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

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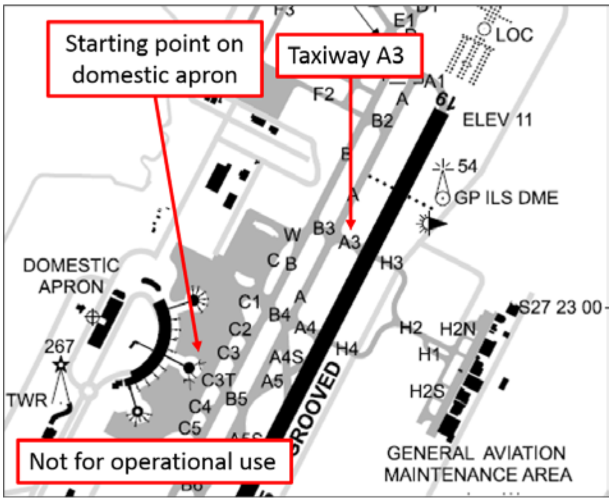
Stickshaker activation involving a Boeing 717-200, VH-NXM

What happened

On 27 May 2015, a Cobham Aviation Services Boeing 717-200 aircraft, registered VN-NXM, was being operated from Brisbane to Gladstone, Queensland. The weather in Brisbane was fine and clear, with a light wind from the south. The Captain was the pilot flying (PF) and the First Officer was the pilot monitoring (PM).[1] As part of their preparation for the flight, the crew determined the required flap setting for take-off, and set the flap/slat control handle take-off position detent accordingly (see flap and slat control description). The PM later recalled that, on this occasion, a flap setting of 5.6 degrees was required. Engine start and push-back were normal, and the crew taxied soon after 0900 Eastern Standard Time (EST) for an A3 intersection departure from runway 19 (Figure 1).

Figure 1: Excerpt from Brisbane aerodrome chart showing the location on the domestic apron where the aircraft commenced taxiing and taxiway A3 where the aircraft waited for a clearance to enter the runway

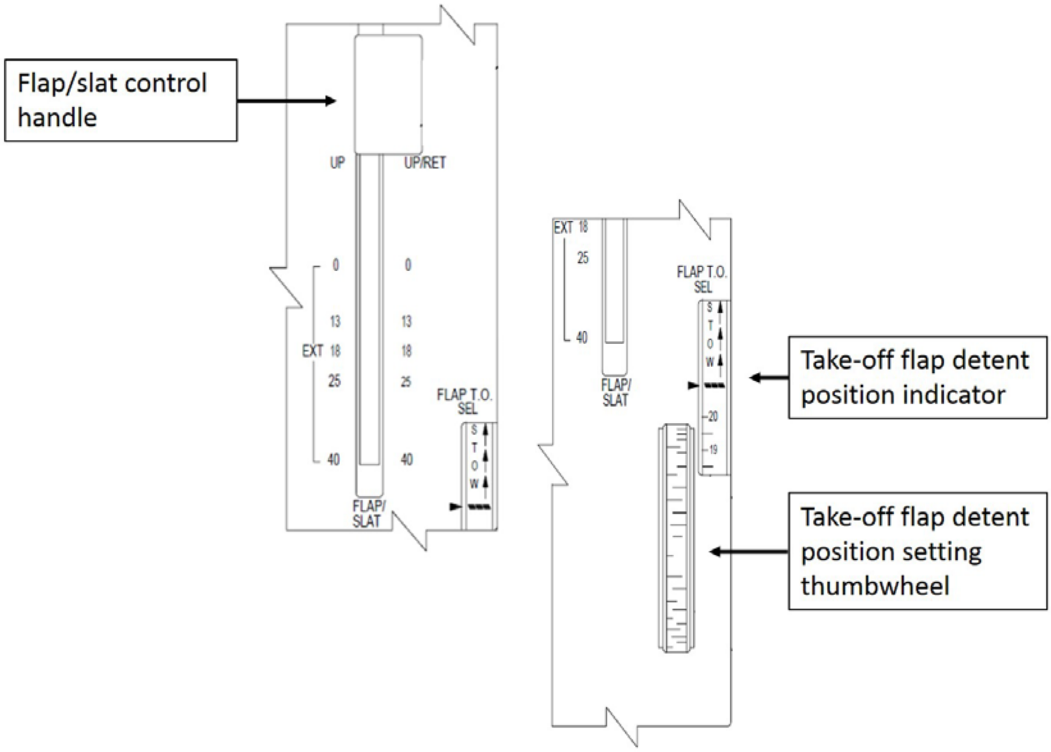


Source: Airservices Australia, with annotations added by the ATSB

> ***Flap and slat control***
>
> The flaps and slats are controlled by a handle on the right side of the centre pedestal (Figure 2). The flap setting for take-off is determined by the crew according to the conditions. The detent position setting thumbwheel is then used to position a detent for the control handle according to that determination, when a flap setting other than 13 or 18 degrees is required. The flap take-off selection indicator window displays the position of this movable detent. Unlike the flaps, the slats are either fully extended or fully retracted – there is no intermediate setting. The position of the flaps and slats is displayed on each pilot's primary flight display, beneath the airspeed indicator (Figure 3). The flap/slat control handle needs to be lifted to move it forward from the 0/EXT setting (flaps up/slats extended) to the UP/RET setting (flaps up/slats retracted), to retract the slats.

[1] PF and PM are procedurally assigned roles with specifically assigned duties at specific stages of flight. The PF does most of the flying, except in defined circumstances. The PM carries out support duties, and monitors the actions of the PF and the flight path of the aircraft.

Figure 2: Flap and slat control



Source: Boeing, with annotations added by the ATSB

As they taxied to the holding point, the crew completed relevant procedures, which included a requirement to confirm that the flap and slat configuration was set for take-off. The crew then held position on taxiway A3 while they waited for a clearance from air traffic control to enter the runway.

