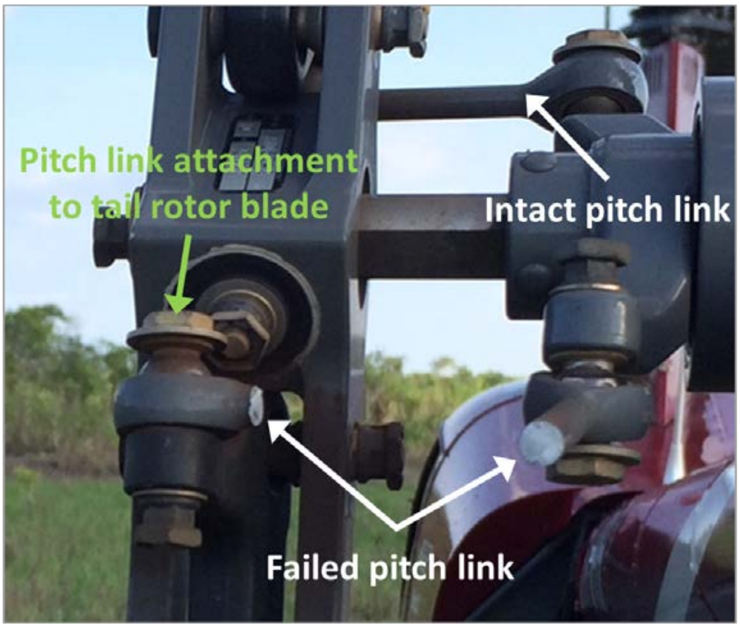
About two minutes into the flight, on climb and at about 300 ft above ground level, the pilot felt a vibration through the tail rotor pedals. The pilot decided to return to La Belle Downs station, turned the helicopter to the right and started a descent. The pilot was unable to stop the turn and the helicopter continued to descend and turn to the right. The helicopter started to spin in a tight circle and completed between five and six rotations before landing hard, bouncing once and then coming to a stop. The pilot performed the shutdown procedure and the pilot and passenger exited the helicopter. The pilot and passenger were uninjured. The helicopter was substantially damaged, including damage to the tail boom and both skids.

Pilot comment

After landing, the pilot observed that the tail rotor pitch link[1] had failed (Figure 1).

Prior to the first flight of the day, the pilot reported carrying out a daily inspection without finding any defects. The pilot had then flown HPH for approximately 2 hours, prior to the accident flight.

Figure 1: Failed tail rotor pitch link



Source: Aircraft operator, annotated by the ATSB

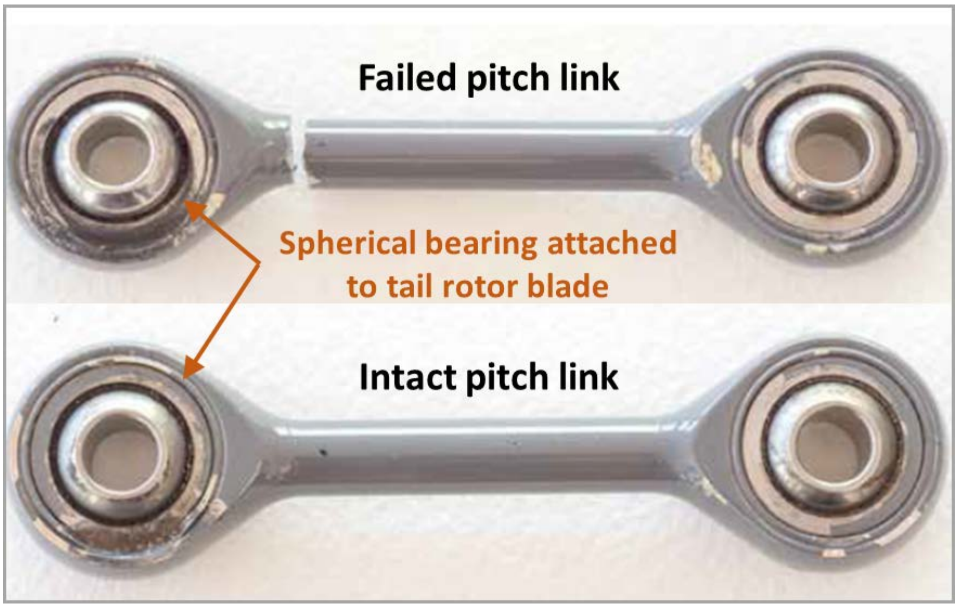
[1] There are two tail rotor pitch links, one for each tail rotor blade. The pitch link connects the blade to the tail rotor pitch control assembly. The tail rotor pitch control assembly is connected via push pull controls to the pedals in the cockpit, which the pilot moves for directional control.

