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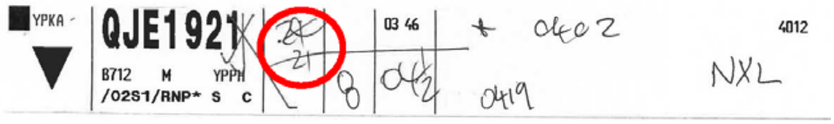
Loss of separation involving a Boeing 717, VH-NXL, and a vehicle

What happened

On 26 July 2014, the crew of a QantasLink Boeing 717 aircraft, registered VH-NXL (NXL), conducted a scheduled passenger flight from Karratha to Perth, Western Australia. At about 1158 Western Standard Time, the approach air traffic controller at Perth Airport cleared NXL to conduct an instrument landing system (ILS) approach to runway 24. The automatic terminal information service (ATIS) current at that time had been issued about 14 minutes earlier, and indicated that the runway was wet with visibility reducing to 3 km in showers of rain and a cloud base of 800 feet. Runways 21 and 24 were the runways in use.

At about 1159, having had a 30 minute break, the aerodrome controller (ADC) took over the position from another controller. At about 1200, the first officer of NXL, as pilot monitoring (PM),[1] switched frequencies from approach to tower, and contacted the ADC who acknowledged the call. The ADC amended the paper flight progress strip which had runway 21 written on it (Figure 1) as they could see on the air situation display (ASD) that the aircraft was on final for runway 24 and the label on the ASD indicated 24.[2] About 45 seconds later, the ADC cleared an Airbus A330 aircraft to land on runway 21.

Figure 1: Flight progress strip for VH-NXL



Source: ***Airservices Australia***

Also at about 1200, an airport safety officer (SO) drove out to the holding point for runway 24 on taxiway Whiskey (W) to conduct a routine runway inspection. The safety officer's vehicle, call-sign 'Safety Two' was bright yellow and fitted with a rotating orange beacon which was switched on. Approaching the holding point, in accordance with standard operating procedures, the SO contacted the surface movement controller (SMC) advising that the vehicle was at W, holding short of runway 24 for a runway inspection. The SMC directed the SO to hold short of runway 24 and contact the tower. At about 1201, the SO contacted the ADC in the tower and advised that they were holding short of runway 24 for a runway inspection. The ADC cleared the SO to enter runway 24 and hold short of runway 21, then wrote 'S2' on the console runway strip to indicate that runway 24 was occupied.

At that time, NXL was on final approach for runway 24 about 7.5 NM from the runway. Neither of the flight crew of NXL recalled hearing the vehicle being cleared onto the runway. On commencing the runway inspection, the SO checked the operation of the precision approach path indicator (PAPI)[3] on runway 24 due to an earlier heavy rain squall. The SO then continued driving along the centreline of runway 24 towards the intersection with runway 21. About 17 seconds later, the crew

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1 Pilot Flying (PF) and Pilot Monitoring (PM) are procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and aircraft flightpath.

2 When the approach controller amended the runway for an arriving aircraft, they would update the runway in The Australian Advanced Air Traffic System (TAAATS) which would then be reflected on the label on the ASD but not on the flight strip.

3 Precision Approach Path Indicator (PAPI) is a ground based, visual approach indicating system that uses a colour discriminating system used by pilots to identify the correct glidepath to the runway.

of the Airbus A330 on final approach to runway 21 requested the PAPI to be set to maximum intensity which the ADC then selected. The A330 then landed on runway 21.

At about 1203, the ADC cleared a Fokker 100 (F100) aircraft for take-off from runway 21. After observing that aircraft pass through the intersection of runway 24, the ADC picked up the flight progress strip for NXL, scanned the runway but did not see the vehicle on it. The ADC then moved the strip into the console runway bay (Figure 2) without noticing the safety vehicle strip, while simultaneously observing the F100 become airborne.

Figure 2: Perth aerodrome controller console

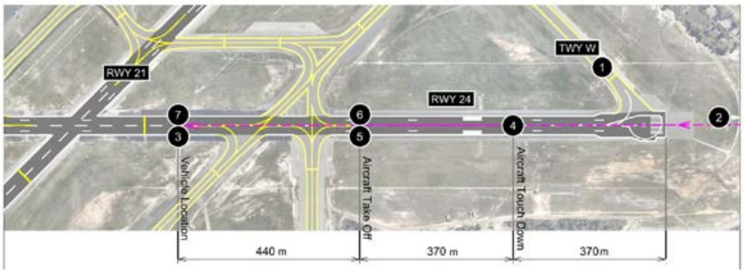
Source: ***Airservices Australia***

The ADC then provided the crew of NXL with the current wind speed and direction at the runway threshold and cleared NXL to land on runway 24. At that time, NXL was on final approach at about 1,000 feet and 1.5 NM from the runway threshold. The safety vehicle was on runway 24 heading south-west just passing taxiway Charlie. The SO reported that while operating on runway 24, they heard NXL being cleared to land but did not hear the assigned runway; otherwise they would have vacated the runway immediately. They expected the aircraft would land on runway 21. When cleared to land, NXL was still in cloud and the first officer sighted the runway when at about 700 feet above the ground.

At about 1204, as NXL touched down on runway 24 about 370 m from the threshold, the first officer saw the flashing lights of a vehicle ahead on the runway, immediately stated ‘go-around, car on the runway’ and the captain commenced a go-around. About 6 seconds later, the aircraft became airborne about 740 m from the threshold. At that time, the safety vehicle was stationary on the centreline of runway 24 about 1180 m from the threshold and facing away from the approaching aircraft. The SO did not see the aircraft, until it passed about 150 feet over the vehicle (Figure 3).

Figure 3: Sequence of events

Point	Description
1	Safety vehicle held at W
2	NXL cleared to land on runway 24
3	Safety vehicle stopped short of runway 21
4	NXL touched down on runway 24
5	NXL reported going around due car on the runway
6	NXL became airborne
7	NXL passed over vehicle at a height of 150 ft



Source: *Perth Airport Pty Ltd*

At about the same time, the ADC directed the F100 to contact Departures then recorded the landing time on the flight strip for NXL, before hearing the first officer of NXL broadcast ‘going around, car on the runway’. At about 1205, the SO asked ‘what happened there?’ on the tower frequency and the ADC directed the SO to vacate the runway. The ADC then coordinated NXL’s missed approach with the Departures controller and instructed the flight crew to transfer frequencies. At about 1206, the SO reported having vacated runway 24 to the ADC. About 20 seconds later, the ADC handed over the Tower position to a relieving controller.

Runway inspections

Five routine runway inspections were conducted daily at Perth Airport: serviceability inspections at 0000 and 0800; and Foreign Object Damage (FOD) inspections at 0500, 1200, and prior to last light. Additional ad-hoc inspections were carried out as required due to weather, birdstrikes or other extenuating circumstances.

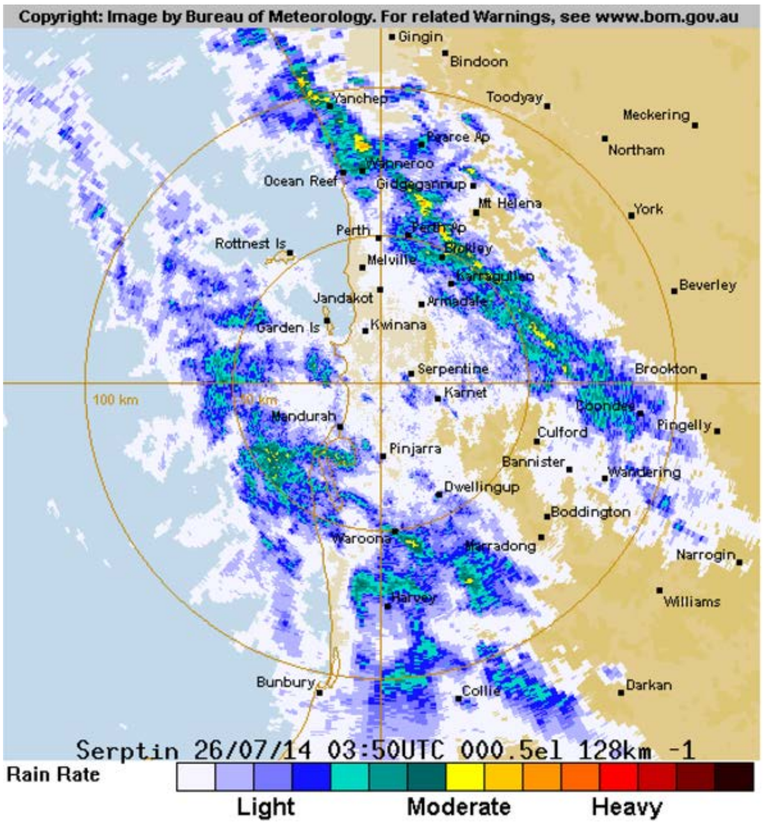
Until May 2014, the standard work procedure was for vehicles to be driven towards oncoming aircraft during the FOD inspections. For the serviceability inspections, the common practice was to follow a set route designed to minimise radio traffic and runway crossings. This resulted in the SO driving towards oncoming aircraft on one runway and with the flow of the aircraft on the other runway. Following a request on 7 May 2014 from Airservices Australia to expedite runway inspections by operating with the flow of aircraft traffic, an email was sent to the SOs by the Perth Airport Pty Ltd Airside Operations Managers regarding conduct of inspections with the flow of aircraft where possible to increase efficiency. Since then, most FOD inspections were conducted with the flow of the aircraft traffic.

At the time of the incident, the safety vehicle was facing away from the landing aircraft, and stationary on the white runway 24 centreline markings. The first officer in NXL reported that it was very difficult to see the vehicle on the runway markings. He started looking when the aircraft was about 30 ft AGL and only saw the vehicle as the main landing gear touched down.

Weather information

The Bureau of Meteorology data indicated that about 10.2 mm of rain fell between 1150 and 1200 on the day of the occurrence. The weather radar showed a line of showers passed through the area about 10 minutes prior to the incident (Figure 4).

Figure 4: Rain radar at 1150 WST



Source: ***Bureau of Meteorology***

Controller comments

The aerodrome controller (ADC) provided the following comments:

- A heavy shower had moved through from west to east and was about 3 NM on final approach to runway 24. A moderate shower was passing over the airport at the time of the incident.
- After many years of experience in air traffic control at Perth Airport, the controller had become efficient at the controlling duties, in particular by combining tasks together, or 'chunking'. In this incident, the controller combined the tasks of picking up the aircraft's flight progress strip in their left hand, while sighting the aircraft and checking that the landing gear was down, scanning the runway, issuing the landing clearance, and placing the strip into the console runway bay, without separating out the individual tasks. The controller reported that they now segment the tasks and complete them serially as separate actions, rather than simultaneously.
- The controller had a single runway bay on the Tower console (Figure 2) where flight progress strips for aircraft using either of the two runways in use were placed. The runway assigned to the aircraft was written on the aircraft's strip.
- The vehicle strip (red with a white centre) was in the console runway bay at the time of the incident. There were two possible reasons the controller may have missed it: the process of placing the aircraft strip without reconciling with the vehicle strip already there was a muscle memory or automatic process rather than a conscious one; or, the combination of picking up the strip, talking and scanning all at once when issuing a landing clearance meant that the controller was looking outside at the runway, talking and moving the strip without looking at the bay to reconcile the strips.
- Recently vehicles were operating more often in the same direction rather than in a reciprocal direction to aircraft movements. Prior to that, the safety vehicles would always conduct runway inspections in a reciprocal direction.

Flight crew comments

The captain of NXL provided the following comments:

- It was a split second decision to go around. If they had commenced the reverse thrust action, they would have been committed to landing.
- The aircraft had landing lights, navigation lights, beacon and high intensity lighting on at the time of the incident.
- The first officer was highly experienced which may have assisted in sighting the vehicle and reacting quickly. The incident provided a very good example of the value of flight crew knowing their role as pilot flying or pilot monitoring explicitly and maintaining a good awareness of their environment.

Safety officer comments

The safety officer reported that at about 1200, there was communication on the 'chit chat' radio on company frequency regarding a malfunctioning security gate which may have diverted their attention and contributed to his not hearing the aircraft being cleared to land on runway 24. The safety officer vacated the runway immediately on receiving the instruction from the controller.

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.

Upgrade to Airservices Australia technologies

Two Airservices Australia technological advancements are scheduled to be commissioned at Perth Airport in the next 12 months which will add significant layers of protection against such an incident. Advanced surface movement guidance control system (ASMGCS) or ground radar, will track and provide a visual display of all aircraft and vehicles on the airfield to air traffic control (ATC) personnel. In this incident, ATC would have received an alert indicating the conflict between the aircraft on final and the vehicle on the runway.

An integrated tower automation suite (INTAS) will combine flight and operational data, surveillance and voice communications into a single integrated tower-specific layout and replace the existing manual air traffic control system. If INTAS had been available at the time of this incident, the controller would have been able to allocate the electronic flight strip assigned to the aircraft in the runway bay, but an alarm would have been triggered.

Airport operator

As a result of this occurrence, Perth Airport Pty Ltd management has proposed the following recommendations:

- Human factors training for Safety Officers is to include a specific focus on relationships with ATC and situational awareness.
- Review the need for a dedicated radio channel for Safety Officers to use when operating on or crossing runways. The company frequency (chit chat) radio is to be switched off during runway operations.
- Reassess the suitability of vehicle lighting for runway operations.
- Mandate all runway inspections to be performed facing oncoming traffic.
- Review the types, frequency, methods and timing of runway inspections.
- Investigate technology that minimises runway entry and occupancy requirements.
- Review runway inspection techniques used at other airports.

Safety message

With experience comes the ability to fuse conscious control with largely automated actions. Instead of conscious focus on individual tasks, experts develop the ability to join separate movements and words together into packages or sequences. This automation of mental performance can improve efficiency and free up attentional resources for other tasks. However, the penalty for mental automation can be absent-mindedness or a lack of attention to a specific task.[4]

General details

Occurrence details

Date and time:	26 July 2014 – 1204 WST	
Occurrence category:	Serious Incident	
Primary occurrence type:	Runway incursion	
Location:	Perth Airport, Western Australia	
	Latitude: 31° 56.42' S	Longitude: 115° 58.02' E

Aircraft details

Manufacturer and model:	The Boeing Company 717-200	
Registration:	VH-NXL	
Operator:	National Jet Systems	
Serial number:	55093	
Type of operation:	Air Transport High Capacity – Passenger	
Persons on board:	Crew – 5	Passengers – 105
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

4 Reason, J, 2008. *The human contribution: unsafe acts, accidents and heroic recoveries*. Ashgate, England.

Incorrect configuration involving an Airbus A320, VH-VFU

What happened

Airbus A320: VH-VFU

Source: Allen Zhao

At about 1324 Eastern Standard Time on 28 July 2014, the flight crew of an Airbus A320 aircraft, registered VH-VFU, was preparing the aircraft for the fourth and final sector of the day. The flight was a return leg from Sydney, New South Wales, to Adelaide, South Australia.

There was a delay waiting for the aircraft to be refuelled, adding to the 25 minute delay already accrued during the first sector into Melbourne, Victoria.

Simultaneous opposite direction runway operations (SODROPS) were in place at Sydney, with arrivals using runway 34 Left (34L), and departures using runway 16 Left (16L). Air Traffic Control (ATC) issued the crew with a pre departure clearance (PDC) for the runway 16L Kevin Three standard instrument departure (SID).

The first officer (FO), the pilot monitoring (PM), calculated the performance data and established that a Configuration 2[1] (Figure 1) was required for take-off. As the pilot flying (PF), the Captain confirmed the performance data calculations and, using the multifunction control display unit (MCDU)[2] (Figure 2), entered the information into the flight management and guidance computer (FMGC). Shortly after, ATC advised the crew that due to an increased downwind component for runway 16L the PDC was cancelled. ATC then issued a departure clearance from runway 34L, via the Katoomba One SID.