After waiting for several minutes, the crew were instructed by air traffic control to line up on the runway, but with a caveat that they needed to be ready for an immediate departure. The crew were ready, so accepted the clearance to line up, which was soon followed by their take-off clearance. The crew later commented that the wording used by air traffic control in providing the clearance to enter the runway was somewhat unusual, but there was no confusion and they clearly understood the intent. The crew entered the runway and commenced a rolling take-off.[2] The crew recalled that the take-off roll was normal in all respects, with standard communication and checks made as the take-off roll progressed.

Soon after take-off, the stickshaker activated (see stickshaker description). The PF responded immediately by checking the control column slightly forward to reduce the aircraft pitch attitude. The PF noted that the airspeed at that moment was in the expected target range of V_2[3] to V_2 + 10 kt, but below minimum speed (V_{min})[4] and stickshaker activation speed (V_{SS})[5] (Figure 3). The PF also noted the airspeed appeared to be stable, with no indication of a speed reducing trend. The crew recalled that the stickshaker remained active for only a very brief period.

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2 A rolling take-off is a take-off that commences when the aircraft enters the runway and proceeds with the take-off without stopping in the lined-up position.

3 V_2 is often referred to as the take-off safety speed. It is the minimum speed at which a transport category aircraft complies with those handling criteria associated with climb, following an engine failure. V_2 is normally obtained by factoring other critical speeds, to provide a safe margin with respect to aircraft controllability.

4 V_{min} is the minimum manoeuvring airspeed in the existing aircraft configuration. V_{min} provides a specific margin above the stickshaker activation airspeed and aerodynamic stall airspeed.

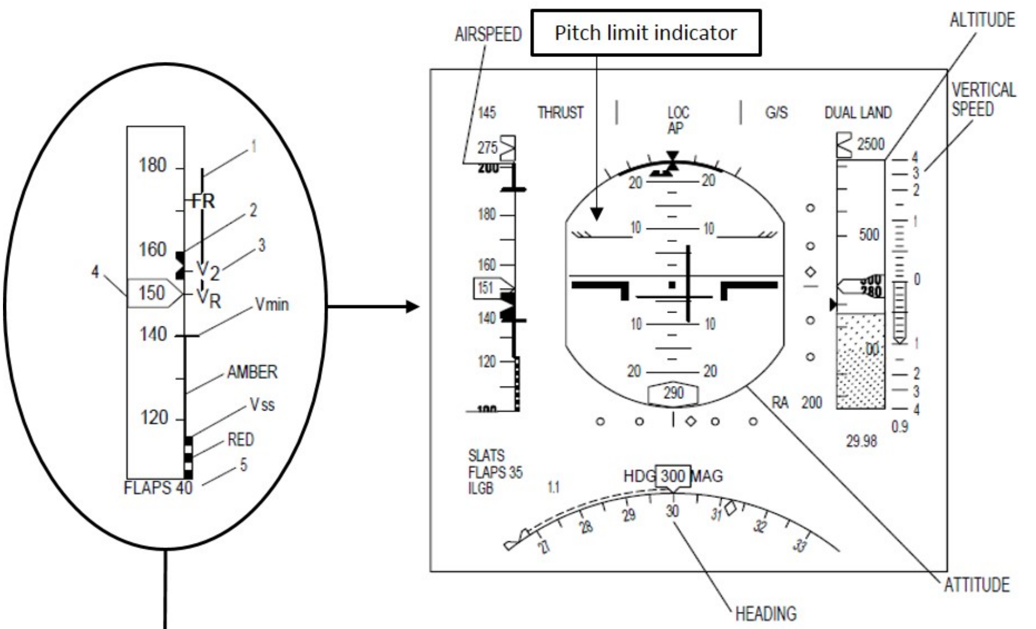
5 V_{ss} represents the airspeed at which the stickshaker activates to alert the crew to the possibility of an approaching aerodynamic stall.

Stickshaker

The stickshaker is part of the aircraft stall protection system. Stickshaker activation is based on a number of parameters, including the angle-of-attack of the aircraft and the position of the flaps and slats. When the required conditions are established, an oscillating force shakes the control column rapidly through a small angle to alert the crew that the aircraft may be approaching an aerodynamic stall. If the aircraft continues towards an aerodynamic stall, other levels of warning and protection may be activated, including visual and aural alerts, and a stick-pusher.

The airspeed range for activation of the stickshaker is displayed as a 'red zipper' on the lower part of the airspeed indicator (Figure 3). V_{SS} marks the top of the red zipper. When the airspeed is below V_{SS} the pitch limit indicator (which provides an indication of the angle-of-attack margin to the activation of the stall warning system) changes colour from cyan to red, to provide an additional alert to the crew. Additionally, the digits (and the outline box surrounding the digits) representing the current airspeed indication turn red if the airspeed falls below V_{SS}.

Figure 3: Primary flight display and description of relevant airspeed indications



1. Airspeed trend indicator, displayed as a green column.
2. Airspeed bug - colour and outline varies according to selection.
3. Reference airspeed pointers (speed bugs) - reference speeds displayed in this manner as appropriate, example shows V_R (rotate speed), V_2 (take-off safety speed) and FR (flap retract speed).
4. Current airspeed.
5. Flap position indication (beneath the speed tape).

Also note V_{min} (minimum airspeed) at the top of the amber bar and V_{SS} (stickshaker airspeed) at the top of the 'red zipper'.

Source: Boeing, with annotations added by the ATSB

Within moments of stickshaker activation, the PM noticed that the flap/slat control handle was set to the UP/RET position (flaps up/slats retract). Upon noticing the position of the handle, the PM immediately called 'flaps', and moved the flap/slat control handle to the previously determined take-off setting position.

As the aircraft continued to climb, the PF noticed that the landing gear was still down - the landing gear would normally be raised soon after having established a positive rate of climb (see description of the operator's normal configuration management procedures). The crew then raised the landing gear and the climb continued. Later during the climb, the flaps were selected up, and soon after, as the aircraft continued to accelerate, the slats were retracted. The flight then continued to Gladstone without further incident.