Operator investigation

An examination of the tail rotor pitch links was conducted on behalf of the helicopter operator by a consultant in engineered-system failure analysis and the following was found (Figure 2):

- Alternating stress in the failed pitch link resulted in the initiation and propagation of a fatigue crack.
- The alternating stress in the pitch link resulted from failure of the spherical bearing to provide a low friction connection between the end of the tail rotor blade and the pitch link.
- The failed pitch link spherical bearing attached to the tail rotor had extensive wear. Axial wear of the spherical bearing was measured to be about 0.108 inch (2.743 mm).
- The intact pitch link spherical bearing attached to the tail rotor also showed signs of extensive wear. Axial wear of the spherical bearing was measured to be about 0.041 inch (1.041 mm).
- The factors that influence the rate of wear in the spherical bearing that attaches the tail rotor blade to the pitch link would not be expected to vary from helicopter to helicopter.
- No physical explanation was found as to why the specified inspection procedures (*R22 Maintenance Manual,* Chapter 2 Inspection, section 2.410) failed to detect bearing wear. Possible explanations beyond what could be ascertained by the examination were that the helicopter was operated in an exceptionally abrasive environment or the Teflon bearing lining was affected by some cleaning action.

Figure 2: HPH tail rotor pitch links



Source: Aircraft operator, annotated by the ATSB

HPH maintenance documentation

About 443 hours prior to the accident, at a 50 hourly inspection, the tail rotor pitch links (part number B345-3) were found to be unserviceable. Two new pitch links, with the same part number, were installed. The pitch link had failed about 2 hours prior to the next scheduled 100 hourly inspection. The maintenance release indicated that all the required daily inspections had been carried out and that there were no outstanding maintenance issues.

Manufacturer comment

The helicopter manufacturer was only aware of one other similar failure that occurred about 10 years ago. The manufacturer believed that the failure was as a result of the axial wear (about five times more than permitted) allowed binding to occur, with resultant fatigue failure to the pitch link.

Pilot operating handbook

Robinson Model R22 Pilot's Handbook, Section 4 *Normal Procedures Daily or Prefight checks*, dated 20 April 2007 page 4-3, included an item to check the tail rotor pitch links for "No looseness".

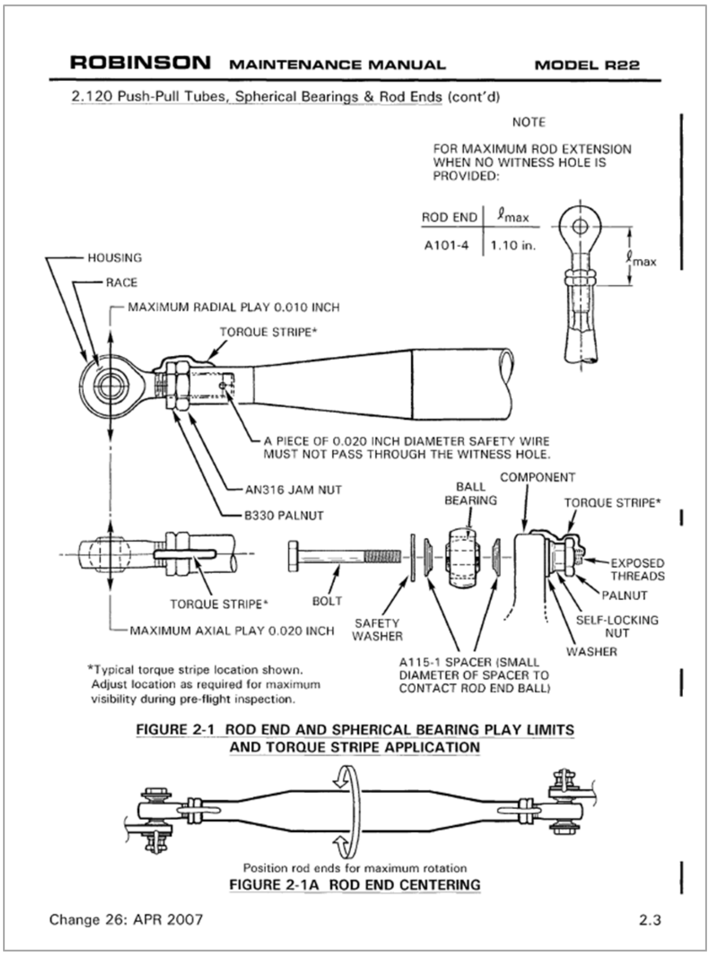
Robinson maintenance manual

The *Robinson Maintenance Manual Model R22* contains inspection requirements to be conducted at the 100-hour or annual inspection. Section 2.410 *Inspection procedures and checklist* item 12. *Rotor Hub Hinge Bolts,* dated October 2014, required the condition of the pitch links and rod ends to be inspected. This inspection was to be in accordance with section 2.120 *Push-Pull Tubes, Rod Ends, and Spherical Bearings* (dated October 2014), with reference to Figure 2-1 (reproduced below in Figure 3). The inspection needed to meet the following conditions:

- the maximum allowed axial play of 0.020 inch (0.508 mm). The axial play of HPH's failed pitch link was about 0.108 inch (2.743 mm) and the intact pitch link was about 0.041 inch (1.041 mm)
- the maximum radial play of 0.010 inch (0.254 mm) for the rod end spherical bearings
- with no looseness between the bearing outer race and the rod end housing.