Figure 1: Typical A320 Configuration settings

(1) FLAPS lever
The FLAPS lever selects simultaneous operation of the slats and flaps.

The five lever positions correspond to the following surface positions:

Position	SLATS	FLAPS	Indications on ECAM			
0	0	0			CRUISE	HOLD
1	18	0	1			
		10	1 + F	TAKEOFF		
2	22	15	2			APPR
3	22	20	3		LDG	
FULL	27	40	FULL			

Before selecting any position, the pilot must pull the lever out of the detent. Balks at positions 1 and 3 prevent the pilot from calling for excessive flap/slat travel with a single action.

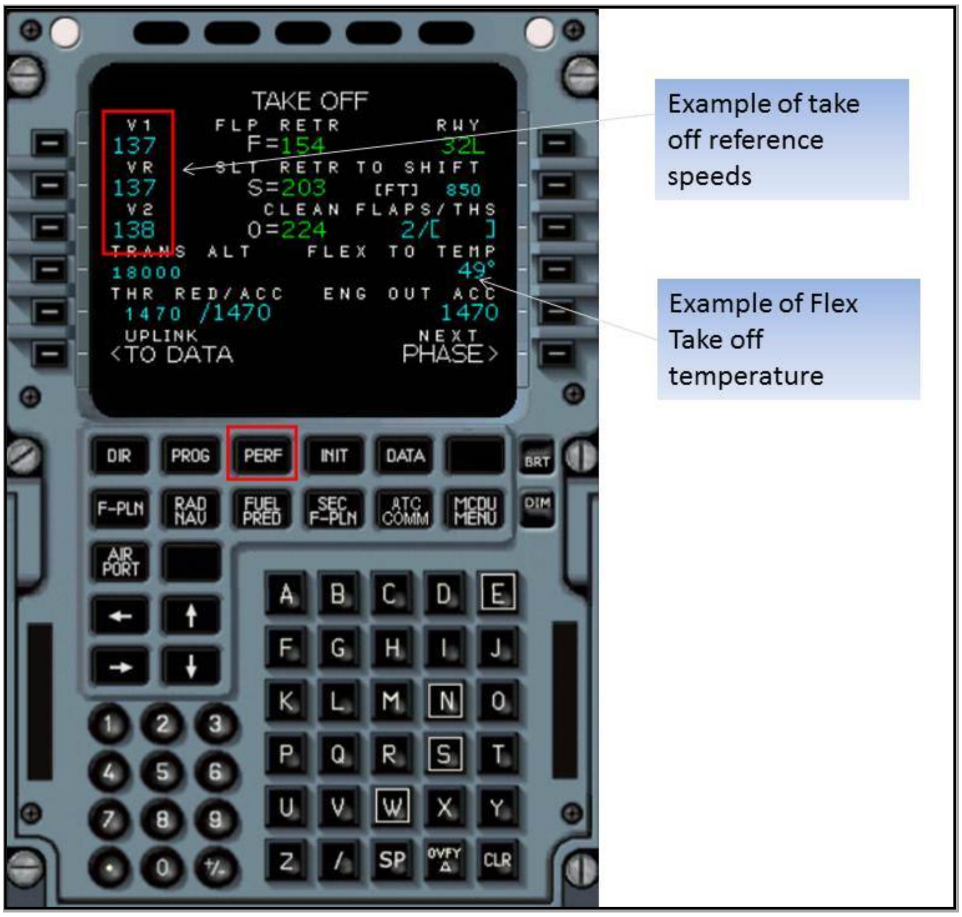
Source: Jetstar A320 flight crew operating manual (FCOM)

To minimise any further delay, the PM worked on the load sheet calculations, while the PF re-calculated the new performance data required as a result of the runway change. It was established that a Configuration 1 + F[3] would now be required for take-off. The PF completed new

1 Configuration 2: Slats 22°, Flaps 15° setting. This is achieved by selecting Flap 2.
2 MCDU is the primary interface between the pilot and the FMGC.
3 Configuration 1 + F : Slats 18°, Flaps 10° setting

take-off and landing data (TOLD) cards, and updated the FMGC with the new performance data; including new take-off reference speeds[4] and flex take-off temperature[5] (Figure 2).

Figure 2: MCDU Performance page: Examples of take-off speeds and flex temperature



Source: EFB Desktop

It was reported that the PM independently verified the performance calculations, and also checked the data in the FMGC. The crew then briefed on the new departure, including the new take-off reference speeds; however, neither crew member recalled specifically briefing on the changed take-off configuration.

As part of the after start procedures (Figure 3, shown as PNF list), the PM inadvertently selected the originally calculated Flap 2 take-off setting. He then checked the flap position on the upper ECAM, which was showing this selection. As he believed he needed to set flap 2, the flap 2 setting displayed on the ECAM confirmed what he believed to be correct.

Note: For a Flap1 take-off, the relevant combination of slats and flaps are commanded (Figure 1) by moving the flap lever to the flaps 1 position and the indication on the upper ECAM becomes 1 + F.

Despite carrying out all the required flows and checklists, as they taxied the aircraft to the runway 34L holding point, neither of the crew detected the incorrect configuration setting.

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[4] Take-off reference speeds (V speeds) are:
- V_1 - decision speeds (with respect to continuation of the take-off following an engine failure)
- V_R - speed at which the pilot initiates rotation of the aircraft to the take-off pitch attitude
- V_2 - take-off safety speed (minimum speed that needs to be maintained up to the acceleration altitude, in the event of an engine failure after V_1.

[5] Flex temperature (higher than the actual ambient temperature) is entered by the crew to allow for a reduced thrust (flex temperature) take-off. Labelled FLEX TO TEMP on the MCDU.

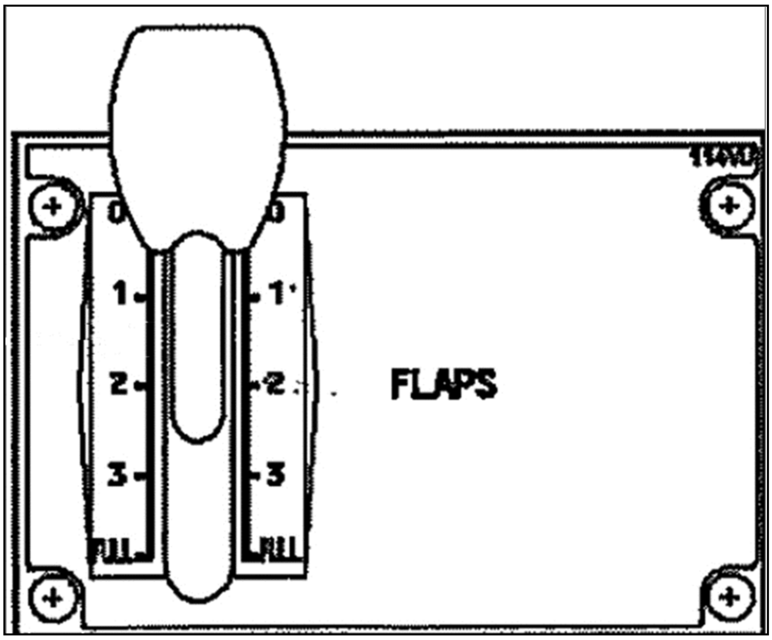
Figure 3: A sample Normal Procedures AFTER START checklist

AFTER START

PF	PNF
ENG MODE selector....NORM	
APU BLEED....OFF	GND SPOILERS....ARM
ENG ANTI-ICE....AS RQRD	RUD TRIM....ZERO
WING ANTI-ICE....AS RQRD	FLAPS....SET
APU MASTER switch....AS RQRD	PITCH TRIM....SET
	ECAM DOOR PAGE....CHECK
•If STS label is displayed: ECAM STATUS....CHECK	
CLEAR TO DISCONNECT....ANNOUNCE	
AFTER START C/L	

Source: A320 Pilot operating handbook

Figure 4: Flap (and configuration) selection lever



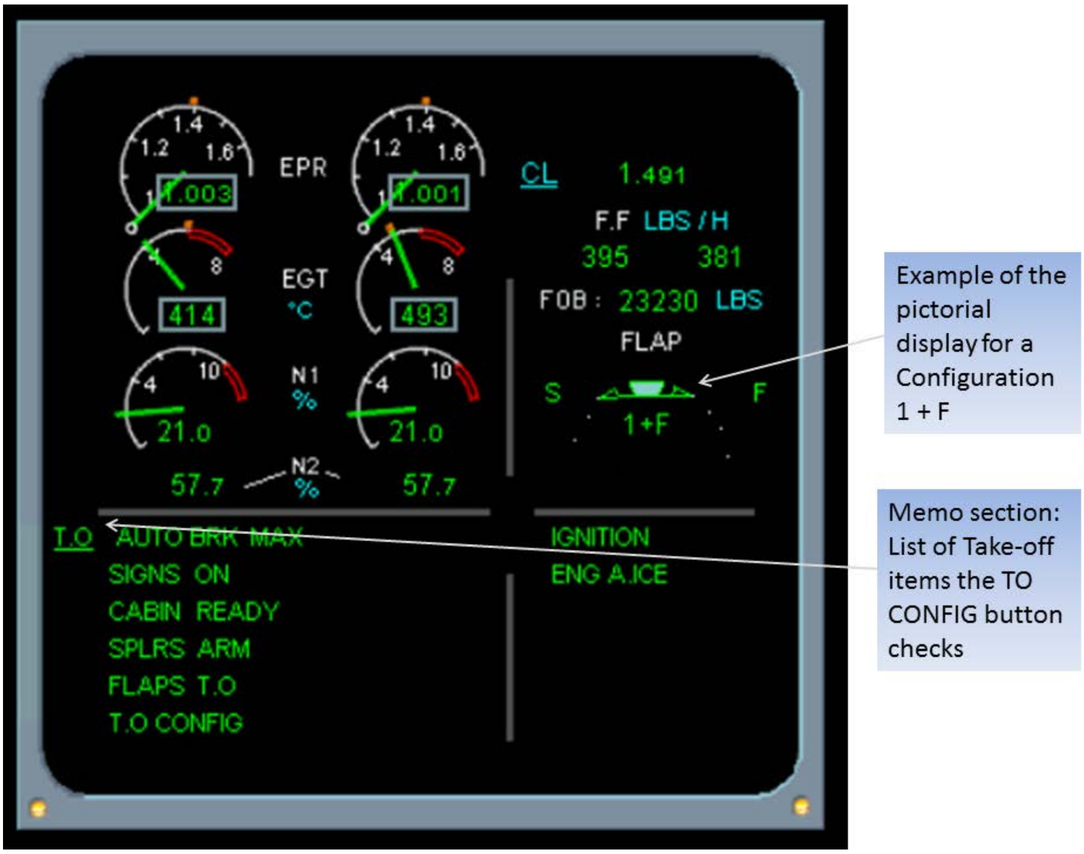
Source: Jetstar A320 Pilot operating handbook

The take-off configuration check (TO CONFIG)

As part of the pre-take-off checks conducted prior to line up, the PM pressed the take-off configuration pushbutton. This button simulates take-off power being applied, and is a final check for the crew on the take-off settings they have selected. The check is designed to trigger a warning if the aircraft is not properly configured for take-off. Any warnings appear in the memo section on the upper electronic centralised aircraft monitor (ECAM) or Engine/Warning Display (E/WD) (Figure 5).

Note: This check does not crosscheck the manually selected take-off flap (configuration) (Figures 1 and 4) with the information programmed by the crew into the FMGC. The system is designed to check that any of the take-off flap positions (1, 2 or 3) has been manually selected, not which particular setting. Therefore, despite the crew incorrectly selecting a Flap 2 (configuration) for take-off, no messages appeared on the ECAM.

Figure 5: A 320 Upper ECAM Engine / Warning Display



Source: EFB Desktop

The take-off and initial climb

During the take-off run there were no warnings or alerts. Had a FLAP 1, 2 or 3 not been selected, a master warning light (MWL) and a continuous repetitive chime (CRC) would have activated when the thrust levers were advanced.

Apart from dealing with an increased crosswind, the PF reported that the rotation and initial climb to the thrust reduction altitude of 800 ft above ground level was normal.

Passing through 800 ft, the PF set the thrust lever in to the climb thrust detent which commanded the aircraft to reduce engine thrust to a climb thrust setting. Upon reaching the acceleration altitude set by the flight crew of 800 ft, which was the same as the thrust reduction altitude, the aircraft started to accelerate. At this time the PF noted on the primary flight display that the aircrafts speed was above the flap retraction speed, annotated as ‘F’ speed[6] on the speed tape. The flight crew reported that this was unexpected as there would not normally be an indication of an ‘F’ speed following a configuration 1 + F take-off, instead they were only expecting a slat retraction or ‘S’ speed to be indicated.

At this time the flight crew realised that they had positioned the flap lever in the flap 2 position which meant that additional slats and flaps were deployed for the take-off (Figure 1). As the airspeed was above F speed, the flap lever was moved to the flap 1 position where the aircraft continued to accelerate toward the S speed indication. After reaching the required S speed the PNF selected Flaps 0, thereby stowing the remaining slat and flap. The remainder of the flight to Adelaide was uneventful.

[6] F speed – The retraction speed for the next stage of flap

Captain experience and comments

The Captain had accumulated over 8,400 flying hours with about 1,200 command hours logged on A320 aircraft.

He reported that he had signed on at 0540 and although he felt he had only an 'average' night's sleep the night before, assessed himself as fit to fly. He had also flown a similar program the day before. He did comment that he felt his alertness had reduced throughout the day.

The Captain stated that the first sector of the day had been characterised by high workload, with delays and a strong jetstream wind enroute to Melbourne. The workload had also increased at Sydney as he had not operated into this port for some time.

During the taxi and take-off, the Captain reported that he had in his mind that it was still a Flap 2 (configuration) for take-off. Until this incident, he had believed that pressing the Configuration Take-off (CONFIG TO) (Figure 1) button would alert the crew by way of a memo on the ECAM.

Although the CONFIG TO pushbutton functionality is normally included in the A320 aircraft type rating, the Captain could not recall any specific training in this area. To date, he had not previously experienced a configuration warning on the A320.

He also commented that Sydney is one of the few places that a configuration 1 + F is used. This is because 34L is such a long runway and there are no significant obstacles after take-off.

First Officer experience and comments

The First Officer had accumulated around 3,800 flying hours, with almost 500 hours on the A320 aircraft.

He reported that he had also signed on at 0540. The FO reported feeling some effects from a busy previous few days but assessed himself as being fit to fly. He stated that he was due to go on annual leave at the completion of this flight.

He also stated that he had been PF for two of the previous sectors that day, including a landing at Sydney in a 15 knot crosswind. He reported that this had increased his workload on what he felt developed into a more demanding tour of duty than normal given that he is still relatively new to the aircraft type.

He recalled briefing the new departure with the PF after the PDC change, but not specifically the change in take-off configuration. He reported that in his experience to date, some crews include a change in configuration in their briefings and others do not. He could not recall if the new take-off information had been put into the FMGC before or after he did the crosscheck. He recalled checking the TOLD card and FMGC data.

He commented that the after start scans where he selected Flap 2 are a memory item. At this stage in the flight deck preparation, the FO believed that both the crew were confident that everything was going to plan. He also recalled that during the checks and flows that he looked at the flap position on the upper ECAM, but for no reason he could establish, did not crosscheck this information with the TOLD card.

Operator report

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

- Both crew members reported being tired at sign on; however, had judged themselves fit to fly.
- There had been a change in procedure after the change in PDC from ATC. The PF revised the performance data which changed the take-off configuration to a Flap 1 + F and then entered this new information into the MCDU before the FO had checked the data in the performance manual. The PF also updated the TOLD cards at this time.

  Company procedures stated that:

The PF will only enter the performance data into the MDCU once they have checked and confirmed the calculated data is correct. If the PF identifies an error in the PNF's calculations and the PNF is absent (ie. walk around duties), the PF may recalculate and amend the recorded data but this must not be entered into the MCFU until the PNF checks and confirms the amendment. In any case both PF and PNF must agree on any data before entry into the MCFU occurs.