Following the incident, the crew deduced that the PM must have selected the flap/slat control handle to the UP/RET position soon after take-off, rather than raising the landing gear handle. The crew's deduction was based upon the configuration of the aircraft before, and immediately after, stickshaker activation. The crew were confident that before take-off procedures had been completed correctly, and that the flaps and slats had been correctly set. The crew also noted that had they commenced the take-off without the flaps and slats set, they would have received an aural warning alerting them accordingly – there was no such aural warning on this occasion.

Operator's normal configuration management procedures after take-off

Normal procedures require that the landing gear be retracted soon after take-off. The PM observes that a positive rate of climb has been established and that the aircraft has accelerated to V_2. Normally, when those conditions are met, the PM calls 'positive rate'. If the PF is satisfied that the appropriate conditions are met, he/she responds by commanding 'gear up'. The PM then raises the landing gear control handle to the UP position accordingly, and when the landing gear has retracted, calls 'gear up'.

Later during the climb, as the aircraft accelerates through the flap retraction speed, the PF calls 'flaps zero'. The PM checks that the speed is at or above the flap retraction speed, and that the aircraft is accelerating, then moves the flap/slat control handle to the 0/EXT position (flaps up/slats extended). When the flaps have reached the selected position, the PM calls 'zero set'. Slat retraction follows a similar process at slat retraction speed which is a slightly higher speed than the flap retraction speed. To retract the slats, the PM sets the flap/slat control handle to the UP/RET position (flaps up/ slats retracted) and when the slats have retracted, calls 'aircraft clean'.

Landing gear control

The landing gear control handle is located on the instrument panel, ahead of and slightly to the left of the pilot in the right seat. The handle is moved in a near vertical motion between the UP and DOWN positions to raise and lower the landing gear.

Flight data analysis

A review of the flight data downloaded following the flight showed that the flaps and slats had been set for take-off. The slats were extended and the flaps had been set to the take-off position determined by the crew. Soon after take-off, at around the time that the landing gear handle would normally be selected to the UP position, the flight data indicates that the flap/slat control handle was moved to the UP/RET position. The stickshaker activated shortly after the flap/slat control handle was moved. At that time, the airspeed was relatively steady at slightly over 160 kt.

The stickshaker was active for about 2 seconds, and stopped at about the time the PF lowered the pitch attitude of the aircraft from about 10 degrees nose-up, to about 6.5 degrees nose-up. The stickshaker stopped as the aircraft was climbing through about 170 ft, with the airspeed continuing to remain relatively steady at slightly over 160 kt. Although the climb shallowed momentarily immediately following stickshaker activation, a positive rate of climb was maintained throughout.

From about 7 seconds after the flap/slat control handle was selected to the UP/RET position, the handle was moved back to the position that had been set prior to take-off. During that 7 seconds, the flaps had travelled to the fully up position, and the slats had begun to retract. As the handle was reset, the slats moved back to the extended position (before having reached the fully retracted position) and the flaps moved back to the position that had been set prior to take-off. By the time the flaps and slats returned to the take-off configuration, the aircraft was accelerating through about 174 kt, and climbing through about 330 ft.

Flight data showed that after the configuration was reset, the aircraft continued to climb at a relatively steady speed of about 180 kt. As the aircraft climbed through about 700 ft, the landing gear was selected up. As the aircraft climbed through about 3,000 ft, the flaps were selected up as the aircraft accelerated, and soon after, the slats were retracted.

Crew comments

The crew made a number of comments regarding the incident, including:

- When the stickshaker activated, the PF initially suspected a problem with the aircraft system that senses the position of the slats. Under some conditions, a faulty sensing system may result in a misleading stickshaker activation. The PF had experienced a failure of that nature previously, with similar symptoms.
- When the stickshaker activated, the PF immediately assessed that the airspeed was appropriate (in the range V_2 to V_2+10) at that point, and that the pitch attitude was normal. Although there was no immediate explanation for stickshaker activation, the PF lowered the pitch attitude slightly to ensure that the speed was maintained. The PF then heard the PM call ‘flaps’, and became aware that the PM was manipulating the flap/slat control handle (this was at the point that the PM was resetting the configuration, back to the take-off configuration).
- The PF also commented that with the benefit of hindsight, the thrust setting should have been increased at the onset of the stickshaker. Although that may have been an appropriate response, the limited duration of the stickshaker meant that there was little time to react.
- The PM could not recall moving the flap/slat handle after take-off, and could not explain why the flap/slat control handle was selected to the UP/RET position when it was. Neither pilot could specifically recall the ‘positive rate’ and ‘gear up’ communication and command that normally takes place soon after take-off, but believe that it was probably carried out.
- The PM indicated that, even though the flap/slat control handle needs to be lifted in order to move it forward from the 0/EXT position to the UP/RET position, the handle can be moved through the 0/EXT position in a single motion.
- Both crew commented that, with the exception of brief remarks regarding the flow of air traffic while they waited on taxiway A3, sterile flight deck procedures[6] were being observed.
- Neither the PF nor PM could recall any specific distractions that may have diverted the attention of the PM at a critical moment during the take-off.
- For the PM, the day of the incident was the fourth consecutive day of duty. While the PM had slept adequately during the evenings leading up to the incident flight, they reported some tiredness associated with a recent change in personal circumstances and a longer commute to and from work.
- For the PF, the day of the incident was the third day of a three-day roster, but the schedule was not demanding.
- After a brief discussion immediately following the event, both pilots were conscious of the need to maintain their focus on the safe and efficient conduct of the flight ahead. They elected not to discuss the incident further during the flight until they were safely on the ground at their destination. Following the flight, they discussed the incident and submitted a report.

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6 Sterile flight deck procedures relate to a requirement for pilots to refrain from non-essential conversations and activities during critical phases of flight.