The maintenance manual also contained a caution that the Teflon-lined bearings must not be lubricated or cleaned with solvent.

Figure 3: Robinson maintenance manual spherical bearing limits



Source: Robinson

ATSB comment

CASA SDR database search

The operator reported to the ATSB that the R22 helicopter tail rotor pitch links had been failing regularly in mustering operations. CASA provided information from their Service Difficulty Report (SDR) database from 1983 to 2014. The database showed three previously reported defects with the same part number tail rotor pitch link as HPH where the pitch link had failed (Table 1). Two of the failures had occurred in flight.

Table 1: CASA SDR database - Tail rotor pitch link failures

month/year of SDR	Failure	Time since new (hours)	Part number pitch link	Operation
09/2009	Tail rotor pitch link failed in flight.	434	B345-3	Mustering
11/2009	Tail rotor pitch link failed in flight. Spherical bearing attached to the tail rotor blade was found worn to limits.	562	B345-3	Mustering
04/2014	During the scheduled 100 hourly inspection the tail rotor pitch link fractured near the spherical bearing attached to the tail rotor blade.	289	B345-3	Unknown

CASA reported two important points in relation to the CASA SDR system:

> *in the case of the Robinson R22, there is no legislation requiring the manufacturer to be notified of the tail rotor pitch link failures in Australia that have been reported to CASA. While there is no requirement to provide this information, CASA usually provides data dumps of defect reports on an annual basis to North American NAAs [National Airworthiness Authorities including the US Federal Aviation Administration and Transport Canada].*
>
> *CASA encourages the industry to pass the defect information to the approval holder [manufacturer] and, as part of any follow up action CASA is likely to send the information to the approval holder [manufacturer], foreign or domestic.*

Safety message

Continuing airworthiness relies on inspections identifying damage so that parts can be repaired or replaced prior to failure. Therefore, scheduled maintenance inspections and the pilot’s daily inspection are a central element of the continuing airworthiness of the aircraft.

Regulators and aircraft manufacturers depend on accurate data to ensure the ongoing continued airworthiness of the aircraft. It is important that defects are reported to CASA through the Service Difficulty Reports (SDR) system, and to the manufacturer, so issues can be identified and rectified.

General details

Occurrence details

Date and time:	18 November 2014 – 1730 CST	
Occurrence category:	Accident	
Primary occurrence type:	Technical – rotor malfunction	
Location:	La Belle Downs Station, Northern Territory	
	Latitude: 13° 06.78' S	Longitude: 130° 29.93' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Co R22	
Registration:	VH-HPH	
Serial number:	3988	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Collision with terrain involving a Robinson R22, VH-APP

What happened

At about 0525 Western Standard Time on 11 February 2015, the pilot of a Robinson R22 helicopter, registered VH-APP, departed from a camp site north of Kalbarri, Western Australia, with a passenger on board. The purpose of the flight was to conduct a reconnaissance of the area where goats were to be mustered that day. The role of the passenger was to point out landmarks relevant to the mustering operation. There was some confusion about the landmarks, but the pilot and passenger completed their reconnaissance then landed at another site (the goat yards) where the passenger disembarked.

From the goat yards, the pilot was to return to the muster area to commence the mustering operation. The passenger was himself also involved in the mustering operation, and had a ground vehicle pre-positioned at the goat yards.

When they landed at the goat yards, the passenger disembarked the helicopter under the supervision of the pilot, but the pilot still had some important points that he needed to clarify with the passenger. Rather than shut down the engine, the pilot elected to leave the helicopter running. After applying cyclic and collective control friction,[1] he disembarked the helicopter to follow the passenger. Having caught up with the passenger about 30 m from the running helicopter, they then engaged in a conversation to clarify the points of concern to the pilot.

The pilot was unable to recall the exact length of time, but sometime in excess of about 2 minutes later, just as the pilot and passenger had concluded their conversation, the pilot heard the helicopter engine RPM increase and almost simultaneously, noticed that the helicopter was lifting clear of the ground. The helicopter climbed to a height of about 3 to 4 m above the ground and yawed through about 80 degrees to the left. The helicopter travelled backwards for a distance of about 8 m, remaining laterally level, and sank back to the ground with a significantly nose-high attitude. The tail of the helicopter struck the ground first, followed by the rear end of the skids. The tail rotor blades separated from the helicopter as the tail struck the ground and the rear part of the left skid broke away during the impact. The helicopter settled upright but during the accident sequence, the main rotor blades struck the ground and stopped abruptly. When the pilot was satisfied that it was safe to approach the helicopter, he moved forward and shut the engine down. Although the helicopter remained upright, it was substantially damaged (Figure 1). The pilot and passenger were both uninjured.