- The PF briefed for a 34L departure, but as the crew had not briefed for a 16L departure, they did not include the threat that the change in runway and subsequent altered CONFIG setting may have.
- A new automatic terminal information service (ATIS) was issued around the time of pushback. After the engine start the PM conducted his after start scan, but still retained a mental image of a 16L departure, leading to the selection of CONFIG 2 instead of CONFIG 1 + F. The PF did not monitor the PM or notice this error.
- Although the checks had all been completed, the crew were briefly distracted by a new Cathay Pacific 747-800 departing.
- The combination of the distraction of the 747 and task focussing contributed to the PF not detecting the incorrect take-off flap setting.
- Although the crew conducted the before take-off checklist they did not notice that the flap setting was incorrect. The decreased vigilance was most likely a result of the crew not operating at their optimum due to the continuous high workload and decreased level of operational capability at the start of duty.

ATSB comment

The mismatch in actual versus intended take-off configuration meant that the calculated take-off reference speeds and aircraft performance would have been different. While the crew encountered no particular difficulties on this occasion, in more extreme cases, particularly those involving significantly inaccurate aircraft weights, or under more critical take-off conditions, inaccurate take-off reference speeds and performance predictions can have more serious consequences.

The ATSB Research Report, *Take-off performance calculation and entry errors: A global perspective* looks more closely at the origin of these errors by both international and Australian crews between the period of January 1989 and June 2009. There is a focus on aircraft weights and V speeds, and more importantly it provides an analysis of the safety factors that contributed to the international occurrences and suggests ways to prevent and detect such errors.

The report is available at: www.atsb.gov.au/publications/2009/ar2009052.aspx

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.

Jetstar has advised the ATSB they are taking the following Safety Actions.

Although the CONFIG TO pushbutton functionality is defined in the Company FCOM, Jetstar have decided to undertake a detailed review of the results from their Flight Safety Integration Audit (FSIA) program. This is a continuous safety audit program targeted toward identifying specific operational threats and risks associated with failed/erroneous Human-Machine Interface activities such as seen in this occurrence.

Jetstar expects the review to be completed by the end of the first quarter of 2015. The airline will then develop action plans to address any identified themes.

Another Safety Action initiative taken by Jetstar is to incorporate a summary of the incident in the next edition of the company flight crew Technical Newsletter. This will include suggestions on how to mitigate against similar occurrences.

Safety message

This incident highlights the importance of careful attention to the actions taken during flows and checks, particularly under circumstances where there is a change in plans, such as a changed departure runway. The incident also highlights the importance of careful attention to cross referencing calculated performance data and configuration with the inputted data and displayed configuration information. This is particularly important under circumstances where a crew may be susceptible to the effects of reduced vigilance, or where there is an increased risk of distraction. Under these circumstances, crew monitoring and cross-checking assume greater importance.

The Airbus Safety Magazine: Safety first #18 reports on potential problems with using incorrect V speeds. A chapter dedicated to take-off speeds highlights the design and operational considerations underlying all recommendations Airbus has issued to flight crews.

The article is available at:
www.ukfsc.co.uk/information/safety-briefings-presentations/335-airbus-safety-first-magazine

Although both crew members had presented for duty that morning stating they were fit to fly, both also reported feeling tired at sign on. The Captain commented on an ‘average’ night’s sleep and a long duty on the previous day.

Neither crew member judged themselves as unfit to discharge their duty at any time throughout their day; however, the high workload, delays and distractions they experienced appeared to augment the tiredness they felt. Crews need to remain aware of the vigilance decrements that can occur when they detect tiredness within themselves during the final sector of a busy duty day.

Many research papers on fatigue, sleep and the circadian cycle are available to provide pilots and operators with further insights into the complex interaction of variables which may contribute to how a crew member performs their tasks if tired or fatigued.

General details

Occurrence details

Date and time:	28 July 2014 – 1337 EST	
Occurrence category:	Incident	
Primary occurrence type:	Incorrect configuration	
Location:	Sydney Airport, New South Wales	
	Latitude: 33° 56.77’ S	Longitude: 151° 120.63’ E

Aircraft details

Manufacturer and model:	Airbus Industrie A320-232	
Registration:	VH-VFU	
Operator:	Jetstar Airways Pty Ltd	
Serial number:	5814	
Type of operation:	Air Transport High Capacity – Passenger	
Persons on board:	Crew – 2 flight crew	Passengers –Unknown
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Turboprop aircraft

Flight crew incapacitation involving a Reims Aviation F406, VH-EYQ

What happened

On 1 August 2014, at about 0935 EST, the crew of Reims Aviation F406 aircraft, registered VH-EYQ, departed Emerald, Queensland, on an aerial survey task. The crew consisted of a pilot and a navigator. The navigator was positioned in the cabin of the aircraft to operate survey equipment and direct the pilot according to survey requirements. The aircraft was unpressurised, but fitted with an oxygen system to allow the crew to operate at altitudes above 10,000 ft. The crew planned to climb to flight level (FL)[1] 240 for the survey task about to be undertaken. Prior to the flight, the pilot checked that there was adequate oxygen in the storage cylinder located in the nose area of the aircraft, and tested the oxygen system for normal operation.

The departure proceeded normally and, as the aircraft climbed through about 8,000 ft, the pilot turned on the aircraft oxygen supply and connected and donned his oxygen mask. This task involved connecting his oxygen system controller (which leads to the oxygen mask) to a port located beneath the pilot's armrest. The task also required the pilot to remove his headset, transfer the microphone function from the headset to his oxygen mask, and place the headset back on (to allow continued receipt of communications through the headset ear cups). The pilot completed transition checks prior to passing 10,000 ft, which included confirmation that his oxygen system was in use and operating normally. The navigator also connected and donned his oxygen mask in the cabin of the aircraft during the climb.[2]

The pilot also placed an oxygen pulse meter (supplied by the operator) on one of his fingers.[3] As the aircraft continued to climb, the pilot monitored his blood oxygen saturation level readings on the oxygen pulse meter, and monitored his flow of oxygen by reference to a flow indication in the supply tube. The pilot recalled that everything appeared normal as the climb continued, but passing about FL 180, he noticed that his blood oxygen saturation level had fallen significantly. The pilot recalled that although flow indications appeared to remain satisfactory, his blood oxygen saturation level had fallen to about 77% - substantially less than what the pilot indicated he would normally expect (in excess of 90%).[4]

As the climb continued, the pilot expressed concern to the navigator about his abnormally low blood oxygen saturation level. Based upon his knowledge from hypoxia awareness training, the navigator was aware that such an abnormally low blood oxygen saturation level meant that the pilot was probably experiencing the effects of hypoxia. Accordingly, the navigator encouraged the pilot to address the problem and increase his blood oxygen saturation level, and began to monitor the pilot's condition.

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1 At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 240 equates to 24,000 ft.

2 The navigator also connected to the aircraft oxygen supply, but using a separate oxygen system controller to that used by the pilot.

3 An oxygen pulse meter allows the wearer to monitor his or her pulse and blood oxygen saturation level (a measure of the concentration of oxygen in the blood). An oxygen pulse meter therefore provides a direct indication of the extent to which a wearer is likely to be suffering the effects of hypoxia.

4 The navigator recalled the pilot mentioning blood oxygen saturation levels as low as about 70% during the incident. The navigator was also wearing an oxygen pulse meter – his oxygen saturation level remained normal throughout the flight.

Although the sequence of events is unclear, a number of things happened over the course of the following several minutes which are broadly summarised as follows:

- The pilot initially attempted to increase the amount of oxygen he was receiving by making an adjustment to his oxygen system controller.[5] He later identified a problem with his oxygen system connection, and spent some time handling the supply tubing and connections in an attempt to resolve the problem. Aware that the pilot was experiencing some difficulties with his oxygen supply, the navigator moved forward in the cabin to render assistance and to more closely monitor the actions of the pilot.
- Without an effective supply of oxygen, the accuracy with which the pilot was controlling the aircraft deteriorated.[6] The navigator recalled encouraging the pilot to maintain control and to descend, a number of times. The pilot recalled losing situational awareness, and prompts from the navigator drawing his attention to the attitude of the aircraft.
- The navigator commented that the pilot failed to respond to some air traffic control (ATC) transmissions, and when he did respond, the responses were non-standard and his speech was slurred. ATC also noticed that the pilot was not responding normally, also noting that his radio transmissions were slurred. ATC encouraged the pilot to ensure that he was receiving a supply of oxygen by transmitting 'oxygen oxygen oxygen' and clearing the pilot to descend. Concerned about the safety of the aircraft, ATC also declared an ALERFA.[7]
- Despite his apparently hypoxic condition, the pilot was ultimately able to identify that an oxygen supply system fitting had become disconnected. The fitting was located beneath the pilot's armrest, and was the same fitting that the pilot had earlier connected during the climb (Figure 1). When he reconnected the fitting, he took a number of deep breaths and sensed almost immediate relief.
- At about the time the pilot appeared to be recovering from his hypoxic condition, the navigator recalled handing his oxygen pulse meter to the pilot, after the pilot indicated that his was not working correctly.
- The pilot commented that his confused state cleared quickly when the flow of oxygen was re-established. He noticed at that point that the engines were still set to climb power. He reduced power and commenced a controlled descent. The navigator noted that the pilot's speech became more coherent and standard radio phraseology returned soon after commencement of the controlled descent.

Following the incident, the crew elected to return to Emerald. The pilot remained on oxygen throughout the remainder of the flight, including the arrival and landing at Emerald, which was uneventful. After landing, the pilot noted that his blood oxygen saturation level had increased back to a normal level (around 97%).

The entire flight lasted about 35 minutes. Available evidence suggests that the length of time from the first indication of a low blood oxygen saturation level to the point at which the pilot's oxygen supply was re-established and a controlled descent commenced, was of the order of 10 minutes. During most of this time, the aircraft was probably manoeuvring between about FL 200 and FL 240. The maximum altitude reached was about FL 245.

5 On-demand oxygen delivery system controllers provide a measured amount of oxygen as the user inhales. The controller in this case included provisions for the operator to make selections (on the body of the controller itself) that supplement and enrich the standard oxygen flow.

6 The aircraft was fitted with an autopilot which the pilot recalled having engaged in lateral heading mode, but no vertical mode was engaged. The pilot was uncertain, but believed that the autopilot was inadvertently disconnected as he attempted to re-establish his oxygen supply.

7 ALERFA (Alert Phase) is an emergency phase declared by ATC when, for example, apprehension exists as to the safety of an aircraft and its occupants, or there is a reason to believe that the safe conduct of a flight is in jeopardy.

Figure 1: Oxygen port beneath pilot's armrest and associated oxygen fitting

Source: Aircraft operator, modified by the ATSB

Oxygen system controller. The pilot's oxygen system controller included oxygen delivery indications in the form of flashing LEDs (light emitting diodes). Among these indications were a green LED that flashed with each pulse of oxygen (associated with a valid inhalation event), and an amber LED and audible beeps intended to alert the user to the absence of a valid inhalation event after a set period of time. The controller also included a red LED and chime to alert the user to a fault in the flow of oxygen to the controller. The controller visual indications and audible alerts did not effectively capture the attention of either crew on this occasion.

Pilot comments

The pilot commented favourably on the role played by ATC in the event, particularly the way in which ATC reacted to their concerns about the condition of the pilot with very deliberate recommendations and clearances. The extent to which ATC contributed to a safe outcome is unclear, but encouragement to the pilot to check his oxygen supply may have been vital. The pilot also commented that his hypoxia awareness training (mandated by the operator for unpressurised survey operations) helped the pilot appreciate the effects of hypoxia and his symptoms.

Operator's report

Consistent with the pilot's recollection of the event, the operator's investigation dealing with the incident found that the pilot's oxygen supply was interrupted when the fitting in the supply system beneath the pilot's armrest became disconnected. The investigation found that the bayonet fitting may not have been fully locked when connected by the pilot, noting that the connection could be in place but not necessarily properly locked. The investigation report added that the position of the port is such that some concentration and manipulation is required to ensure that the connection is seated correctly. The investigation also found that the supply tube may not have been correctly routed through an armrest cut-out, and that movement of the armrest may have dislodged the improperly secured bayonet fitting.

The operator's report also found that the pilot's oxygen controller was not visible to the pilot or navigator. As such, the crew were unable to see indications on the controller that could have alerted them to an oxygen supply problem.

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 actions are being considered in response to this occurrence.

Aircraft operator

As a result of this occurrence, the aircraft operator has taken steps in relation to pre-flight oxygen system checks, and crew cross-checks on the performance of each other's oxygen system during flight above 10,000 ft.

Safety message

This incident highlights the importance of careful attention to aircraft oxygen systems, particularly with respect to connecting and monitoring oxygen system performance. An interruption in the supply of oxygen can quickly lead to hypoxia and crew incapacitation, particularly at higher altitudes. While the pilot was able to re-establish the flow of oxygen on this occasion and recover from his hypoxic condition, pilots are reminded that hypoxia is an insidious condition and the time of useful consciousness is often very limited. A prompt and decisive response to the first indication of an oxygen supply problem is imperative.

The signs and symptoms of hypoxia vary from individual to individual, and may be affected by environmental factors such as temperature and physical activity. The SKYbrary website Hypoxia Briefing Note[8] available at www.skybrary.aero/index.php/Hypoxia_(OGHFA_BN), addresses the stages of hypoxia, along with common signs and symptoms, and discusses the concept of time of useful consciousness. The Briefing Note includes a summary of key points regarding hypoxia, including:

> *Hypoxia is dangerous because it impairs cognitive and physical performance, sometimes without the flight crew realising that anything is wrong.*

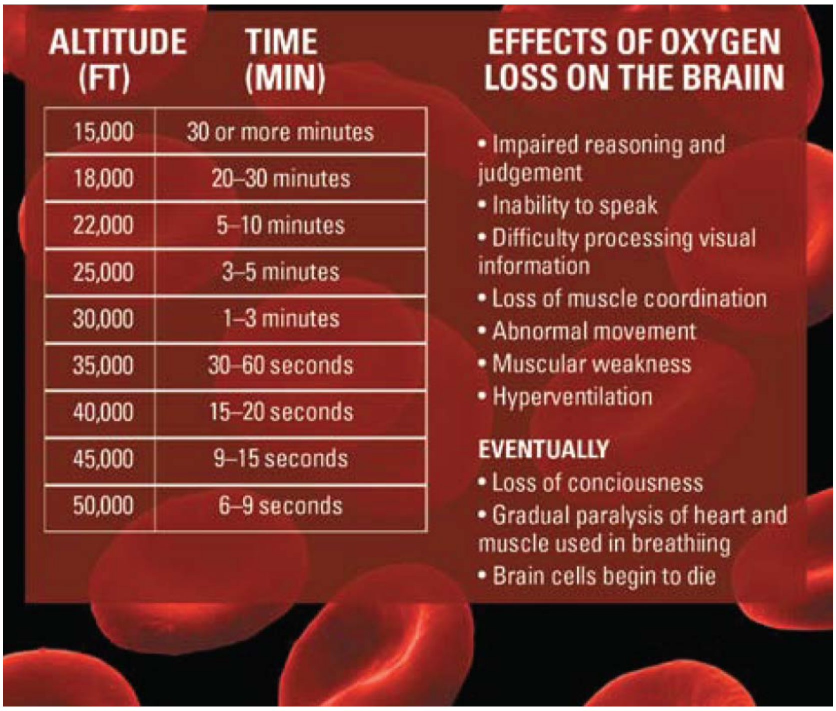
The SKYbrary website includes an additional descriptive article outlining the nature of hypoxia, including signs and symptoms, and discusses sudden and gradual onset defences. The article, available at www.skybrary.aero/index.php/Hypoxia, includes the comment:

> *Sudden onset may require a rapid and instinctive response by aircrew whereas gradual onset is a matter of awareness so that an appropriate response can be made before incapacitation occurs.*

An article in the CASA *Flight Safety Australia* magazine July-August 2005 edition titled *Blackout* provides additional information about the nature of hypoxia and the time of useful consciousness. That article is available online at www.casa.gov.au/wcmswr/_assets/main/fsa/2005/aug/21-23.pdf. The article includes a table dealing with the time of useful consciousness and some effects of oxygen loss on the brain (Figure 2). The September-October 2013 edition of the CASA *Flight Safety Australia* magazine also includes an article on hypoxia, titled *Do not go gentle: the harsh facts of hypoxia*. That article and a hypoxia training video are available on the CASA website via the following link: www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_101633

8 Full title is Operator's Guide to Human Factors in Aviation – Human Performance and Limitations – Hypoxia Briefing Note. Content source identified as the Flight Safety Foundation.