ATSB comment

Available evidence suggests that the PM inadvertently selected the flap/slat handle to the UP/RET position, instead of selecting the landing gear handle to the UP position. While the reasons are unclear, the most likely explanation resides in an understanding of human error types. The SKYbrary website includes information about human errors that may have relevance to this occurrence, particularly with respect slips and lapses – referred to collectively as execution errors (Human Error Types). The SKYbrary website also includes an article dealing with the relationship between human performance and level of arousal (Level of Arousal). The article illustrates that over-arousal can lead to a degradation in performance, but importantly, under-arousal can have a similar influence.

In a similar incident in 2003 (ATSB Report 200302037), the co-pilot of a Boeing 717-200 repositioned the flap/slat handle soon after take-off, instead of the landing gear handle. In response to that incident, the operator added the following caution to the procedures for flap/slat retraction after landing:

> *When retracting flaps/slats to UP/RET, pause at the UP/EXT position until the flaps indicate UP on the PFD prior to retracting the slats. Never move the flap/slat handle to UP/RET in one motion.*

The ATSB report states that:

> *The purpose of the change was to separate the retraction of the flaps and slats into two distinct actions, in an attempt to prevent the retraction of the flaps and slats becoming `learned' as a single continuous action.*

In another incident, the flaps of a British Aerospace 146-300 began to retract soon after take-off, just before the aircraft reached 100 ft above ground level. Flap retraction began at about the time the call to raise the landing gear would have normally been made (ATSB Investigation Report 9704041). Although there were numerous factors surrounding the incident, the report commented that 'On balance … the likelihood rests that the co-pilot inadvertently selected the flaps up instead of the landing gear.'

More information about stall warnings in high capacity aircraft is available in ATSB research report AR-2012-172 *(Stall warnings in high capacity aircraft: The Australian context 2008 to 2012)*. The report outlines the results of a review of 245 stall warnings and stall warning system events over a 5-year period from 2008 to 2013. Of those 245 events, 163 were stickshaker activations.

Safety message

This incident highlights the susceptibility of pilots to execution errors such as slips and lapses, irrespective of knowledge and experience. Pilots are encouraged to reflect on the circumstances surrounding this incident to help build their own awareness of human factors issues associated with operating complex equipment in a highly dynamic environment.

General details

Occurrence details

Date and time:	27 May 2015 – 0915 EST	
Occurrence category:	Incident	
Primary occurrence type:	Incorrect configuration	
Location:	Brisbane airport, Queensland	
	Latitude: 27° 23.05’ S	Longitude: 153° 07.05’ E

Aircraft details

Manufacturer and model:	Boeing 717-200	
Registration:	VH-NXM	
Operator:	Cobham Aviation Services	
Serial number:	55094	
Type of operation:	Air transport – high capacity	
Persons on board:	Crew – 5	Passengers – 49
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Loading event involving an Airbus A330, VH-QPJ

What happened

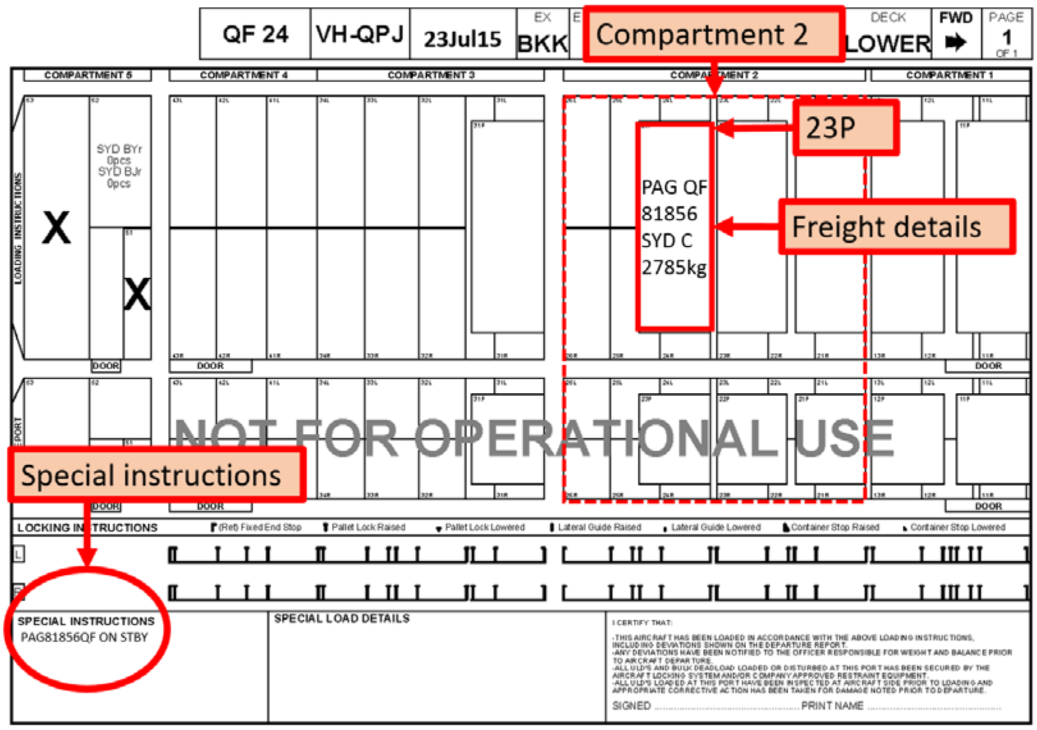
On 23 July 2015, an Airbus A330 aircraft, registered VH-QPJ and operated by Qantas Airways, was being loaded at Bangkok Airport, Thailand, prior to flying to Sydney, Australia. The ground-handling agent (and loading supervisor) was in Bangkok, and the load controller was in Warsaw, Poland.