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[1] The cyclic and collective are primary helicopter flight controls. The cyclic control is similar in some respects to an aircraft control column. Cyclic input tilts the main rotor disc varying the attitude of the helicopter and hence lateral direction. The collective control affects the pitch of the blades of the lifting rotor to control the vertical velocity of the helicopter. The collective control of the Robinson R22 incorporates a throttle mechanism designed to increase engine RPM automatically as collective is applied. Both the cyclic and collective controls are fitted with a friction mechanism.

Figure 1: Helicopter damage

Source: Pilot

Pilot comments

The pilot believed that despite the application of control frictions, the vibration of the helicopter over the following couple of minutes (as he was engaged in conversation with the passenger) was enough to allow the collective to vibrate up with a commensurate application of engine power. He also commented that he was surprised at how quickly the accident happened. From the moment he heard the engine RPM begin to increase to the collision with terrain, was only a few seconds.

The pilot noted that he was possibly distracted at the time of the accident. Although he was an experienced mustering pilot, he had not mustered goats for some time. He was anxious to commence mustering as soon as possible that morning, mindful that in hot conditions goats were often more difficult to muster than cattle. Added to the distraction of perceived time pressure, the pilot had limited sleep during the evening prior to the accident and was generally mindful that it was likely to be a challenging day ahead. The pilot considered that with the benefit of hindsight, these distractions may have combined to influence his judgement in managing the circumstances surrounding the accident.

Robinson R22 Pilot's Operating Handbook

The Normal Procedures in the R22 Pilot's Operating Handbook (POH) includes the caution: 'Never leave helicopter flight controls unattended while engine is running.'[2] The POH also includes a number of important safety tips and notices. One Safety Notice with relevance to this accident is Safety Notice 17, which includes the following text:

NEVER EXIT HELICOPTER WITH ENGINE RUNNING

> *Several accidents have occurred when pilots momentarily left their helicopters unattended with the engine running and rotors turning. The collective can creep up, increasing both pitch and throttle, allowing the helicopter to lift off or roll out of control.*

Along with a range of important reference information about Robinson Helicopters, the R22 POH is available on the Robinson Helicopter Company website under the Publications tab.

Company Operations Manual

The company Operations Manual permitted pilots to leave a company helicopter unattended with the engine running for a period not exceeding 5 minutes, under specific conditions. Those conditions related primarily to the operational circumstances and the operating environment. The conditions also required the pilot to lock the controls and ensure that passengers and any other

[2] The POHs for Robinson Helicopter Company R44 series and R66 helicopters include the same caution.

personnel in the vicinity of the helicopter were appropriately managed. The pilot believed that he was operating in accordance with those conditions at the time of the accident.

Safety message

Leaving any vehicle unattended with the engine running carries considerable risk. Even where appropriate approvals are in place, pilots are encouraged to exercise extreme caution when considering the circumstances, and not allow perceived time pressures or other external factors to affect their judgement.

CASA Flight Safety Australia magazine Issue 91 (March/April 2013) includes an article titled *Don't Walk Away* which discusses regulatory issues surrounding leaving a helicopter unattended with the engine running. Pilots and operators are encouraged to ensure that they are familiar with the relevant regulations and the conditions attached to any associated exemptions. Furthermore, operators are encouraged to seek advice from CASA where any doubt exists regarding application of the regulations or associated exemptions. The article also provides a summary of some accidents that resulted when pilots left helicopters unattended with the engine running. A copy of the March/April 2013 edition of the CASA *Flight Safety Australia* magazine is available on the CASA website.

General details

Occurrence details

Date and time:	11 February 2015 – 0615 WST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	54 km NNW of Kalbarri, Western Australia	
	Latitude: 27° 14.17' S	Longitude: 114° 04.27' E

Aircraft details

Manufacturer and model:	Robinson Helicopter Co R22	
Registration:	VH-APP	
Serial number:	1070	
Type of operation:	Aerial work	
Persons on board:	Crew – Nil*	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

* The helicopter lifted off with nobody on board after the pilot and passenger had disembarked.

Wirestrike involving a Robinson R44, VH-LOL

What happened

Source: Supplied to the ATSB and reproduced with permission

On 10 April 2015, at about 1120 Central Standard Time (CST), the pilot of a Robinson R44 helicopter, registered VH-LOL (LOL) was engaged in herbicide dispensing operations near Marion Bay on the Yorke Peninsula in South Australia.

Also on board were client representatives who were directing the noxious weed management operation and manually dispensing the chemical into each bush. In the course of traversing the field at low level in search of the weed, the helicopter struck a previously unidentified power line. The helicopter's main rotor blade made initial contact with the power line and during the avoidance manoeuvre, the tail rotor blades also made contact, severing the blade tips (Figure 1). The pilot landed the helicopter safely. The helicopter was substantially damaged but the occupants were uninjured.