Figure 2: Time of useful consciousness and some effects of oxygen loss on the brain



Source: CASA Flight Safety Australia magazine July-August 2005

General details

Occurrence details

Date and time:	01 August 2014 – 1000 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Crew incapacitation	
Location:	Near Emerald Aerodrome, Queensland.	
	Latitude: 23° 34.05’ S	Longitude: 148° 10.75’ E

Aircraft details

Manufacturer and model:	Reims Aviation S.A. F406	
Registration:	VH-EYQ	
Serial number:	F406-0047	
Type of operation:	Aerial work	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Runway undershoot involving a Pilatus PC-12, VH-HIG

What happened

On 23 September 2014, a Pilatus PC-12 aircraft, registered VH-HIG, was arriving at Coober Pedy, South Australia, after a flight from Amata, South Australia. Enroute to Coober Pedy, the pilot listened to the aerodrome weather information service (AWIS)[1] and reviewed the Aerodrome Forecast,[2] but noted nothing of significance. Approaching Coober Pedy, the pilot observed what he described as a line of storm activity in the area. He passed through this weather as he approached the airport, altering track as required to remain clear of significant cloud, but encountered patches of moderate turbulence and vertical wind shear (described as updrafts and downdrafts) in the proximity of the cloud and beneath. The pilot also observed virga[3] extending beneath the cloud from about 12,000 ft down to about 4,000 ft, and blowing dust in the area.

As he arrived in the circuit area, the pilot noted that the aircraft GPS was indicating a wind speed of about 60 kt. He also noted that the aerodrome windsock was indicating that a strong wind was blowing from a northerly direction. There was a considerable amount of blowing dust in the vicinity of the aerodrome, although the dust appeared to remain close to the ground. The pilot positioned for a landing on runway 32, which he assessed as the preferred runway given the strength and direction of the wind. As he descended through about 500 ft above ground level (AGL) on final approach, the pilot lost visual contact with the runway due to blowing dust, and discontinued the approach. As he repositioned for another approach, he noted that there was still blowing dust in the area, but he was satisfied that it had cleared sufficiently to allow another landing attempt.

During the second attempt to land, the pilot recalled that the approach became unsettled as the aircraft encountered increasing turbulence between 300 ft and 200 ft AGL. At this point, the airspeed was about 90 kt, while the ground speed was about 50 kt, and the runway was clearly visible. At about 100 ft AGL, the pilot encountered strong wind shear – the intensity of the turbulence increased, the pilot could feel the aircraft buffeting through the rudder pedals, and the aircraft sink rate increased significantly. Almost simultaneously, the aircraft was engulfed in what appeared to the pilot to be a swirling cloud of blowing dust that swept up from beneath the aircraft. The blowing dust denied the pilot any external visual reference. The pilot contemplated another go-around, but noting the very high sink rate, the intensity of the turbulence and the proximity of the aircraft to the ground, he assessed that he could not execute a go-around safely.

The pilot reacted by pulling the control column back, in an effort to reduce the severity of what he felt was imminent ground impact. The aircraft touched down short of the runway threshold and to the right of the runway centre-line, on a firm surface that was once part of the runway strip. The aircraft passed through a wire aerodrome perimeter fence, and came to a stop after a ground roll of around 150 m (Figure 1). The aircraft also passed through a mound of loose dirt, and clipped a steel post, both associated with the wire fence (Figure 2).

During the ground roll, the aircraft continued to buffet, and the pilot was unable to see outside the aircraft, until it had almost come to a stop. The pilot later commented that the touchdown had not been heavy, and apart from the buffeting and intense wind noise, he did not feel anything unusual during the ground roll. The pilot was not aware at that time that the aircraft had passed through a fence during the landing roll.

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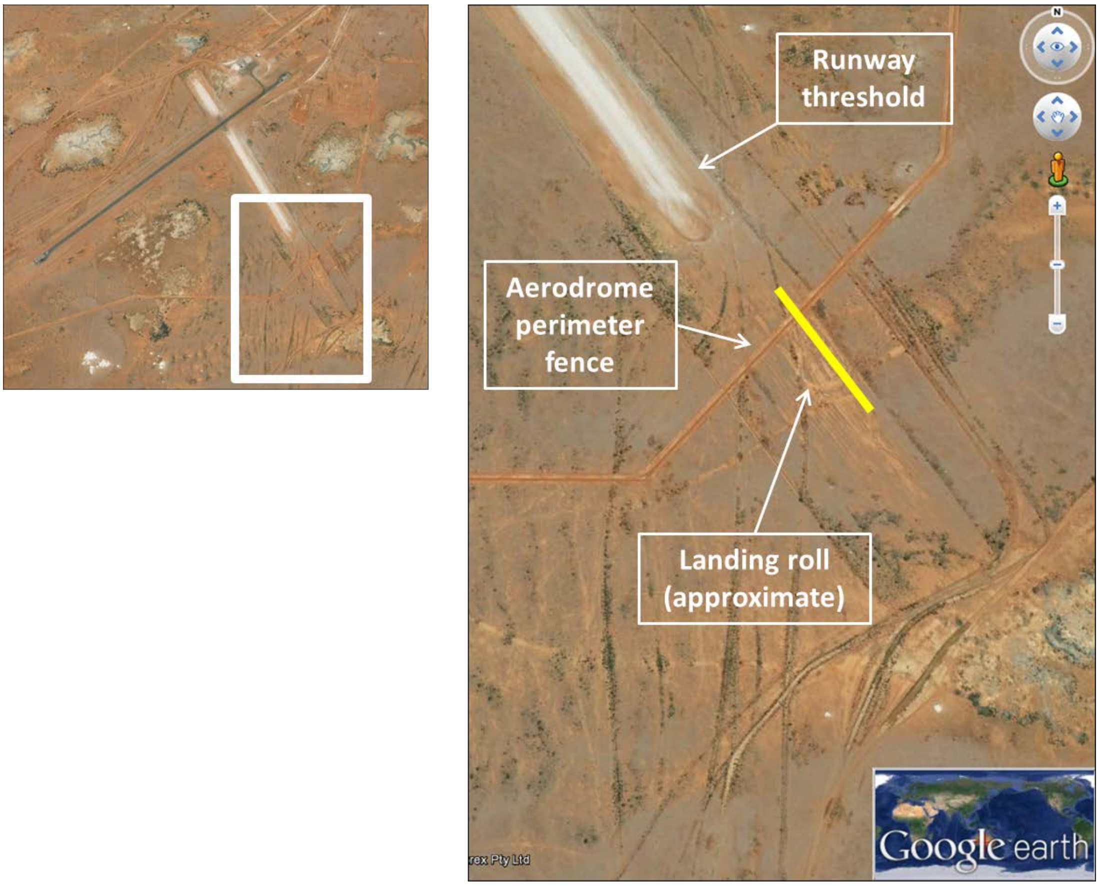
1 The AWIS provides actual weather conditions, via telephone or radio broadcast, from Bureau of Meteorology automatic weather stations.

2 Aerodrome forecasts are a statement of meteorological conditions expected for a specified period in the airspace within a radius of 5 NM of the aerodrome.

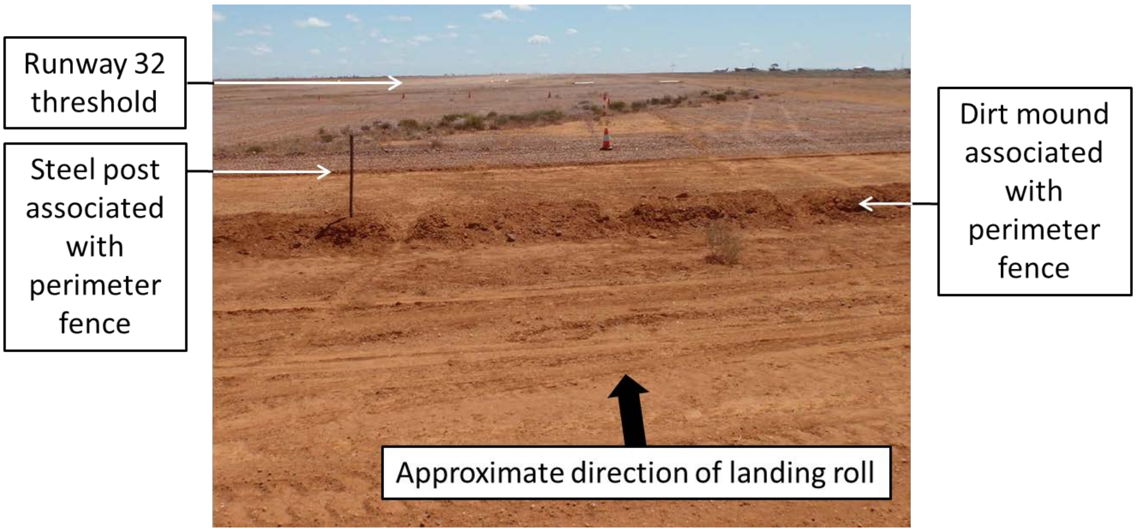
3 Virga is defined as precipitation that evaporates before it reaches the ground.

Figure 3: Coober Pedy Aerodrome with approximate position of the aircraft ground roll relative to the aerodrome perimeter fence and runway threshold



Source: Google earth – modified by the ATSB based on information provided by the aircraft operator

Figure 4: Aircraft track through aerodrome perimeter fence



Source: Aircraft operator – image cropped and modified by the ATSB

The dust cleared as the aircraft slowed during the later stages of the landing roll, allowing the pilot to orientate himself with respect to the runway. He taxied the aircraft onto the runway surface, then to the terminal area for a refuel. As he taxied, the pilot looked back toward the area short of runway 32 and noticed the continued presence of blowing dust in the area. After shutting down the engine, the pilot inspected the airframe and propeller, and did not identify any damage, or see anything unusual.

The refuelling agent commented to the pilot that the onset of the weather had been quite sudden. The pilot also noticed the line of stormy weather moved over the aerodrome while he was on the ground at Coober Pedy, following which the wind eased considerably.

Following the refuel and satisfied that the aircraft was undamaged, the pilot continued to Adelaide, South Australia. The pilot commented that there was no indication of any abnormal condition until descent into Adelaide, when an unsafe nose landing gear caution light illuminated. When the pilot subsequently lowered the landing gear, the caution light extinguished and three green lights illuminated, indicating that the landing gear had extended normally. The pilot continued for an uneventful landing.

Initial inspection of the aircraft following the flight identified that a micro-switch adjustment was required to address the nose landing gear indication problem. Closer inspection however revealed some damage in the area where the nose landing gear meets the aircraft structure, and scoring damage to the underside of the left wing and flap surface, just outboard from the left main landing gear. Scoring damage to the underside of the left wing and flap surface was probably the result of the wing and flap contacting the steel post visible to the left of the wheel track marks in Figure 2.

Relevant weather information

The Aerodrome Forecast valid at the time of the incident indicted that the pilot could expect strong and gusty winds from the north-east at the time he arrived at Coober Pedy, but the forecast made no reference to the possibility of reduced visibility. The relevant Area Forecast[4] indicated that areas of blowing dust could be anticipated, and that visibility may be reduced to as little as 1,000 m in thick blowing dust. The Area Forecast also indicated that cumulus (with a relatively high base) and altocumulus cloud be expected in the area at the time of the incident.

The aerodrome weather reports around the time of the incident suggested that there was a significant amount of middle-level cloud in the area, consistent with the pilot's observations. No wind speed information was available because the wind speed monitoring capability of the automatic weather station at Coober Pedy Aerodrome was not operational on the day of the incident. The temperature at the Coober Pedy Aerodrome was about 24 °C at the time of the incident.

Pilot comments

The pilot commented that the onset of the extreme conditions was dramatic and unexpected, leaving little time to assess the circumstances. Having been engulfed in the dust cloud and noting the high sink rate and turbulent conditions, the pilot believed that the safest course of action was to allow the aircraft to touch down, rather than attempt a go-around. His decision to allow the aircraft to touch down was also influenced by his knowledge that the area in which the aircraft would touch down was once part of the runway strip, and that the surface was likely to be firm and clear of significant vegetation. The pilot was unaware that the aerodrome perimeter fence now crossed the area.

The pilot also commented that he would not have flown the aircraft to Adelaide after the incident if he was aware that the aircraft had passed through a fence, or that the aircraft had sustained any damage. He carefully inspected the aircraft after the incident before departing Coober Pedy, paying particular attention to the propeller, but could find no evidence of damage.

The pilot also commented that ongoing work in the aerodrome environment may have loosened the surface in some areas, thereby making the aerodrome environment more susceptible to blowing dust when strong winds prevailed.

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4 An area forecast is issued for the purpose of providing aviation weather forecasts to pilots for operations at or below Flight Level 200. Australia is subdivided into a number of forecast areas.

ATSB comment

The Bureau of Meteorology publishes a range of information about weather phenomena that may be hazardous to aviation (see www.bom.gov.au/aviation/knowledge-centre/). Noting the weather conditions in the area at the time of the incident, the following two documents may be particularly relevant:

- *Hazardous Weather Phenomena – Wind Shear.* This document discusses wind shear formation and detection. With respect to the detection of wind shear, the document comments:

    External clues that may be directly visible to the pilot include … virga from convective cloud, because downdrafts may still exist and reach the ground even though the precipitation itself has evaporated.

- *Hazardous Weather Phenomena – Thunderstorms*. This document discusses the nature and development of thunderstorms, and the associated aviation-related hazards. Following is an extract from the document that discusses the nature of a dry microburst:

    In a dry microburst, precipitation at the surface is either very light or does not occur at all, although virga (precipitation falling from a cloud but evaporating before reaching the ground) may be present. They develop in environments with weak vertical wind shear, dry low levels and moist mid levels. The dry microburst is initiated by evaporative cooling. If the air underneath a cloud is relatively dry then rain and ice crystals falling from the cloud will quickly evaporate and chill the air. The cooled air will be heavier than the surrounding environmental air and will therefore accelerate downward. Dry microbursts can develop in the absence of lightning and thunder. High-based cumulus and altocumulus have been observed to produce damaging dry microbursts.

Flight Safety Foundation (FSF) Approach and Landing Accident Reduction (ALAR) Briefing Note 5.4 – Wind Shear comments that 'Flight crew awareness and alertness are key factors in the successful application of wind shear avoidance techniques and recovery techniques'. The Briefing Note also comments that visual observations such as blowing dust, rings of dust and dust devils, are often indications of wind shear. The Briefing Note also includes a range of considerations associated with wind shear avoidance, recognition and recovery. Briefing Note 5.4 can be accessed via the SKYbrary FSF ALAR Toolkit website at www.skybrary.aero/index.php/Flight_Safety_Foundation_ALAR_Toolkit

In October 2012, a Fokker 100 was approaching Nifty Aerodrome in the Pilbara region of Western Australia. At the time, there were high-based cumulus cloud and isolated thunderstorms in the area. The aircraft encountered wind shear and landed heavily, touching down almost 300 m short of the normal touch down point. The ATSB investigation found that:

> *… when the aircraft was on approach to land at about 80 ft above ground level, the flight path almost certainly coincided with the strong outflow of a dry microburst, resulting in a performance-decreasing windshear that led to the rapid drop in airspeed, high sink rate, undershoot and a hard landing.*

The ATSB report dealing with this accident is available on the ATSB website at www.atsb.gov.au/publications/investigation_reports/2012/aair/ao-2012-137.aspx

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 the occurrence.