> The load instruction report (LIR) displayed a pictorial representation of the planned uplift. To maximise uplift within the aircraft's operational limitations, the report contained a set of loading instructions. These instructions identify positions within the aircraft hold for loading containers, baggage and freight.

The load controller in Warsaw issued a load instruction report (LIR) to the loading supervisor in Bangkok (Figure 1). The loading supervisor was required to load the aircraft in accordance with the LIR. The LIR also contained 'Special instructions' and 'Special load details'. The Special instructions for QF24 stated that the freight pallet shown on the LIR in position 23P was on standby. The loading supervisor then called the load controller by telephone to provide a 'partial read back'. The supervisor read back to the controller how the aircraft had been loaded, based on the LIR.

The loading supervisor commenced by reading out the description and weight of the pallet loaded into position 23P. The load controller responded that the pallet in 23P was on standby as per the Special instructions, and directed the loading supervisor to offload that freight. The supervisor responded 'yes', and stated that the loading was in accordance with the LIR. The loading supervisor then continued to read the loading to the controller, again commencing with the pallet in 23P, followed by the rest of the loaded freight. The pallet in 23P remained loaded on the aircraft.

Figure 1: Load instruction report showing freight positions and special instructions



Source: Aircraft operator

After completion of the loading, the loading supervisor again phoned the load controller to provide the final read back of the loading. The loading supervisor stated ‘forward compartment no change’, to which the load controller responded clarifying position 23P was ‘no fit’[1]. The loading supervisor replied, ‘yeah, no change’ and the load controller responded ‘ok’.

The load controller then prepared the final loadsheet for the flight, based on the information provided over the phone by the loading supervisor. The load controller transmitted the final loadsheet to the flight crew via the Aircraft Communications Addressing and Reporting System (ACARS). The loadsheet included the calculated aircraft total and component weights including fuel, passenger, baggage and freight weights. It also provided the aircraft balance details including the aircraft take-off trim setting position.

The flight crew then used this data to calculate reference speeds for take-off, fuel consumption rates, and initial climb altitude. At about midday local time, the aircraft departed Bangkok for Sydney and the flight crew did not detect any abnormal flight characteristics, nor did they receive any warnings related to the aircraft’s weight or balance.

After the flight had closed, the load control system automatically generated a Container Pallet Message (CPM) report. The report was based on the input from the load controller, and therefore did not include the pallet in 23P. The loading supervisor identified that the pallet in 23P was not on this report and contacted the load controller. The load controller confirmed that the pallet should have been offloaded, and was therefore not included in the uplift weight calculations. The load controller then contacted the Qantas Integrated Operations Control (IOC) in Sydney and advised them that a pallet had been loaded onto the aircraft, which was not included in the loadsheet, and that some operational limitations had been exceeded.

About 75 minutes after the aircraft departed from Bangkok, the IOC advised the aircraft flight crew of the error. The flight crew entered the amended aircraft weight into the flight management computer.

Load discrepancy

The weight of the standby pallet for 23P indicated on the LIR was 2,785 kg. The final loadsheet indicated 1,225 kg of freight in compartment 2. Compartment 2, depicted in Figure 1, included a number of freight positions including 23P. The calculation for total freight weight in Compartment 2 was based on freight loaded in positions 26L (615 kg), 26R (610 kg) and zero in 23P.

Based on the final loadsheet, the taxi weight was calculated to be 235,485 kg (maximum 233,900 kg) and the take-off weight was 232,300 kg (maximum 233,000 kg).

As a result of the discrepancies, Qantas advised that the maximum taxi weight had been exceeded by 1,585 kg, and the maximum take-off weight by 2,085 kg. The initial cruise altitude of 35,000 ft did not exceed the maximum altitude when the actual weight was subsequently entered into the aircraft flight management computer.

Qantas investigation

Qantas conducted an investigation into the incident, which included a review of the transfer of load control operations to Warsaw (from its previous location in Hong Kong), the systems supporting the load controller and loading supervisor, and their individual actions.

The investigation identified a number of safety factors that contributed to the incident. These included the following.

Depiction of standby freight

The load controller represented the standby freight as listed on the LIR, with the freight depicted in the loaded position, and a standby notation included in the Special Instructions box. The Qantas

[1] No fit means that the position is empty.

investigation found that was not a documented procedure for handling standby freight, but it was an accepted practice. The training of loading supervisors did not include how standby freight was to be documented on the LIR.

Communication

The communications between the loading supervisor and load controller were open to misinterpretation, had ambiguous phraseology, untimely transmissions, and did not involve a read-back hear-back process.

During the partial read back, the offload instruction caused confusion as to whether the pallet in 23P was to be loaded or not, and that confusion was not resolved.

During the final read back, a misunderstanding resulted from the load controller's use of the phrase 'no fit', meaning not loaded, and the loading supervisor's use of the phrase 'no change' meaning no change to the loading depicted on the LIR.

Training

Irregularities were identified with the training regarding LIR presentation and interpretation. Specifically, the training on procedures for handling standby items provided to load controllers did not cross-reference the training provided to loading supervisors and vice versa.

Safety actions

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, Qantas advised the ATSB that they are taking the following safety actions:

Immediate action taken

For all flights out of Bangkok, the loading supervisor must receive a scanned copy of the final LIR before transmitting the final loadsheet to the flight crew (by ACARS).

Standard phraseology is to be used for all read back communications.

Standby freight procedure

Load Control will document the following:

- procedures for listing standby freight in the LIR Special Instructions
- use of LIR Special Instructions
- sample communications for instructions to offload and the required response from loading supervisors.

Training

The training provided to load controllers and loading supervisors was to be coordinated. The training procedures will include a standardised process for handling standby freight.

A process for updating load control training material will also be implemented.

Firstload

An automated read back system, 'Firstload', is scheduled to be introduced to Bangkok and other international ports in November 2015. Firstload is an iPad-generated LIR and read back system. Implementation of the system will remove the requirement for verbal read backs.