Figure 1: Tail rotor blade damage to VH-LOL

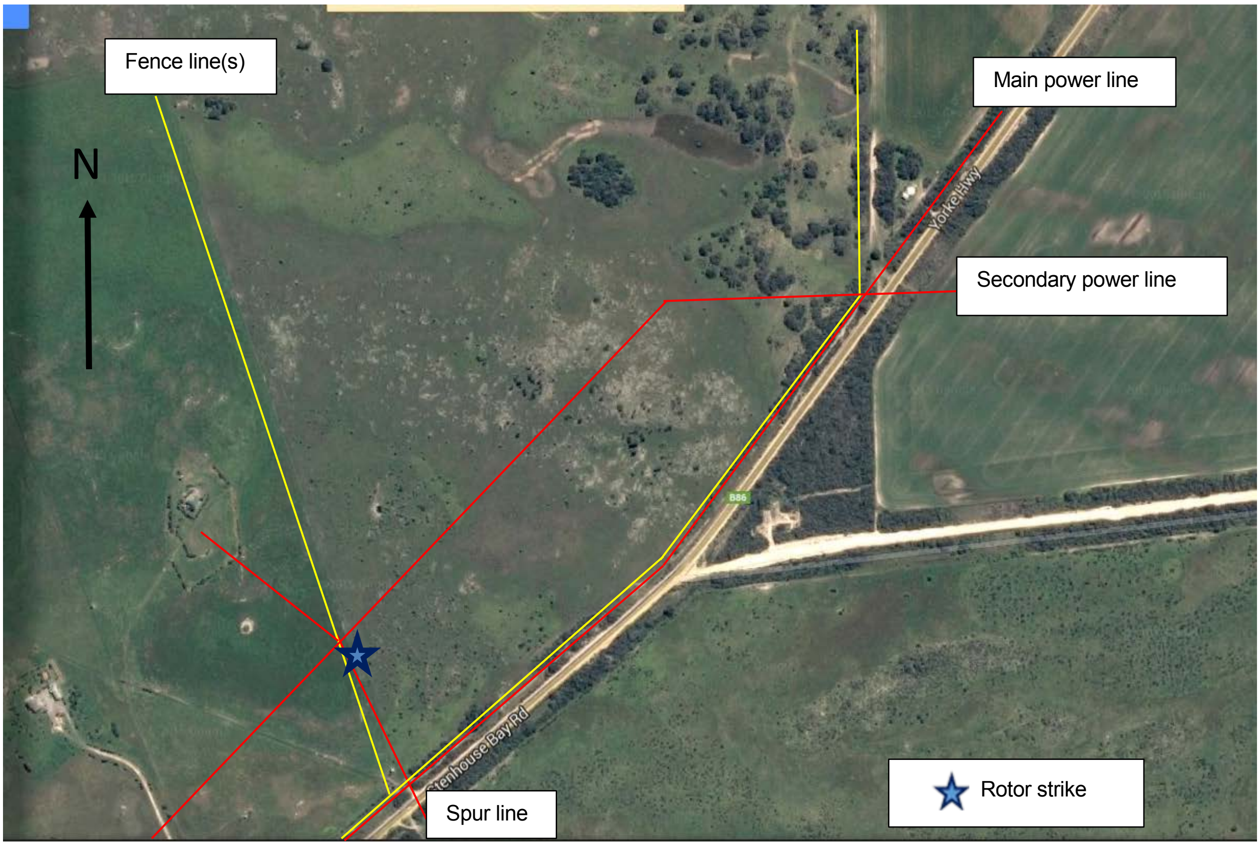
Source: Maintenance organisation

Power line identification

In preparation for the herbicide operations, the pilot conducted an aerial survey of the area. The aerial survey was a standard operating procedure to confirm the powerlines as previously advised by local sources. This survey identified main power lines running parallel to a boundary road and a secondary power line running parallel to the main lines (Figure 2). The secondary line effectively dissected the target area and operations were concentrated on sectors to the north and south of the secondary line. The location of the power lines were also mapped on the data logger that was being used to track the progress of the herbicide dispensing.

The unidentified powerline was a single wire that was strung between the poles supporting the main and secondary powerlines and traversed, unsupported, through the southern boundary of the operational area. It was not mentioned by the locals, nor marked on the data logger map. It was not readily discernible from the air although additional support poles did lead the wire away from the secondary power line towards a distant building.

Figure 2: Powerlines and boundary fencing



Source: Google Earth and modified by ATSB

Pilot comment

The pilot stated that the aerial survey of the powerlines confirmed the accuracy of the local knowledge and created a sense of confidence in him that all obstructions had been identified and accordingly mapped. In hindsight, a fully independent assessment by the pilot in command for the presence of powerlines in the target area may have located the single wire. The pilot had in excess of 14,000 hours operating at low level but not necessarily in powerline congested areas.