Aircraft operator

As a result of the incident, the operator is reviewing procedures and plans to incorporate information into the Operations Manual to highlight the nature of some hazardous weather phenomena, particularly wind shear and thunderstorms.

Safety message

This incident highlights the hazardous nature of wind shear and blowing dust. Wind shear can be exceptionally powerful, dramatically affecting aircraft controllability and performance. Similarly, blowing dust can instantly and significantly reduce visibility. The combined effect of wind shear and blowing dust presents a particularly significant hazard to aviation. Pilots are encouraged to carefully review relevant weather forecasts and monitor the environment for any signs of hazardous weather. Pilots operating in remote areas should be particularly cautious, noting that the threat presented by some hazardous weather phenomena may not be readily apparent.

General details

Occurrence details

Date and time:	23 September 2014 – 1345 CST	
Occurrence category:	Serious incident	
Primary occurrence type:	Runway undershoot	
Location:	Coober Pedy Aerodrome	
	Latitude: 29° 02.65’ S	Longitude: 134° 43.63’ E

Aircraft details

Manufacturer and model:	Pilatus PC-12/47	
Registration:	VH-HIG	
Serial number:	772	
Type of operation:	Aerial Work	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Minor	

Collision with terrain involving an Air Tractor AT-502B, VH-PTF

What happened

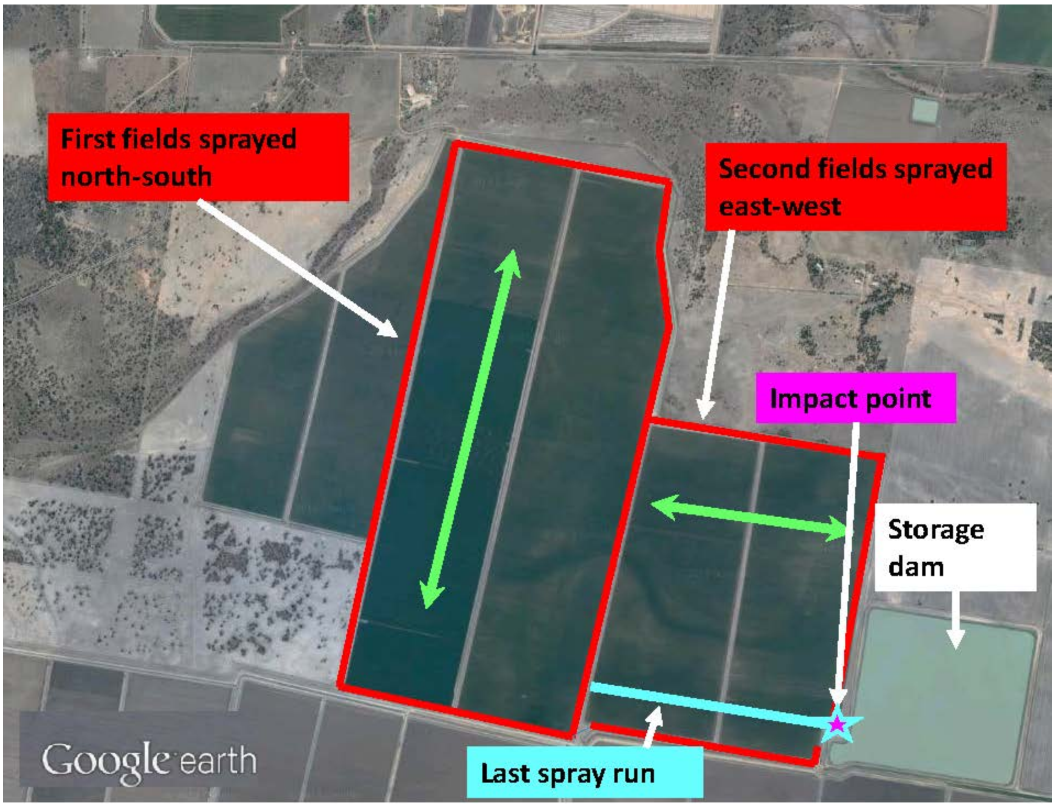
On 18 December 2014, at about 0520 Eastern Daylight-saving Time (EDT), the pilot of an Air Tractor AT-502B aircraft, registered VH-PTF (PTF), commenced aerial agricultural spraying on a property about 45 km west of Moree, New South Wales.

The job consisted of spraying four fields (Figure 1), and the operator had tasked three aircraft, including PTF, to complete the job. The pilots first sprayed the two western-most fields, operating in a north-south direction. To avoid a property to the north-east of the treatment area, the two remaining fields were sprayed in an east-west direction.

Damage to VH-PTF

Source: Pilot

Figure 1: Spray areas and impact location



Source: Google earth

The pilots established three parallel racetrack patterns to operate in, with the pilot of PTF operating at the southern end of the field. The pilot overflew the storage dam wall heading east, in order to set up the reference points in the GPS, which established the racetrack pattern to be flown. At that time, he observed the dam wall and the sun was rising but obscured by cloud. The pilot then turned the aircraft towards the west and commenced the first spray run, again overflying the dam wall. At about 0700, after completing that spray run, the pilot turned the aircraft to the east again for the second spray run.

The sun was then above the cloud and directly in the pilot's eyes, obscuring his visibility ahead of the aircraft. The glare from the sun reduced the pilot's depth perception, and he could see a shadow on the western side of the dam wall, but not the top of the wall. As the pilot was about to commence a climb and turn at the end of the spray run, he sighted some weeds just south of the aircraft and extended the run to spray the weeds. The pilot then turned the spray off and commenced a climb from about 5 ft above the crop height. As the aircraft climbed to about 30 ft, the landing gear collided with the dam wall, about 60 cm below the top of the wall. The pilot initially thought the aircraft had struck an object such as a windmill. He saw that the left flap had partially detached from the wing and was hanging at an angle and the right flap had detached completely. He also observed a large quantity of fuel escaping from the ruptured left fuel tank.

The pilot then slowly dumped the chemical load while monitoring the flight characteristics of the damaged aircraft, and assessed the options of landing immediately, returning to the airstrip he had departed from, or continuing to Moree where more services were available. The pilot elected to return to the airstrip on the property about 4 km away, mindful that he may need to conduct a forced landing at any time. A pilot operating nearby advised the pilot of PTF that the landing gear was no longer attached.

At about 0704, PTF landed on a dirt road parallel to the airstrip. Both landing gear struts had been detached, which had then broken off the right flap, damaged the left flap and ruptured both fuel tanks. During the landing the propeller was damaged (Figure 2). The pilot was not injured.

Figure 2: Damage to VH-PTF

Source: Pilot

Pilot comments

The pilot reported that during the second spray run, he was aware that the dam wall was ahead of him. As he approached the end of the spray run, he saw the weeds and elected to spray them because they were within reach of the aircraft. He had also considered spraying them later, on the final spray run. While he considered his options, he had shifted the focus of his attention away from the dam wall, assuming that he would be well clear of it.

The storage dam was marked on the work order provided to the pilots at the start of the day, but the wall was not marked nor was it identified as a hazard.

He had the sun visor down on his helmet, but it was still very hard to see due to the sun glare.

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 operator of VH-PTF has advised the ATSB that they are taking the following safety actions:

Reminder to company pilots

All company pilots will be reminded of the importance of identifying hazards as part of the pre-application checks. The circumstances leading to the accident will be discussed with the pilots. The importance of identifying hazards and how to mitigate their risks will be reiterated during annual proficiency checks.

Safety message

This incident highlights the importance of assessing whether to conduct a precautionary landing or continue a flight after damage or an issue with the aircraft has been identified.

The ATSB report *Wirestrikes involving known wires: A manageable aerial agriculture hazard,* available at www.atsb.gov.au/publications/2011/avoidable-2-ar-2011-028.aspx, cautioned pilots to conduct an aerial reconnaissance to confirm the location of wires and other hazards. Having a plan and a procedure to minimise the risk of collision with hazards is a valuable mitigation strategy. For further risk management strategies for agricultural operations, the Aerial Application Pilots Manual is available from www.aerialag.com.au/Home.aspx.

The ATSB conducted a database review of reported occurrences involving sun glare as a contributing safety factor. A range of incidents and accidents occurred due to glare from a rising or setting sun, including: airborne collisions with terrain and objects, such as fences, trees and other aircraft; difficulty for pilots to correctly select and set switches and controls on the instrument panel; near collisions where one or more pilots could not clearly sight another aircraft; and ground collisions. Research conducted by the US Federal Aviation Administration (FAA) into sunlight and its association with aviation accidents, found that 130 accidents occurred between 1988 and 1998 in which sun glare was a contributing factor. The article is available at www.hf.faa.gov/docs/508/docs/cami/0306.pdf.

General details

Occurrence details

Date and time:	18 December 2014 – 0700 EDT	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	45 km W Moree aerodrome, New South Wales	
	Latitude: 29° 25.37' S	Longitude: 149° 23.35' E

Aircraft details

Manufacturer and model:	Air Tractor Inc. AT-502B	
Registration:	VH-PTF	
Serial number:	502B-0404	
Type of operation:	Aerial Work – Aerial Agriculture	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Piston aircraft

Collision with terrain involving a Cessna 172, VH-ZZD

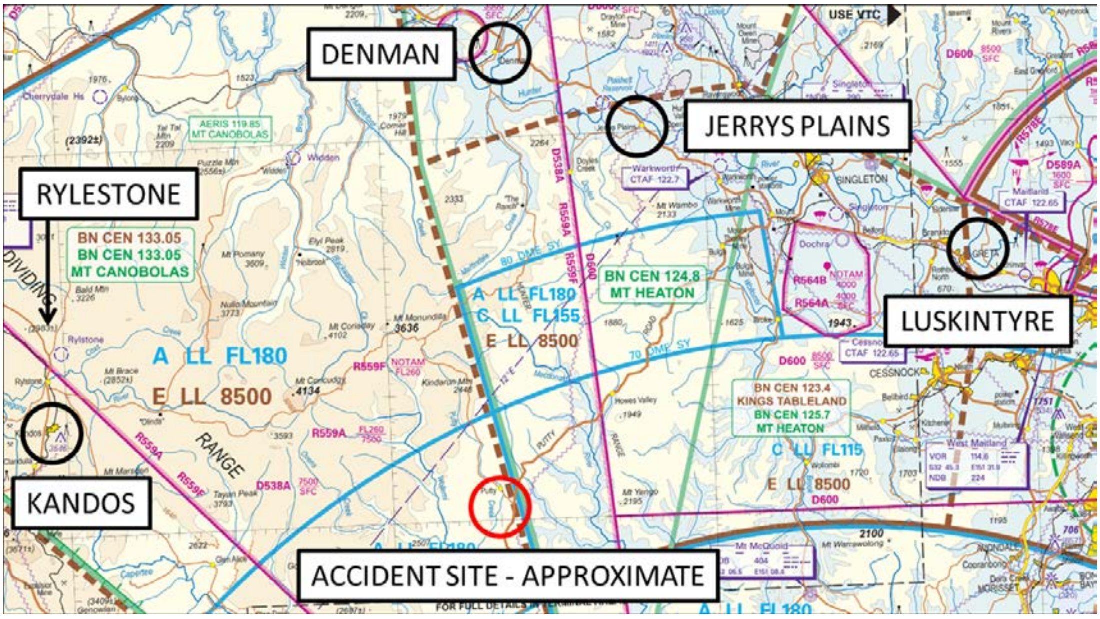
What happened

On 27 October 2014, at about 1030 Eastern Daylight-savings Time (EDT), the pilot of a Cessna 172 aircraft, registered VH-ZZD, departed Ballarat, Victoria, for Luskintyre, New South Wales, on a private flight under the visual flight rules.[1] The pilot had planned the flight carefully, and although he had adequate fuel to reach Luskintyre without refuelling, he planned to reconsider his progress at Temora, New South Wales, and land for additional fuel if required.

The pilot encountered some poor weather during the early stages of the flight and, although it was unplanned, he elected to land at Wangaratta, Victoria, to take a break and have some refreshments. While at Wangaratta, he also took the opportunity to add some fuel. After a short break and refuel, the pilot continued to Temora, where he elected to land for another break. The pilot re-assessed his fuel requirements at Temora, and determined that he had sufficient fuel to continue to Luskintyre with ample reserve without refuelling.

After departing Temora, the pilot planned to overfly Rylestone, Denman and Jerrys Plains, en route to Luskintyre. The flight proceeded as planned to about Kandos (just south of Rylestone), where the pilot visually fixed his position. At that point, rather than continuing as planned overhead Rylestone then on to Denman, the pilot elected to track directly to Luskintyre (Figure 1).

Figure 1: Extract from Visual Navigation Chart showing planned route and accident site



Source: Airservices Australia – annotations made by the ATSB

The direct track between Kandos and Luskintyre was over heavily treed and undulating terrain, leaving the pilot unable to positively visually fix his position. As he continued in an easterly direction, the pilot grew increasingly concerned about the possibility of infringing controlled airspace further to the east. Conditions at the time were windy and although the pilot recalled that the visibility was good, there may have been some bushfire smoke in the area.

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1 Visual Flight Rules 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.

Rather than risk infringing controlled airspace, the pilot decided to make a precautionary landing to ascertain his position. He located a valley that appeared to have some cleared areas, then circled for several minutes assessing precautionary landing options. The pilot commented that precautionary landing options were very limited, but he ultimately selected a paddock that was clear of obstacles, and while relatively short, it offered an uphill landing run to assist in stopping the aircraft.

During his approach to land on the selected paddock, with full flap selected, the pilot found himself overshooting the selected aim point. He endeavoured to recover the profile, but had increasing difficulty maintaining the preferred aim point. Concerned that he would not be able to land safely, the pilot elected to discontinue the approach and commenced a go-around. As the go-around proceeded however, the pilot found that he was unable to climb over tress ahead of the aircraft on rising terrain beyond the far end of the selected paddock. He was able to manoeuvre around a small number of individual trees, but collided with a line of trees, slightly further on. The aircraft was substantially damaged in the collision (Figure 2) and the pilot received serious injuries.

Figure 2: Aircraft wreckage

Source: Putty Rural Fire Service

Search and rescue

The aircraft was fitted with an emergency locator transmitter (ELT) which was activated by the impact. An overflying aircraft detected the ELT signal at about 1715 EDT, and search and rescue authorities were alerted. Sometime after the accident, the pilot was also able to activate a portable locator beacon. In addition, the pilot had left a Flight Note at the point of departure. When the pilot had not made contact by the nominated time, the holder of the Flight Note commenced enquiries and notified authorities.

The aircraft wreckage was ultimately discovered by a local resident, around 2 hours after the accident, independent of other search and rescue activities. The local resident alerted authorities, who attended the scene and were able to secure the wreckage and provide medical assistance to the injured pilot.

Pilot experience

The pilot held a private pilot licence and had about 270 hours total aeronautical experience, all under the visual flight rules. He had flown about 23 hours, in the 90 days preceding the accident.

Safety message

In many cases, deviation from a flight plan is necessary to ensure continued safe flight. Where deviation from a flight plan is not essential, pilots are encouraged to consider the risk of operational complications such as potential difficulties with navigation or fuel management. Deviation from a flight plan or Flight Note may also affect search and rescue activities in the event of an accident, to the extent that a search is conducted in the wrong place.

Where available, pilots unsure of their position or requiring navigational assistance, are encouraged to seek Flight Following services from ATC. In this case, contact with ATC may have allayed the pilot's concerns about the prospect of infringing controlled airspace, and negated the need to consider a precautionary landing. A fact sheet regarding Flight Following services is available on the Airservices Australia website via the following link, under the group heading *working with air traffic control*: www.airservicesaustralia.com/publications/safety-publications/

With respect to precautionary landings, pilots are encouraged to initiate an early go-around as soon as there is any doubt regarding the prospects of a safe landing. The potential for a safe go-around may diminish as an aircraft continues an approach, particularly where there is rising terrain or obstacles beyond the selected precautionary landing area. With the assistance of a suitably qualified instructor, pilots are encouraged to regularly practise the skills required to make a safe precautionary landing.