Safety message

This incident highlights the importance, particularly when dealing with safety-critical data, for:

- standard phraseology in verbal communications
- ensuring a verbal instruction has been understood and complied with
- validating verbal communication with written documentation.

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

Data input errors, such as the wrong figure being used, happen for many reasons. The consequences of these errors can range from aborted take-offs, to collisions with the ground. More information is available in the ATSB safety research report, *Take-off performance calculation and entry errors: A global perspective*.

General details

Occurrence details

Date and time:	23 July 2015 – 2128 UTC	
Occurrence category:	Incident	
Primary occurrence type:	Loading related event	
Location:	Bangkok (Suvarnabhumi Airport), Thailand	
	Latitude: 13° 40.87' N	Longitude: 100° 44.83' E

Aircraft details

Manufacturer and model:	Airbus A330-303	
Registration:	VH-QPJ	
Operator:	Qantas Airways Limited	
Serial number:	0712	
Type of operation:	Air transport – passenger	
Persons on board:	Crew – Unknown	Passengers – Unknown
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Turboprop aircraft

Collisions with kangaroos involving a Fairchild SA227 (Metroliner), VH-HPE, and a King Air B200, VH-FDB

What happened

On 1 September 2015, the pilot of a SA227 (Metroliner) aircraft, registered VH-HPE (HPE), was conducting a scheduled freight run from Brisbane, to Emerald, via Thangool Airport, Queensland.

Approaching Thangool, the pilot conducted a Distance Measuring Equipment (DME) arrival with a left circuit onto runway 28, touching down at 0545 Eastern Standard Time, just before first light.

Shortly after touchdown, and with all landing gear wheels in contact with the ground, the pilot saw the glimpse of an animal flash from left to right in front of the aircraft. At the time, the aircraft was travelling at about 80 kt. The right propeller then struck the animal, later identified as a small kangaroo. The pilot reported that following the large bang associated with the propeller striking the animal, there was a lot of vibration throughout the aircraft, but no abnormal engine indications. The pilot continued the landing roll, and used ground idle rather than reverse thrust to slow the aircraft.

The pilot taxied the aircraft to the parking bay, shut down the engines, then carried out an external inspection and found that one of the propeller blades attached to the right engine was twisted (Figure 1). The pilot was not injured.

Following the incident, the operator replaced the right engine and propeller and arranged for the original engine to be further assessed by engineering staff.

Figure 1: Damage to propeller blade on VH-HPE

Source: Pilot

Pilot experience and comments

The pilot held an Airline Transport Pilot Licence (Aeroplane) (ATPLA) and had about 4,900 flying hours, with about 1,310 hours on Metroliner aircraft. The pilot stated that there were no relevant NOTAMS for Thangool Airport, nor any alerting radio calls regarding wildlife. During the approach, the pilot had activated the pilot activated lighting (PAL), which provides runway and airport lighting, however no wildlife was evident on the runway.

Thangool Aerodrome Safety Officer comments

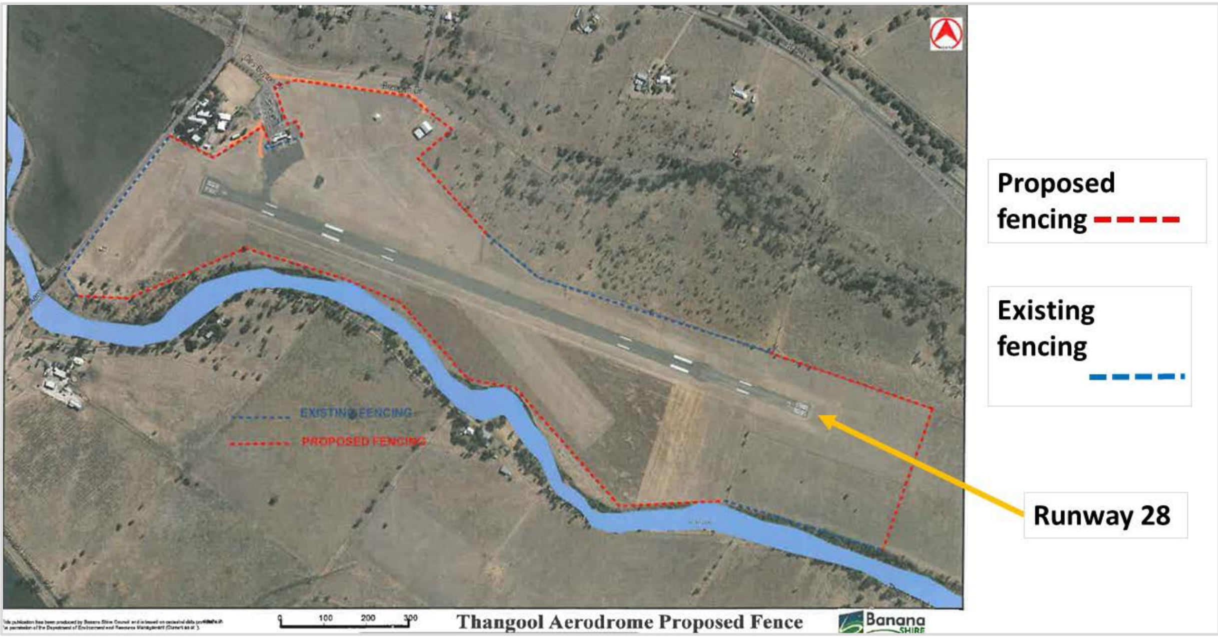
The aerodrome safety officer (ASO) reported that, due to continual pro-active mitigation strategies, such as animal culling, there have been no reported kangaroo strikes at the airport in the last 28 years.

The ASO also commented that they had conducted a runway inspection about 20 minutes prior to the Metroliner landing. No animals were evident during that inspection.

Banana Shire Council comments

Sections of the Thangool Airport had wildlife protective fencing however, it is not fully fenced. At the time of publication, the Banana Shire Council, who own and operate the airport, had a funding application lodged with the Australian Government’s Regional Aviation Access Programme to enable the remainder of the airport fencing to be completed (Figure 2).