Risk management

The helicopter operator had documented a risk assessment of the planned operation, addressing aircraft operational considerations, environmental impacts, required personal protective equipment and herbicide management. The cabin occupants were also provided with a helicopter safety brief and formal induction prior to commencement of flight operations. Risk assessment outcomes and operational requirements were included in a specific job plan that was discussed in briefings with ground and flight crews at the beginning of the campaign. Briefings were also conducted with crews prior to the commencement of each day's flying.

Wire awareness, detection and avoidance techniques were also documented in the company operations manual in various sections along with specific references to aerial agriculture publications where mitigation for such hazards are addressed.

ATSB comment

This accident provides a reminder to flight crews of the need for consistency in aerial surveys for powerlines, the establishment of standardised procedures for their identification and the need for independent assessment of their presence.

Single wires can be difficult to see and occur in the most unexpected places in rural areas. ATSB research article *Avoidable accidents No. 1 - Low level flying' provides additional information on wire hazards associated with flight below 500*. The report is available at the ATSB website.

Avoidable Accidents No. 2 – Wirestrikes involving known wires: A manageable aerial agriculture hazard also explains a number of strategies, developed by the Aerial Agriculture Association of Australia (AAAA) and the ATSB, to help pilots manage the on-going risk of wire strikes. The report is available at the ATSB website.

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:

The operator has reviewed the risk assessment and moved to standardise procedures and now place greater emphasis on employee inductions with a focus on hazards and published information relating to high risk activities. Whilst the published information was generally available to company pilots, a greater focus on promulgating this information was recognised as beneficial. The use of non-permanent staff was to be reconsidered along with the dissemination and acknowledgement of receipt of safety critical information specific to the contracted flying program.

Operator client

Following a separate, internal investigation into the accident, the client updated its procurement processes. This update was to further ensure that contractor and project sponsor responsibilities were clearly defined in contracts and operational plans, with respect to:

- hazard identification
- operational briefings
- safety inductions.

General details

Occurrence details

Date and time:	10 April 2015 - 11:20 CST	
Occurrence category:	Accident	
Primary occurrence type:	Operational - Terrain Collisions – Wirestrike	
Location:	142 km WSW of Adelaide, South Australia	
	Latitude: S 35° 13.07'	Longitude: E 137° 59.90'

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R44	
Registration:	VH-LOL	
Operator:	Helifarm PTY LTD	
Serial number:	1885	
Type of operation:	Aerial work	
Persons on board:	Crew – 3	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Remotely Piloted Aircraft Systems

Loss of operator control involving an Aeronavics SkyJib 8 remotely piloted aircraft

What happened

On 29 March 2015, an Aeronavics SkyJib 8 remotely piloted aircraft (RPA) (Figure 1) was being used to assist with media coverage of the International Cricket Council World Cup Final, at the Melbourne Cricket Ground (MCG), Melbourne, Victoria. The RPA was being operated from the top of the south-western scoreboard of the MCG. The operating team consisted of:

- a flight controller, who piloted the RPA
- a ground station controller, who performed a range of functions including monitoring the position of the RPA and providing a back-up control for the flight controller
- a camera gimbal controller, who controlled the camera mounted beneath the RPA.

Figure 1: RPA prepared for flight with camera mounted beneath

Source: RPA operator

The accident flight followed four earlier uneventful flights that day. The crew completed all pre-flight checks[1] and made broadcasts on appropriate air traffic frequencies, then launched the RPA at about 1430 Eastern Daylight-saving Time. On this particular flight, the operator intended to capture footage of the MCG and surrounds as the competing teams entered the MCG and during the pre-match ceremonies. The RPA's take-off and departure were normal. The RPA was flown slowly southward toward Hisense Arena (Figure 2), climbing to a height of about 300 ft above ground level. The route was similar to that flown during earlier flights, without incident. All three control systems (flight control, ground station control and camera gimbal control) appeared to be functioning normally during the departure and transit to Hisense Arena.

[1] Pre-flight checks included confirmation that the GPS had acquired a sufficient number of satellites, the RPA 'home lock' feature was functional, and that battery systems were fully charged. The 'home lock' feature allows the flight controller to command the RPA to return to its starting point, using the flight control system 'return to home' function. The 'return to home' function uses GPS information to command the RPA to return to its starting point.

About 2 minutes into the flight and soon after the competing teams entered the MCG, with the RPA over the northern roof of Hisense Arena, the camera gimbal operator lost control of the gimbal. The gimbal operator reported the loss of control to the other team members. Several seconds later, the ground station controller also lost communication with the RPA. At that point, with the RPA moving slowly southward over Hisense Arena, the flight controller made a decision to discontinue the flight and return the RPA to the top of the scoreboard. The flight controller made appropriate control inputs but found that the RPA was unresponsive, and it continued to move slowly southward.