While in this case the aircraft was found by a local resident independent of search and rescue activities, the accident nonetheless provides a reminder of the potential value of a Flight Note. Pilots are encouraged to prepare a Flight Note where relevant, and to ensure that the information provided on the Flight Note is as accurate as possible. Pilots are also encouraged to advise ATC of any deviation from the planned route, to ensure that search and rescue authorities have access to updated information where relevant. More information about Flight Notes is available in the Visual Flight Rules Guide, available on the CASA website at www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90008

General details

Occurrence details

Date and time:	27 October 2014 – 1715 EDT	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	Near Putty, New South Wales	
	Latitude: 32° 58.75' S	Longitude: 150° 40.65' E

Aircraft details

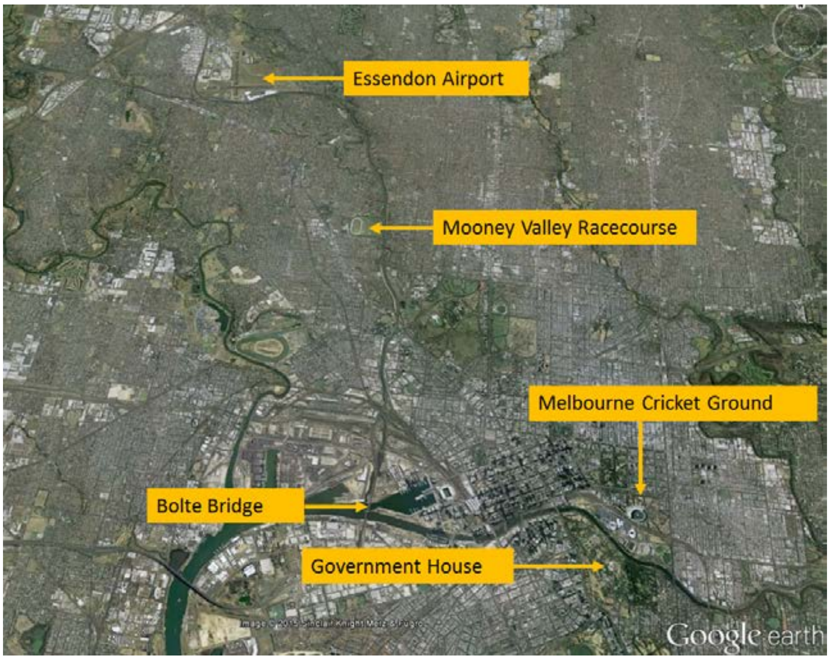
Manufacturer and model:	Cessna 172G	
Registration:	VH-ZZD	
Serial number:	17254242	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – 1	Passengers – Nil
Damage:	Substantial	

Proximity event between a Robinson R44, VH-JKF and a Cessna 172, VH-EVR

What happened

On 28 December 2014, at about 1310 Eastern Daylight-saving Time (EDT), the pilot of a Robinson R44 helicopter, registered VH-JKF (JKF), taxied for a 20-minute scenic flight from Essendon Airport, Victoria. The helicopter travelled as the lead helicopter 'in-company' with another Robinson R44 helicopter. In that role, the pilot of JKF was issued with a discrete transponder code by air traffic control (ATC), and the following helicopter squawked 'standby'. He was also responsible for making all the radio calls on behalf of both helicopters. At about 1312, the aerodrome controller (ADC) advised the pilot of JKF that the current aerodrome terminal information service (ATIS)[1] had changed as the wind was then southerly at 10 kt, and cleared JKF and company for take-off to the south tracking to Bolte Bridge (Figure 1).

Figure 1: Melbourne area



Source: Google earth

At about 1315, the student pilot of a Cessna 172 aircraft, registered VH-EVR (EVR), contacted ATC requesting a clearance to taxi for a training flight to Point Cook. An instructor was also on board. Runway 17 was the runway in use for departures at Essendon Airport at that time.

During the scenic flight, the pilot of JKF observed a flag on Government House indicating a light north-easterly wind and assumed the wind at Essendon would be the same, and therefore that runway 35 would be the runway in use, and did not listen to the ATIS. At about 1321, JKF and company were cleared by the ADC to track from the Melbourne Cricket Ground (MCG) to Essendon, not above 1,500 ft.

1 An automated pre-recorded transmission indicating the prevailing weather conditions at the aerodrome and other relevant operational information for arriving and departing aircraft.

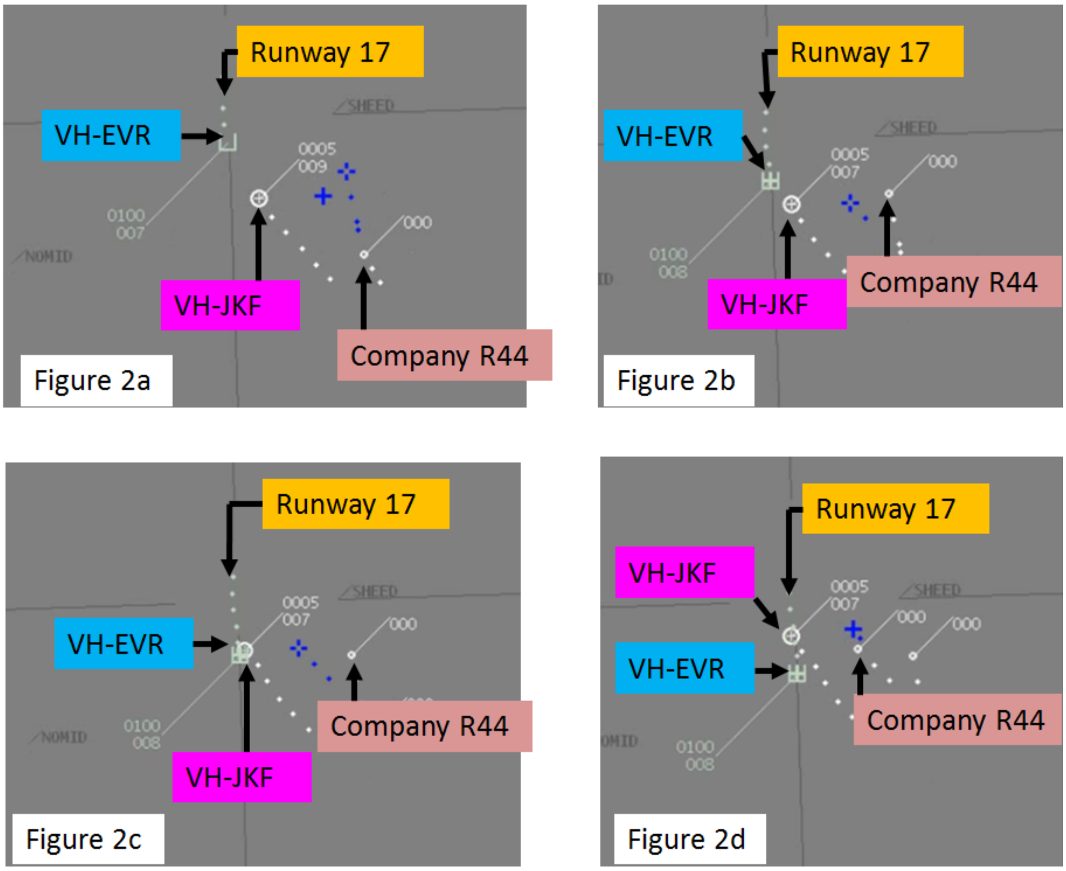
At about 1323, EVR was cleared to track direct to Point Cook at 1,500 ft and subsequently cleared for take-off. At 1325, the instructor of EVR requested clarification that EVR had been cleared for take-off, and the student then commenced the take-off run. When overhead Mooney Valley racecourse, the pilot of JKF heard ATC communications with EVR. At that time, the pilot of JKF was briefing passengers for landing and did not hear the runway direction in the instructions issued to EVR by the controller. He had observed the wind over the city coming from a northerly direction, and assumed EVR would be taking off from runway 35.

At about 1325, the ADC directed JKF and company to track towards the runway 17 threshold and to report sighting the Cessna in the take-off roll. The pilot of JKF read back the instruction, but inadvertently tracked towards the 35 threshold. He responded to the ADC that he was looking for the Cessna. The pilot of the in-company R44 helicopter broadcast that he had the aircraft rolling in sight, and ADC responded that all communications (for the in-company flight) had to be transmitted by the pilot of JKF. The pilot of JKF then responded that he had the traffic in sight. The ADC advised JKF that the Cessna was just crossing the runway intersection and airborne off runway 17 and directed JKF to pass behind it (Figure 2a).

About 16 seconds later, the ADC asked both helicopters to confirm they had the aircraft in sight that was then crossing the freeway (Figure 2b). The pilot of JKF had sighted the Cessna and as he assumed it was tracking to the north, assessed that there was no conflict. The pilot of the R44 travelling in company with JKF, which was tracking correctly to the runway 17 threshold, responded that he did have the traffic in sight. This was partially over-transmitted by the instructor of EVR who had just sighted JKF in close proximity (Figure 2c).

The pilot of JKF then realised that he was tracking to the incorrect threshold and sighted the Cessna. He slowed the helicopter and passed behind and below EVR (Figure 2d).

Figure 2: Radar images depicting event sequence



Source: Airservices Australia

Radar data

Airservices Australia analysed the radar data relevant to the incident and provided a copy of the data to the ATSB (Figure 2). The analysis indicated that JKF passed about 100 ft below and about 75 m behind EVR. Airservices advised that the secondary surveillance radar (SSR) horizontal position was accurate to within 52 m and the relative accuracy of two aircraft in close proximity was within 50 ft.

In-company flights

The ATSB found limited information regarding rules and procedures for in-company flights. In-company flights were defined in the Manual of Air Traffic Services (MATS) Version 28, as: 'A group of aircraft that occupy an airspace block that is defined in the flight notification'. MATS 10.10.5 *In-company flights* included: 'When airborne, separation between aircraft within an in-company flight is the responsibility of individual pilots. This also includes periods of transition, when aircraft are manoeuvring to attain separation within the in-company flight, and during join up and break away'.

The Aeronautical Information Package (AIP) En Route (ENR)[2] 1.4-6 stated:

> *(5) aircraft flying as part of an in-company flight will not be provided with separation with respect to other aircraft of the same in-company flight whilst airborne. Runway separation will continue to be provided.*
>
> *Note: A group of civil aircraft conducting the same flight (e.g. an air safari), which require the aircraft to operate at separation distances greater than those specified for formation flights will be considered to be separate aircraft when applying separation.*

Pilot comments

Pilot of VH-JKF

The pilot provided the following comments:

- After discussing the incident with the ADC, the two aircraft in company were advised that they should stay 'in-company' even if the lead pilot makes a mistake, and the following pilot should call and correct or advise the lead pilot. The controller suggested that when operating 'in-company' the two aircraft should stay within 1 NM of each other. Civil Aviation Order (CAO) 95.7[3] detailed the conditions under which a helicopter was exempt from the subregulation that would otherwise require it to maintain at least 600 m horizontal separation from another helicopter. Pilots without a formation endorsement were not permitted to operate aircraft closer than 600 m apart unless flying within a published access lane or corridor.
- He had broken sleep in the nights prior to the incident and combined with the hot day, he may have been more tired than he had assessed prior to the flight. He had eaten breakfast at 0700 and not had the opportunity to eat anything else prior to the incident, although he had consumed some water.
- He had completed four scenic flights that morning prior to the incident flight.
- He was more senior than the following pilot and this may have created a 'cockpit gradient' preventing the following pilot from voicing his concern at the lead pilot's deviation from ATC instructions.

Instructor of VH-EVR

The instructor of EVR reported that he first sighted a black helicopter when at about 600 ft above mean sea level. He reported that he estimated that JKF passed about 25-30 m from the left of EVR. He had not been asked by ATC to sight a black helicopter.

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2 www.airservicesaustralia.com/aip/current/aip/enroute.pdf

3 www.comlaw.gov.au/Details/F2010C00712

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.

Helicopter operator

As a result of this occurrence, the helicopter operator has advised the ATSB that they have ceased in-company flights.

Safety message

This incident serves as a reminder to keep a good lookout at all times, including in Class C airspace. The Civil Aviation Safety Authority pilot guide for Essendon Airport, available at www.casa.gov.au/wcmswr/_assets/main/pilots/download/melbourne2.pdf, advised pilots: 'Just because traffic information is provided does not mean that you don't have to keep a good lookout and manoeuvre to avoid other traffic if necessary'. An ATC instruction to pass behind another aircraft requires pilots to see the other aircraft and regulate their speed and approach path to achieve separation. Pilots and ATC have a dual responsibility to maintain situation awareness of other traffic.

General details

Occurrence details

Date and time:	28 December 2014 – 1325 EDT	
Occurrence category:	Incident	
Primary occurrence type:	Operational non-compliance	
Location:	Essendon Airport, Victoria	
	Latitude: 37° 43.68' S	Longitude: 144° 54.12' E

Helicopter details: VH-JKF

Manufacturer and model:	Robinson Helicopter Company, R44 II	
Registration:	VH-JKF	
Serial number:	10585	
Type of operation:	Charter – Passenger	
Persons on board:	Crew – 1	Passengers – 3
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Aircraft details: VH-EVR

Manufacturer and model:	Cessna Aircraft Company, 172R	
Registration:	VH-EVR	
Serial number:	17280252	
Type of operation:	Flying training – dual	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

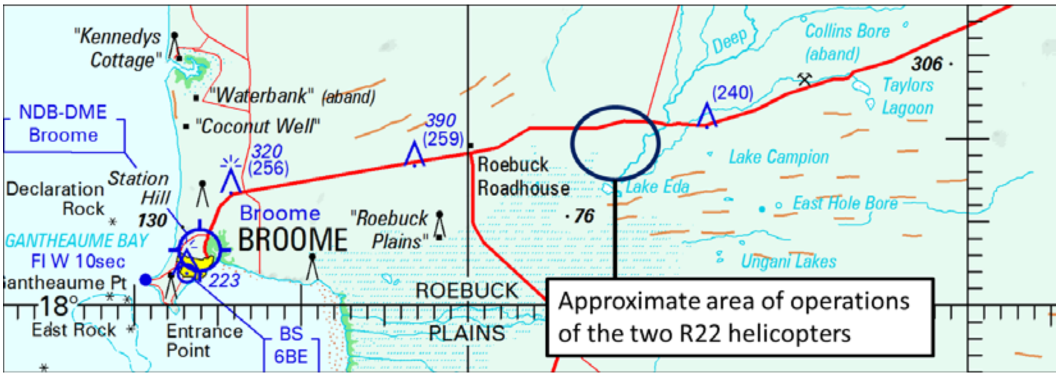
Helicopters

Aircraft proximity event between two Robinson R22s, VH-HQJ and VH-IAY, and an unknown aircraft

What happened

On 16 September 2014, two Robinson R22 helicopters, registered VH-HQJ and VH-IAY, were conducting aerial mustering operations about 26 NM east-north-east of Broome, Western Australia (Figure 1). The two R22 pilots were working together, and had planned mutual separation using relevant ground features in the area of operations. The two R22 pilots were also in radio contact on a company radio, and monitoring the multicom frequency 126.7 MHz.[1] There was lifting fog in the area at the time, with some clear patches emerging. The fog in a westerly direction towards Broome was relatively thick, but it appeared to be clearing further east.

Figure 1: Approximate area of operations of the two R22 helicopters



Source: Airservices Australia – information added by the ATSB

At about 0745 Western Standard Time, the pilot of one of the R22s observed a light aircraft in close proximity, and advised the pilot of the other R22 that was operating some distance away. That pilot immediately looked in the direction that he thought the light aircraft may have appeared, and observed a single-engine light aircraft travelling at low level in an easterly direction. He witnessed the aircraft bank sharply towards the north, perhaps in response to having sighted the other R22 which was operating almost directly beneath the flight path of the light aircraft. Following what appeared to be an evasive manoeuvre, the light aircraft resumed its easterly track, still at low level.