Figure 2: Thangool airport with current and proposed fencing marked



Source: Banana Shire Council

Additional wildlife strike

On 2 September 2015, another kangaroo strike was reported to the ATSB (ATSB occurrence number 201503915). In this occurrence, a Raytheon B200 aircraft, VH-FDB, was on a medical retrieval mission from Townsville to Barcaldine Airport, Queensland. As the aircraft touched down in the early hours of the morning, at about 0141 EST the pilot caught a last moment glimpse of the animal before the aircraft struck a small kangaroo. The pilot reported that engine indications were normal, with no noticeable vibration as they completed the landing roll and then shut down the left engine while on the runway. They then taxied clear of the runway using the remaining engine. The strike caused damage to the three propeller blades attached to the left engine and disabled the aircraft (Figure 3)

Operator comment

The operator commented that although the Enroute Supplement Australia (ERSA) entry for Barcaldine Airport warns that both an animal and bird hazard exists, the local base had never sighted any animals, and therefore were somewhat inclined to discount it as a likely occurrence.

The operator/crew had not requested a “roo inspection” prior to the landing. They have also advised the ATSB that apart from the propeller damage, the left engine power module may also need replacing.

Figure 3: VH-FDB showing twisted propeller blades

Source: Operator

Barcaldine Regional Council

A council representative advised the ATSB, that a 6 ft chain mesh fence, with locked gates surrounded Barcaldine Airport. The airport staff conducted regular wildlife inspections at the airport, and also upon request with prior notice. They advised that due to drought conditions, there has been a noticeable increase in kangaroo numbers in the prior months. This increase was due to the animals seeking feed.

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-FDB

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

Strip inspection

The operator is amending their internal procedures, to automatically request a strip inspection for animals at any airport in the ERSA where an animal hazard is listed. This new procedure will also extend to requesting a strip inspection at any aeroplane landing area (ALA) when deemed appropriate.

Safety message

Occurrences involving aircraft striking wildlife, particularly birds, are the most common occurrences reported to the ATSB. They are a significant economic risk for aerodrome and airline operators as well as a potential safety risk. The ATSB regularly publishes a statistical report on the number and frequency of wildlife strikes. The aim of the report is to give information back to pilots, aerodrome and airline operators, regulators, and other aviation industry participants to assist them with managing the risks associated with bird and animal strikes. This is available on the ATSB website.

Both animal strikes and bird strikes remain a mandatory reporting item under the Transport Safety Act 2003. Reporting obligations are available on the ATSB website.

Source: ATSB

General details

Occurrence details – VH-HPE

Date and time:	1 September 2015– 0600 EST	
Occurrence category:	Serious Incident	
Primary occurrence type:	Collision with wildlife	
Location:	Thangool Airport, Queensland	
	Latitude: 24° 29.63'S	Longitude: 150° 34.57' E

Aircraft details – VH-HPE

Manufacturer and model:	Fairchild Industries Inc SA227-DC	
Registration:	VH-HPE	
Serial number:	DC-823B	
Type of operation:	Charter - Freight	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – N/A
Damage:	Substantial	

Occurrence details – VH-FDB

Date and time:	2 September 2015– 0200 EST	
Occurrence category:	Serious Incident	
Primary occurrence type:	Collision with wildlife	
Location:	Barcaldine Airport, Queensland	
	Latitude: 23° 33.9 S	Longitude: 145° 18.4' E

Aircraft details – VH-FDB

Manufacturer and model:	Raytheon Aircraft Company B200	
Registration:	VH-FDB	
Serial number:	BB-1977	
Type of operation:	Aeromedical	
Persons on board:	Crew – 2	Passengers – 1
Injuries:	Crew – Nil	Passengers – N/A
Damage:	Substantial	

Piston aircraft

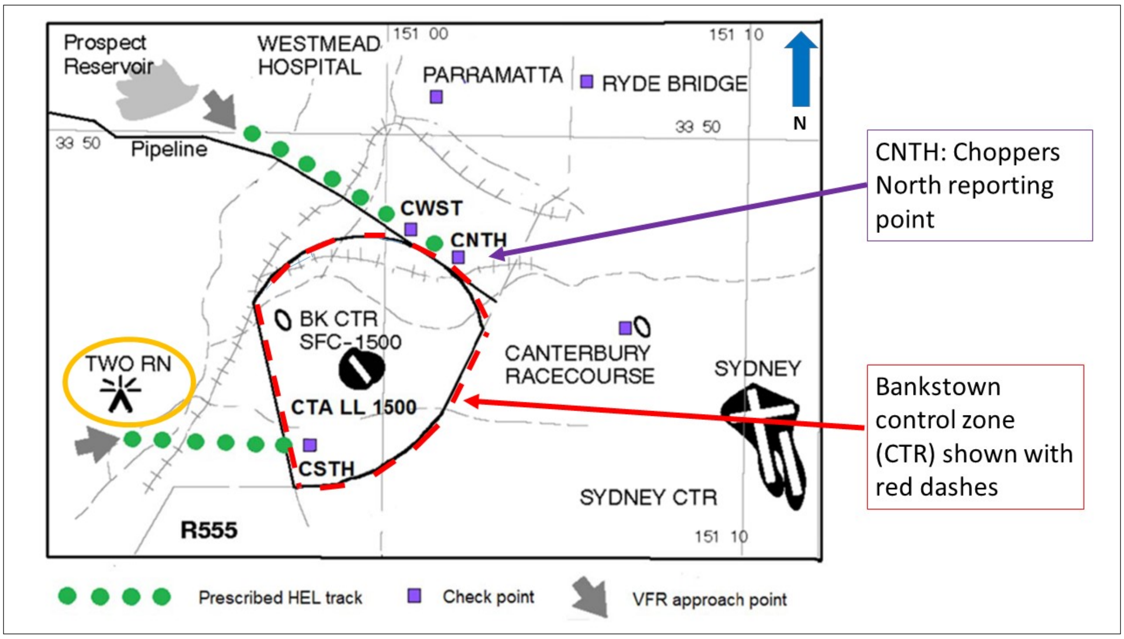
Near collision between an Extra 300L, VH-KCF and a Robinson 44, VH-OLG