Having lost normal control of the RPA, the flight controller commenced alternate RPA recovery procedures. The flight controller switched from GPS to attitude mode,[2] but was still unable to control the RPA. The flight controller then activated the ‘return to home’ function, but this was also ineffective. The flight controller then reverted to manual control,[3] in an attempt to recover control of the RPA, but the RPA remained unresponsive. Throughout this time, the ground station controller continued attempts to re-establish communication with the RPA, also without success.

About 20 seconds after the initial control problems, the RPA commenced travelling at medium speed in a westerly direction, and began slowly descending. The flight controller continued attempts to re-establish control by switching between control modes and again activating the ‘return to home’ function, but all attempts were unsuccessful. When the RPA reached a point south of Rod Laver Arena, it appeared to cease lateral movement and stabilise just above treetop level. Continued attempts by the flight controller to regain control were unsuccessful, and the RPA descended beneath the treetops, out of sight of the controlling crew.

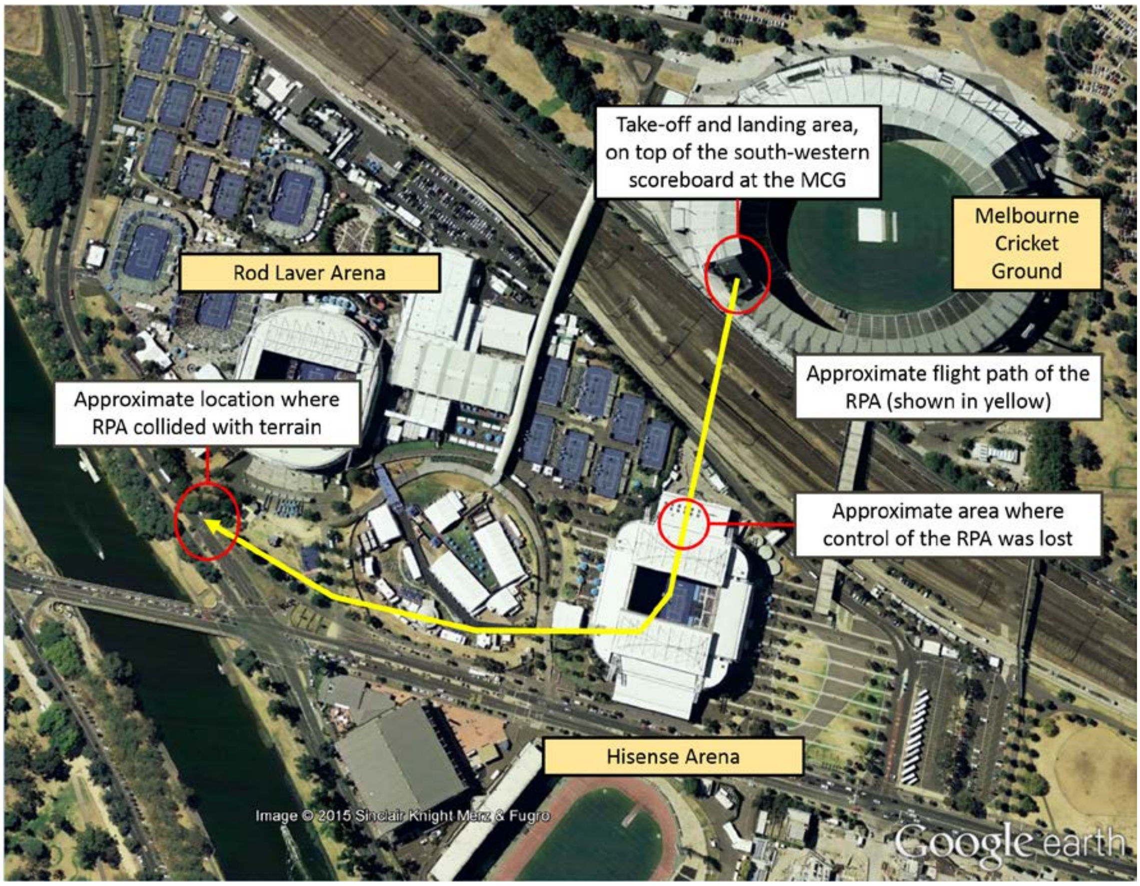
The RPA collided with terrain on the median strip on Batman Avenue to the south of Rod Laver Arena, a little over 3 minutes after the flight had commenced. The operating crew had maintained line of sight with the RPA until it descended beneath the treetops. Initial control difficulties were experienced when the RPA was just over 200 m from the position of the operating crew. The collision with terrain was about 450 m from their position (Figure 2).

There were no injuries to people on the ground, and no damage to other property, but the RPA and associated equipment were substantially damaged during the collision.