The R22 pilot that observed the manoeuvring of the light aircraft estimated its altitude to be about 200 ft above ground level (AGL). He estimated that the other R22 (close to the flight path of the light aircraft) was operating at about 100 ft AGL. He tried a number of times to contact the pilot of the light aircraft on the multicom frequency, but without response. The frequency in use by the pilot of the light aircraft is unknown, but they may have been monitoring the Area VHF.[2] The light

1 The multicom frequency (126.7 MHz) is used for broadcasts when an aircraft is operating to or from, or in the vicinity of, a non-controlled aerodrome depicted on an aeronautical chart that does not have a discrete Common Traffic Advisory Frequency (CTAF) assigned.

2 Aeronautical Information Publication (AIP) Australia (Operations in Class G Airspace – Climb and Cruise Procedures) states that pilots of radio-equipped VFR aircraft must listen out on the appropriate VHF frequency. Apart from operations in the vicinity of aerodromes depicted on aeronautical charts, Area VHF is the appropriate frequency. AIP Australia also includes provision for some aircraft (such as those engaged in agricultural operations) operating below 5,000 ft in Class G airspace, to maintain a listening watch on other than the Area VHF.

aircraft continued out of sight towards the east, and the two R22s resumed their aerial mustering operation.

ATSB comment

Without a report from the pilot of the light aircraft, the full circumstances surrounding the incident are unclear. Nonetheless, this incident demonstrates the importance of an effective lookout. An ATSB research report titled *Limitations of the See-and-Avoid Principle* discusses the numerous factors that influence the effectiveness of a pilot's lookout, including pilot workload, limitations of the human visual system, field of view considerations, target characteristics and psychological factors. A copy of the report is available on the ATSB website at www.atsb.gov.au/publications/1991/limit_see_avoid.aspx.

Although this incident did not occur in the immediate vicinity of a non-controlled aerodrome, the CASA booklet titled *Operations at non-controlled aerodromes* has some relevance. The limitations of the see and avoid principle, and the importance of effective communication are discussed in the booklet. The publication also provides an overview of 'radio rules' with respect to frequency management at non-controlled aerodromes (including reference to the use of the multicom frequency and the area frequency). The booklet is available on the CASA website at www.casa.gov.au/wcmswr/_assets/main/pilots/download/nca_booklet.pdf.

AIP Australia also provides important information regarding frequency management during operations in Class G airspace. A copy of AIP Australia is available on the Airservices Australia website at www.airservicesaustralia.com/publications/aeronautical-information-package-aip/.

Safety message

This incident highlights the importance of an effective lookout, even at low level when other aircraft may be unexpected. Pilots engaged in aerial mustering operations are usually focussed on the task at hand – monitoring the movement of livestock, the proximity of the aircraft to terrain and obstacles, and aircraft performance. These task demands reduce the capacity of a mustering pilot to maintain an effective lookout for unexpected aircraft. Accordingly, other pilots are encouraged to avoid operating at low level in areas where other aircraft may be engaged in aerial mustering or similar operations.

General details

Occurrence details

Date and time:	16 September 2014 – 0745 WST	
Occurrence category:	Serious incident	
Primary occurrence type:	Aircraft proximity event	
Location:	48 km east-north-east of Broome, Western Australia	
	Latitude: 17° 50.0' S	Longitude: 122° 40.0' E

Aircraft details

Manufacturer and model:	Robinson R22	
Registration:	VH-IAY	
Serial number:	4642	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Aircraft details

Manufacturer and model:	Robinson R22	
Registration:	VH-HQJ	
Serial number:	1958	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Separation issue between a Robinson R44, VH-YDK, and a Bell 412, VH-EWA

What happened

On 16 November 2014, a Robinson R44 helicopter, registered VH-YDK (YDK), was approaching Jandakot Airport following a charter flight from Rottnest Island, Western Australia, with a pilot and three passengers on board. At about 1348 Western Standard Time, the pilot of YDK reported downwind on the Jandakot Tower frequency, and the Jandakot aerodrome controller (ADC) responded 'precinct, report on the ground'.[1] Runway 24 was the runway in use.

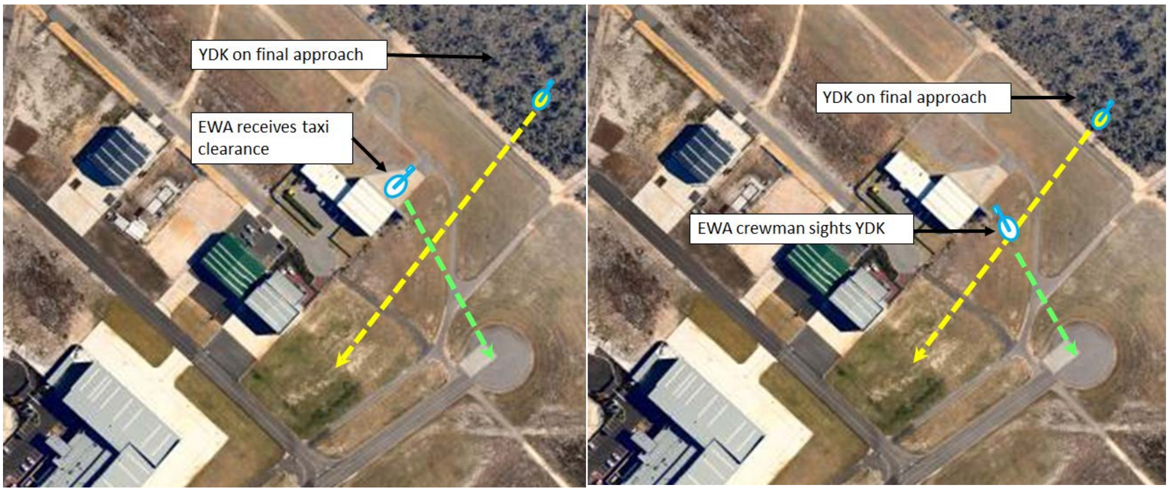
At about the same time, the pilot of a Bell 412 helicopter, registered VH-EWA (EWA), and callsign 'Rescue 65', prepared to conduct a rescue flight to Bunbury, Western Australia, with a crewman and paramedic on board.

As YDK turned onto final, at about 400 ft above ground level (AGL), the pilot of YDK sighted EWA outside its hangar with the rotors turning. He elected to continue the approach as he assumed that the pilot of EWA would sight YDK and remain stationary.

At about 1350, the pilot of EWA contacted the Jandakot Surface Movement Controller (SMC) on the Ground frequency, and stated 'request taxi to compass swing bay'. The SMC replied 'taxi to compass bay time 50 and a half and contact Tower 118.1 ready'. As the pilot commenced taxiing, the crewman, seated in the left front seat, sighted YDK at a height he estimated to be about 150 ft AGL and on an approach towards EWA. After sighting the helicopter, he directed the pilot of EWA to 'go forward' (Figure 1b). The pilot initially did not understand how a possible conflict could exist at that time and slowed to establish a hover to try and observe the other aircraft. The crewman repeated the call and the pilot commenced taxiing.

Figure 1: Sequence of events and approximate helicopter tracks

Figure 1a **Figure 1b**



[1] This was a standard instruction for helicopters landing in the precinct and entitled the helicopter to approach anywhere in the uncontrolled section (see Figure 2) and then advise air traffic control when on the ground.

Figure 1c

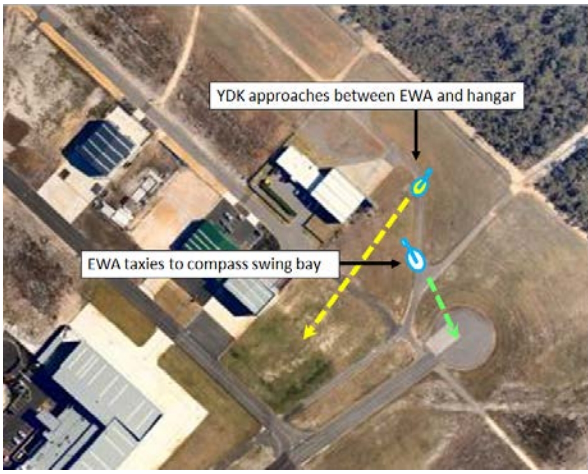


Figure 1d

Source: *Google Earth*

When at about 200 ft AGL,[2] the pilot of YDK observed EWA commence taxiing and he brought YDK into a hover over the trees at the edge of the precinct, about 100 m from EWA (Figure 1b). At about 1350, the pilot of YDK broadcast on the Tower frequency: 'Rescue 65, YDK just out your left hand window'. The pilot of EWA was still monitoring the Ground frequency and did not hear that call. The pilot of YDK did not receive a response. YDK then descended and passed behind EWA towards a landing on the middle of the grassed area (Figure 1c).

The pilot of EWA continued to taxi towards the compass swing bay, and as he turned the helicopter into the 240° direction approaching the bay, first sighted YDK which was then passing behind EWA and about 30 m away (Figure 1d).

About 30 seconds after YDK's broadcast to Rescue 65, the pilot of EWA broadcast on Tower frequency: 'ready compass swing bay parallel 24', ADC replied 'parallel runway 24 right compass swing bay report airborne', and Rescue 65 then reported 'airborne'.

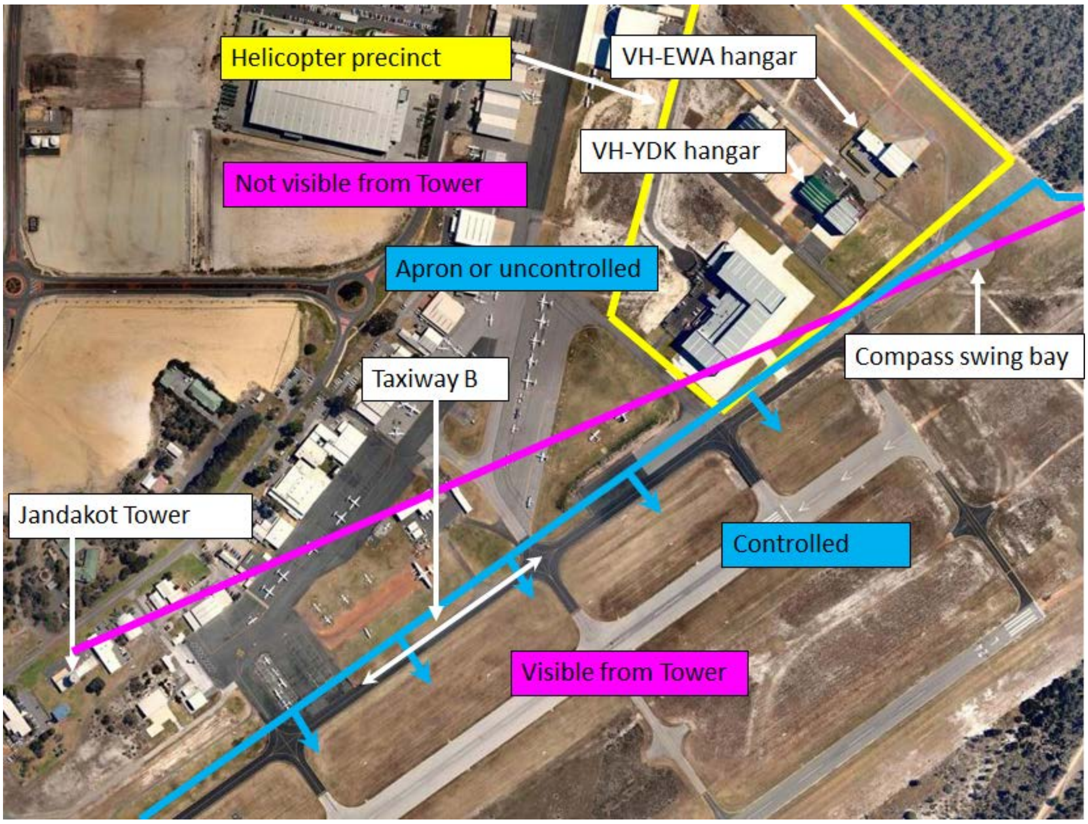
YDK landed on the grass between the hangar and taxiway B.

Jandakot airport helicopter precinct

The 'helicopter precinct' (Figure 2) is located in the north-eastern section of Jandakot Airport. Due to buildings situated between the control tower and the precinct, all ground movements are uncontrolled, as the controllers have no visibility of taxiing aircraft in the precinct. The precinct is considered to be an apron area. Air traffic control (ATC) only provides take-off or landing clearances where they can see the aircraft.

[2] Airservices Australia provided the radar data to the ATSB but the aircraft altitudes were not able to be accurately verified.

Figure 2: Jandakot Airport



Source: *Google Earth*

The standard instruction from the ADC for helicopters landing within the precinct was to report on the ground; for helicopters taking off from within the precinct, the standard instruction from SMC was to report on the tower frequency when ready for take-off. A clearance to the helicopter precinct entitled the helicopter to approach anywhere in the uncontrolled section. No specific clearance to land or taxi (or take off) was issued as the precinct was uncontrolled. The airspace above the precinct was contained within Jandakot Class D airspace and was therefore controlled during Tower hours.

There was no requirement for the SMC to advise the ADC that an aircraft was taxiing from the helicopter precinct to a taxiway nor was there any procedure for the ADC to advise SMC that an aircraft was approaching the uncontrolled apron (AIP GEN 3.4 page 56).[3]

The operator of YDK was the first general aviation helicopter organisation to move into the precinct. The airport management plan is to move all helicopter operations to the precinct. Most of the allocated lots have now been leased and construction is underway for the hangars. This will further increase the amount of helicopter traffic operating in the precinct and therefore the potential for conflict between helicopters operating without defined approach and departure points.

Pilot comments

Pilot in command of VH-YDK

The pilot of YDK provided the following comments:

- He knew the pilot of EWA would be on Ground frequency not Tower when he called stating that he was out to the left of EWA, but he hoped to alert ADC of the potential conflict. He was unsure whether the SMC and ADC communicated regarding traffic in the precinct.

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[3] www.airservicesaustralia.com/aip/current/aip/general.pdf

- He thought EWA was going to stop taxiing as he observed its tail dip, but it then continued forwards.
- Most of the company pilots aim for the same landing areas: either the grass or the taxiway intersection, but there was no strict procedure in place.
- A designated helicopter landing site (HLS) would assist with separation but it would be preferable to have some flexibility to land at different sites rather than be restricted to the HLS for all take-offs and landings.
- He did not have the landing or navigation lights on.

Pilot in command of VH-EWA

The pilot of EWA provided the following comments:

- The helicopter was fitted with blackout curtains as mandatory equipment required for flight under the instrument flight rules. The curtains obscure the pilot's line of sight through the roof of the helicopter to aircraft operating above.
- The crewman was maintaining a more thorough lookout than normal, following a similar incident, 2 weeks prior.
- During the taxi, the pilot performs checks, which require a substantial amount of attention inside the helicopter.
- Having established procedures in place would benefit all helicopter operators in the precinct. If helicopters approached taxiway B, rather than the grass between the hangar and the taxiway, that would assist in maintaining adequate separation.
- More helicopter operations, including firebombers, will be moving to the precinct, increasing the potential for conflict if no specific approach or departure points are defined.
- There was the intent by the airport operator to make the compass swing bay an HLS, but this has not occurred and an alternative compass swing bay would be required.
- Creating two HLSs, such as one at the intersection of taxiway B and taxiway H, and the other at the compass swing bay, and designating one for approach and one for departures, would reduce the potential for conflict. Having a determined approach point makes the traffic flow orderly and predictable.
- Changing to Tower frequency, prior to taxiing, would provide less than 1 minute to communicate with other traffic on that frequency, or for ADC to give traffic information.