2 GPS mode provides RPA position and attitude stabilisation, while attitude mode provides platform stabilisation without GPS position stabilisation. In attitude mode, control inputs are required to counter the effects of wind. The control mode will switch automatically from GPS mode to attitude mode after a set time if the GPS signal is lost.

3 Manual mode is the most basic form of RPA control. In manual mode, the RPA is controlled by flight control stick inputs, without position or attitude stabilisation.

Figure 2: Approximate flight path of the RPA, from the take-off location on top of the south-western scoreboard at the MCG, to where control was lost over Hisense Arena and the collision location on Batman Avenue



Source: Google Earth with additions by the ATSB

Operator's approval and risk assessment

The operator had approval from the Civil Aviation Safety Authority to operate the RPA near people and over populous areas while taking aerial photography during the event. The approval included a number of conditions related to such things as RPA control capabilities, the operating area and the operating environment. The operator had also conducted a risk assessment relevant to the flight during which the accident occurred. This assessment included consideration of a range of environmental factors, and outlined a number of risk mitigation measures. Among other things, the risk assessment included consideration of:

- weather conditions that may affect control of the RPA
- light conditions that may affect the ability of the operating crew to maintain visual contact with the RPA
- the intended flight path with respect to the location of people and property
- the location of structures, other obstacles and other air traffic that may affect the flight
- the adequacy of emergency procedures and possible equipment failure modes
- the operating environment in terms of noise and possible distractions (operating crew and members of the public).

Operator's investigation

The operator investigated the accident, with a particular focus of establishing the reasons for which control of the RPA was lost. The investigation included consideration of a number of system-related and environmental factors, and the behaviour of the RPA following the loss of control.

The operator's report concluded that radio frequency interference was the most likely cause of the accident. The volume of radio frequency traffic at the time of the accident was probably substantial, and perhaps sufficient to override RPA control signals. Numerous fixed telecommunications facilities and mobile broadcast vehicles in the vicinity of the MCG were probably transmitting at the time of the accident. Over 93,000 people attended the event, many of whom were probably using personal mobile communication devices at about the time of the accident. Furthermore, the use of portable communication devices by event management personnel (such as security and emergency services personnel) may also have contributed to the volume of radio frequency traffic.

The operator considered that the behaviour of the RPA was consistent with signal interference or confusion, rather than signal loss. In the event that the signal was lost, the RPA would have entered a fail-safe mode. In fail-safe mode, if the RPA had a valid GPS signal it would have returned to the starting point and landed. Without a valid GPS signal, the RPA would have held position, then descend slowly in that position, until touch down. Additionally, the operator found no evidence that there was any fault with the RPA control systems or any hardware issues, which may have resulted in the loss of control.

The operator's investigation report commented that very similar operations had been conducted without incident prior to the accident flight. On this particular flight, the scale of the event, and probably the amount of associated radio frequency traffic, were more substantial. The operator's report also acknowledged that further testing and analysis was required before the primary cause of the accident could be confirmed beyond doubt.

Safety action

As a result of this occurrence, the RPA operator has advised the ATSB that they are planning further tests to better understand the nature of the loss of control of the RPA. A better understanding of the nature of the problem may allow identification of engineering measures to reduce the risk associated with the possibility of radio frequency interference.

The operator also intends to review procedures and update risk assessments considering the circumstances surrounding this accident.

Safety message

On this occasion, the available evidence suggests that a high volume of radio frequency traffic compromised RPA control and communication functions. This accident highlights the need for careful consideration of 'what might be different this time' during risk assessments, including the identification of appropriate risk mitigation strategies. Although the operator had conducted a risk assessment for the accident flight, the possible effects of a substantial increase in the volume of radio frequency traffic had not been specifically considered.

In a broader sense, this accident highlights the ongoing importance of appropriate RPA operational controls and procedures. These are particularly important where operations are intended in the vicinity of populated areas or other air traffic. The careful application of operational controls and procedures, underpinned by robust risk assessment, will become increasingly important as relevant technologies develop further and new RPA applications continue to emerge.

Important information for RPA operators, including information about relevant regulations, operational approval requirements and RPA associations, is available on the CASA website.

General details

Occurrence details

Date and time:	29 March 2015 – 1430 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	Near the Melbourne Cricket Ground, Melbourne, Victoria	
	Latitude: 37° 49.36’ S	Longitude: 144° 58.67’ E

RPA details

Manufacturer and model:	Aeronavics SkyJib 8 (v2.0) remotely piloted aircraft
Registration:	N/A (not required)
Type of operation:	Aerial photography
Damage:	Substantial

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

Enquiries 1800 020 616
Notifications 1800 011 034
REPCON 1800 011 034
Web www.atsb.gov.au
Twitter @ATSBinfo
Email atsbinfo@atsb.gov.au

Investigation

ATSB Transport Safety Report
Aviation Short Investigations
Aviation Short Investigations Bulletin Issue 41
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