Jandakot Airport operator comments

The Jandokot Airport operator, Airservices Australia and the operators of EWA and YDK held two meetings in June and July 2013, 16 months prior to the incident. These meetings were held to determine operational procedures in the helicopter precinct. The discussion notes provided to the ATSB from the meetings included the following points:

- Because of buildings, air traffic controllers cannot see north-west of taxiway B and only 50% of the compass swing bay.
- Because controllers are not able to see operations within the new precinct, helicopters will need to position to a location that ATC can see for both departures and arrivals.
- To easily control the traffic there needs to be specific aiming points.
- The compass swing bay is used on a 'first come first served' basis, and can be occupied for up to 15 minutes by aircraft doing a compass swing. Jandakot Airport Holdings advised that it was possible for another compass swing bay to be built, so that the existing bay becomes solely a helipad. Jandakot Airport Holdings stated they could also look at marking the compass swing bay as a helipad.
- Operators would prefer to have separate pads for arrivals and departures. However, there was no suitable location for two pads that ATC would be able to see from the Tower. Arrivals could

be accommodated without a visual landing, but for the departure, ATC must be able to see the aircraft.

- As more rotary wing operators were expected to move progressively into the new precinct, the airport operator and Airservices committed to have further discussions with each of the operators to address any issues that arise.

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-YDK

As a result of this occurrence, the operator of VH-YDK has recommended all company pilots to aim for the intersection of taxiways B and H for arrivals, approaching along taxiway B. Departures are to be down taxiway B unless there are fixed wing aircraft on the taxiway, in which case the strip between the taxiway and runway is to be used.

The operator also advised that the area was not for the sole use of their helicopters and they have no control over other operators who land in the area. A published procedure or Tower instruction would be required to ensure all helicopters follow this approach.

Operator of VH-EWA

The operator of VH-EWA has recommended company pilots change to Tower frequency prior to taxiing.

The operator of EWA reported that approach to the helicopter precinct should be via hover taxi from an established runway and then taxiway to eliminate conflict in the uncontrolled zone of the helicopter precinct. The operator will continue to liaise with Airservices and Jandakot Airport operator in an attempt to have this procedure implemented.

Airservices Australia

Airservices Australia advised that responsibilities for apron management were being reviewed with CASA. The outcomes were to be communicated via an Aeronautical Information Circular (AIC) publication in 2015.

Safety message

Alerted see-and-avoid has been shown to be far more effective than unalerted processes. In this incident, the pilots of the two helicopters were on different frequencies and operating in accordance with air traffic control requirements and did not hear any communications from each other. The helicopter precinct at Jandakot Airport is a unique environment, with airborne helicopters on Tower frequency and those taxiing ‘uncontrolled’ and on Ground frequency. Adding to the complexity, is that there are no designated helicopter landing sites within the precinct and pilots can taxi, take-off and approach and land anywhere in the precinct. This combination of factors requires pilots to make the mandatory radio calls, maintain a good lookout and to taxi, depart and approach the area by the most predictable routes to assist others in sighting them.

General details

Occurrence details

Date and time:	16 November 2014 – 1351 WST	
Occurrence category:	Incident	
Primary occurrence type:	Separation issue	
Location:	Jandakot Airport, Western Australia	
	Latitude: 32° 05.85' S	Longitude: 115° 52.87' E

Helicopter details: VH-YDK

Manufacturer and model:	Robinson Helicopter Company R44 II	
Registration:	VH-YDK	
Serial number:	12386	
Type of operation:	Charter – passenger	
Persons on board:	Crew – 1	Passengers – 3
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Helicopter details: VH-EWA

Manufacturer and model:	Bell Helicopter Company 412EP, VH-EWA	
Registration:	VH-EWA	
Serial number:	36312	
Type of operation:	Aerial work – EMS	
Persons on board:	Crew – 3	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

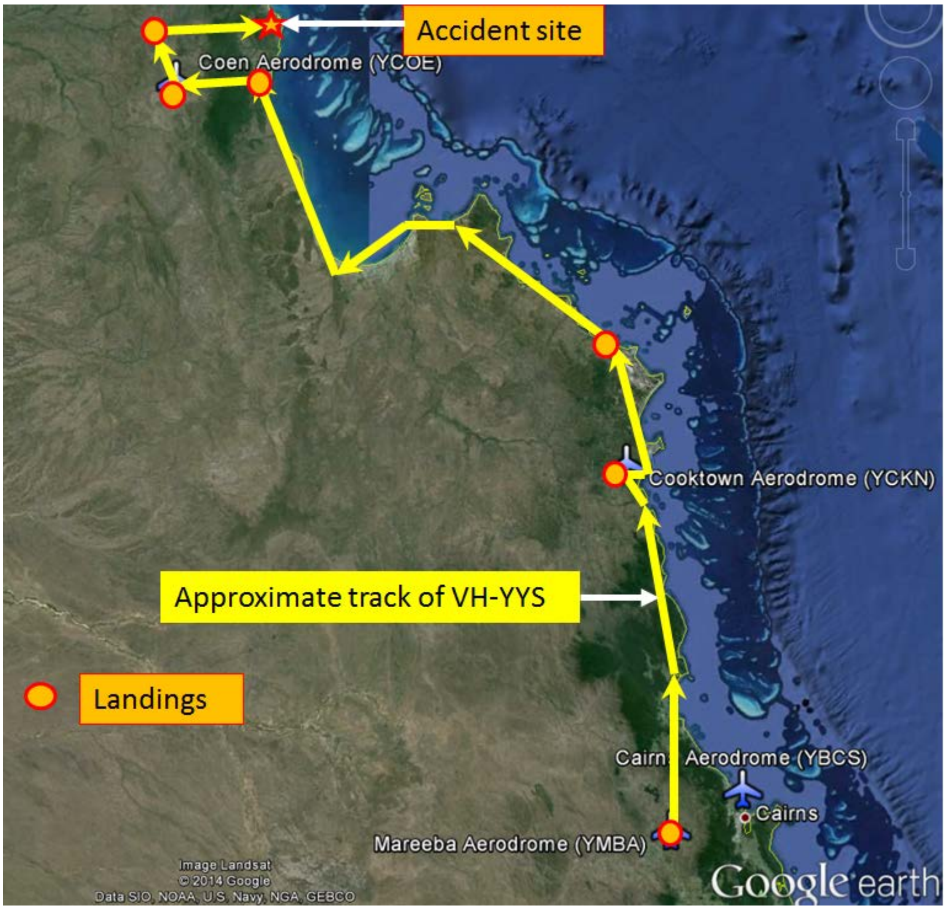
Forced landing and ground fire involving a Robinson R44, VH-YYS

What happened

On 22 November 2014, at about 0600 Eastern Standard Time, a Robinson R44 helicopter, registered VH-YYS, departed from Mareeba, Queensland on a private flight with the pilot and one passenger on board. The helicopter had previously been flown for 4.4 hours following an engine overhaul and the pilot had expressed concern about the quantity of oil the engine was consuming following the overhaul. He was advised by the licenced aircraft maintenance engineer who had conducted the overhaul to take the helicopter for a longer flight, of up to 7 hours, to 'bed in'[1] the engine. The passenger was an employee of a local aircraft maintenance company that had installed the engine in the helicopter following the overhaul. The pilot had asked the passenger to accompany him on the flight due to his concerns about the engine.

The helicopter tracked to the coast from Mareeba, then flew coastal to Cooktown where the pilot landed and refuelled (Figure 1). The helicopter had used about 1 L of oil during the 1.5 hour flight, and the pilot added that amount of oil prior to lifting off and continuing north. About 1 hour later, the pilot landed in a clearing on the coast, allowed the engine to cool and conducted an external inspection. He wiped away some oil that was smeared on the rear two cylinder heads.

Figure 1: Approximate aircraft track and landing sites



Source: Google earth and p*ilot recollection*

[1] The aim of bedding in an engine was to settle the piston rings into the cylinder wall.

From there the helicopter continued over Princess Charlotte Bay and Silver Plains and the pilot again landed and allowed the engine to cool. He wiped some oil from the cylinder heads but was unsure whether that oil leakage was normal while the engine bedded in, and whether it was leaking from the cylinders or being distributed there from the breather. The pilot did not add oil at that stage and departed for the 15 minute flight to Coen.

After landing in Coen, the pilot refuelled the helicopter and added 1 L of oil to bring the total oil quantity back up to 8 L. At about 1300, the helicopter departed Coen for Archer River. After arriving in Archer River, the pilot conducted another external inspection of the helicopter and did not add any oil. The helicopter lifted off at about 1400 and planned to track to the coast and then back to Cooktown.

When about 30 NM from Archer River and at about 1,300 ft, the pilot observed the engine revolutions per minute (rpm) decreasing rapidly. He immediately entered an autorotation: lowered the collective[2], rolled off the throttle and advised the passenger to brace for impact. The pilot sighted a clearing ahead and aimed to land there. During the descent, he observed the low rotor rpm (RRPM) caution light illuminate, but did not recall hearing the low RRPM warning horn. He turned the helicopter directly into wind and levelled it with the cyclic[3].

As the helicopter neared the ground, the pilot saw that they were landing into tall guinea grass. As soon as the helicopter landed, the pilot locked the cyclic off, retrieved the emergency beacon and he and the passenger quickly exited the helicopter. The pilot observed smoke billowing from the rear of the helicopter, where heat from the helicopter's exhaust ignited a grass fire. They ran away from the helicopter and grassed area towards trees and within seconds the helicopter was engulfed by fire. The helicopter was subsequently destroyed and the pilot and passenger were uninjured (Figure 2). The helicopter had been fitted with bladder fuel tanks.

Figure 2: Accident site

Source: ***Provided to the ATSB***

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

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

Engine history

The helicopter was fitted with a Lycoming O-540-F185 engine, serial number L-26764-40E.

23 June 2014: Total time in service (TTIS) 890.6 hr

> *On 23 June 2014, following a sudden stoppage and engine overspeed, the engine was removed from the helicopter for a bulk strip. Maintenance records indicated that the following items were subsequently fitted: left magneto, right magneto, carburettor, oil cooler, cylinders 1-6, and a starter motor.*

29 September 2014: TTIS 890.6

On 29 September 2014, the repaired engine was returned to a licensed aircraft maintenance engineer and installed in the helicopter.

When the pilot/owner collected the helicopter he observed that it was low on oil and added 2 L to bring the oil quantity to 8 L. He was advised that this had probably been taken up in the filters following initial engine runs. After completing a number of circuits at the airport, the pilot flew the helicopter to the home property. He observed that although the cylinder head temperature and oil temperature gauges were indicating in the green range, both were noticeably higher than prior to the engine maintenance.

17 October 2014: TTIS 896.3

On 17 October, the pilot conducted a flight in the helicopter and, particularly when operating in the range of about 80-90 kt, detected a 'kick' in the cyclic. He initially assessed this as an issue with the blade track and reported it to the maintenance engineer. The engine was using about 1 L of oil every 15 minutes and the pilot was concerned about the high rate of oil consumption, as well as the higher operating cylinder head and oil temperatures. Prior to the engine overhaul, the oil consumption was about 0.2 L/hr and the normal operating cylinder head temperature and oil temperature had been lower.

He returned the helicopter to the engineer and they conducted a short test flight. The engineer observed the 'kick' in the cyclic, coinciding with a marked drop in engine rpm.

The maintenance log recorded 'Engine using excessive oil removed for repairs'.

21 October 2014 Service Difficult Report (SDR) submitted:

On 21 October, the engineer submitted the following SDR report to CASA:

> *Aircraft rebuilt after heavy landing overspeed incident. On completion of the rebuild, aircraft flown for approximately 4 hours within that time the pilot/owner noticed a kick in the aircraft as it was flown resembling a lateral vibration. He also mentioned that the oil consumption was quite high. On inspection the oil was down to 5 quarts. We put 2 quarts in and did a track and balance believing the vibration was a lateral related balance issue. On completing the first flight it was apparent that the lateral was related to an engine miss. On landing we checked the oil consumption again and it was down to 6 quarts[4].*
>
> *Investigation results: It was decided to remove the plugs; all had excessive oil present on the plugs. Boroscope of the cylinders was carried out noting excessive wear of the cylinder timings. It was decided to remove the engine, return it to the engine shop for inspection. On removal also noticed No. 2 and No. 6 cylinders had loose cylinder base nuts.*

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[4] 1 litre is equivalent to about 1.06 quarts

29 October 2014: TTIS 896.3

The following maintenance record was entered by the engine repairer on 29 October:

> *Engine received for investigation of high oil consumption and evidence of several loose studs. High oil consumption was found to be caused by cylinder 2 and 4 having the rings gaps aligned and evidence of corrosion in the upper portion of the cylinder, all cylinders pitted beyond repair and replaced by 6 overhauled cylinders. Back bone bolts re-torqued. Note there was no evidence of any oil leaks from the studs found to be left loose after engine has operated for 8.2 hours.*

14 November 2014: 4.4 hour flight

On 14 November, the pilot retrieved the helicopter from the engineer and conducted a flight from Mareeba to Cooktown and return. He reported that there was some oil on the cylinders following the flight, but it was only a smear. He had landed a few times along the way and reported that the oil consumption on that flight was about 1.5 L/hr. Following this flight he was advised to take the helicopter for a longer flight to bed the engine in. This flight led to the forced landing.

Engineering inspection

Following the accident, the engine was inspected by the engineer who had conducted the engine overhaul. A full engine strip down was not conducted. The magnetos were badly fire damaged and it was not possible to determine their serviceability at the time of the accident. As a result, the cause of the reduced engine rpm was not determined.

Grass fire risk

Since 2000, 14 occurrences of a helicopter being destroyed by grass fire have been reported to the ATSB. Many of the reports highlighted the speed with which the grass ignited and the rapid spread of the fire. In November 2002, Robinson Helicopter Company published Service Bulletin SB-46,[5] *which recommended that shields could be installed on the exhaust collectors and tailpipe to reduce the chance of grass fire. All Robinson R44 helicopters serial number 1270 and subsequent were fitted with aluminium shields on the exhaust collector and tailpipe, to reduce the chance of grass fire. VH-YYS had a serial number of 1801, indicating that the shields had been fitted during the manufacturing process.*

A review of the post-accident photographs found presence of the stainless steel brackets and clamps indicating that these shields had been fitted; however the actual aluminium shields were not observed and may have melted in the ensuing fire.

Safety message

In this incident, the pilot was concerned about the serviceability of the helicopter. The cause of the loss of power was unable to be determined. The incident highlights the importance of pilot decision making in determining whether to conduct and/or continue a flight when abnormal indications such as excessive oil consumption occur.

Robinson R44 helicopters have exhaust systems that are low to the ground. The ground to muffler height on a new R44 is about 49 cm. The Pilot Operating Handbook for all R44s has a note in Section 10, Safety Tips stating:

> *Do not land in tall dry grass. The exhaust is low to the ground and very hot; a grass fire may be ignited.*

5 www.robinsonheli.com/service_library/r44_service_bulletins/r44_sb46.pdf

The pilot conducted a successful autorotation, but the helicopter was destroyed by the subsequent fire. When conducting a forced or precautionary landing, pilots may have limited choices for a suitable landing site. When time permits, the dangers of landing on grass, especially in areas of high temperatures and low humidity should be included when planning and assessing suitable landing sites.

General details

Occurrence details

Date and time:	22 November 2014 – 1430 EST	
Occurrence category:	Accident	
Primary occurrence type:	Abnormal engine indications	
Location:	56 km E Archer River, Queensland	
	Latitude: 13° 29.45' S	Longitude: 143° 26.27' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R44	
Registration:	VH-YYS	
Serial number:	1801	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Australian Transport Safety Bureau

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

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

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

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

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

About this Bulletin

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

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

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

The primary objective of the team is to undertake limited-scope, fact gathering investigations, which result in a short summary report. The summary report is a compilation of the information the ATSB has gathered, sourced from individuals or organisations involved in the occurrences, on the circumstances surrounding the occurrence and what safety action may have been taken or identified as a result of the occurrence.

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

Conducting these Short investigations has a number of benefits:

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

Australian Transport Safety Bureau

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Investigation

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Aviation Short Investigations

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