What happened

At about 1335 Eastern Standard Time (EST) on 15 July 2015, the pilot of an Extra 300L aircraft (Extra) VH-KCF, was returning to Bankstown Airport, New South Wales, after completing a local, private flight. The pilot, the sole person on board, reported inbound to Bankstown Tower at the TWO RN reporting point (Figure 1). At this point, the Extra was maintaining 1,500 ft above mean sea level. Air Traffic Control (ATC) cleared the aircraft to join the crosswind leg of runway 29R and to maintain 1,500 ft.

Shortly after the pilot of the Extra had called inbound, the pilot of a Robinson 44 helicopter (R44), VH-OLG also called Bankstown Tower with inbound details, from overhead the Olympic Stadium, about 6 NM northeast of Bankstown Airport. The R44, with the pilot and three passengers on board, had just completed a scenic charter flight over the Sydney CBD. ATC requested the pilot to report again at Choppers North (Figure 1). The pilot descended to the required 700 ft and reported at Choppers North.

Figure 1: Helicopter inbound procedures diagram for Bankstown Airport. Note the Choppers North inbound reporting point as used by VH-OLG (purple arrow). On this occasion, VH-OLG was inbound from the northeast. TWO RN, the inbound reporting point for VH-KCF is also marked (yellow circle)



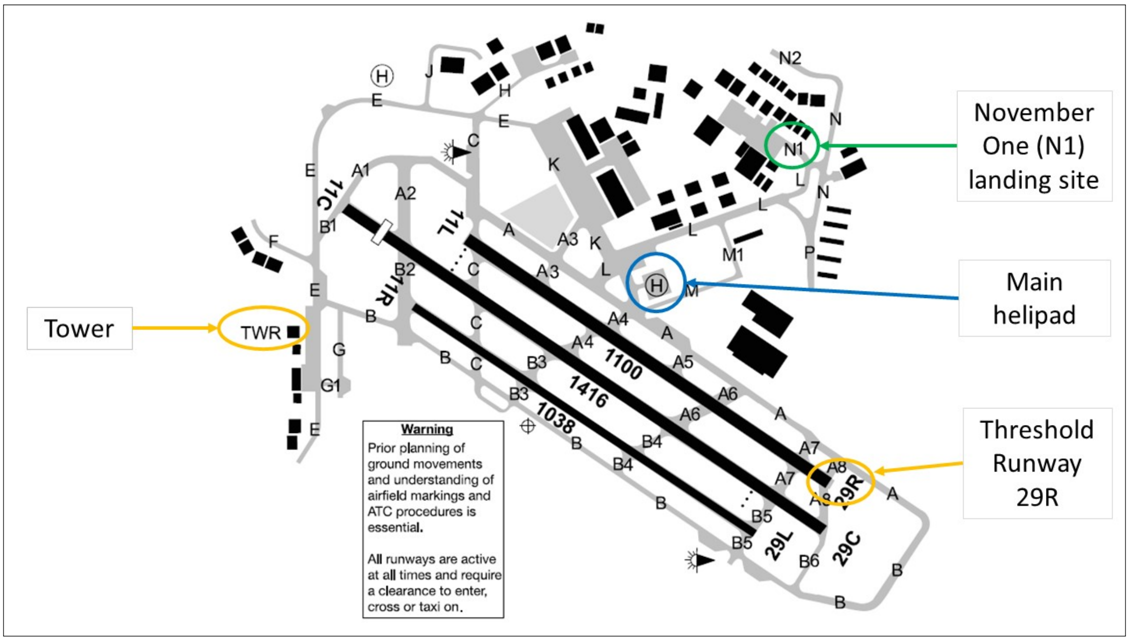
Source: Airservices Australia Enroute Supplement Australia (ERSA) Sydney / Bankstown extract, modified by the ATSB

From Choppers North, ATC instructed the R44 pilot to continue the approach and report on base leg. The pilot complied with this instruction, and reported on an ‘early base’. ATC then cleared the R44 for a November One (N1) arrival (Figure 2).

N1 arrival

An N1 arrival could only be conducted by appropriately trained and qualified pilots (such as the pilot of the R44). The arrival allowed a visual approach from the helicopter circuit altitude of 700 ft via an oblique approach to taxiway N1 (Figure 2). In an N1 arrival, the Tower were unable to see a helicopter during the latter part of the approach. So the pilot was required to advise the Tower when they had landed.

Figure 2: Bankstown Airport showing the N1 taxiway used as a landing site for a November One arrival (green)



Source: Airservices Australia – ERSA extract for Sydney / Bankstown

Meanwhile, as the Extra tracked to join crosswind for 29R, ATC alerted the pilot about a conflicting DR-107 One Design aircraft. The DR-107 had been cleared for take-off from runway 29C, and to initially maintain runway direction on climb to 1,500 ft.

The pilot of the Extra reported sighting the DR-107. The Extra pilot then requested a clearance to conduct a touch and go circuit on runway 29R. Once in receipt of this clearance, the pilot left 1,500 ft on descent, making a continuous turn onto base and then final approach. To enhance forward visibility the pilot then sideslipped the aircraft toward the landing threshold (Figure 3).

During the descent and sideslip of the Extra, the pilot of the R44 continued their descent at about 100-150 fpm toward N1. While descending through about 350-300 ft, the passengers and pilot on the R44 saw the underside of the Extra pass from right to left in front of the helicopter. They estimated it was within 100 ft of the R44's altitude and about 70-100 m in front of them (Figure 5).

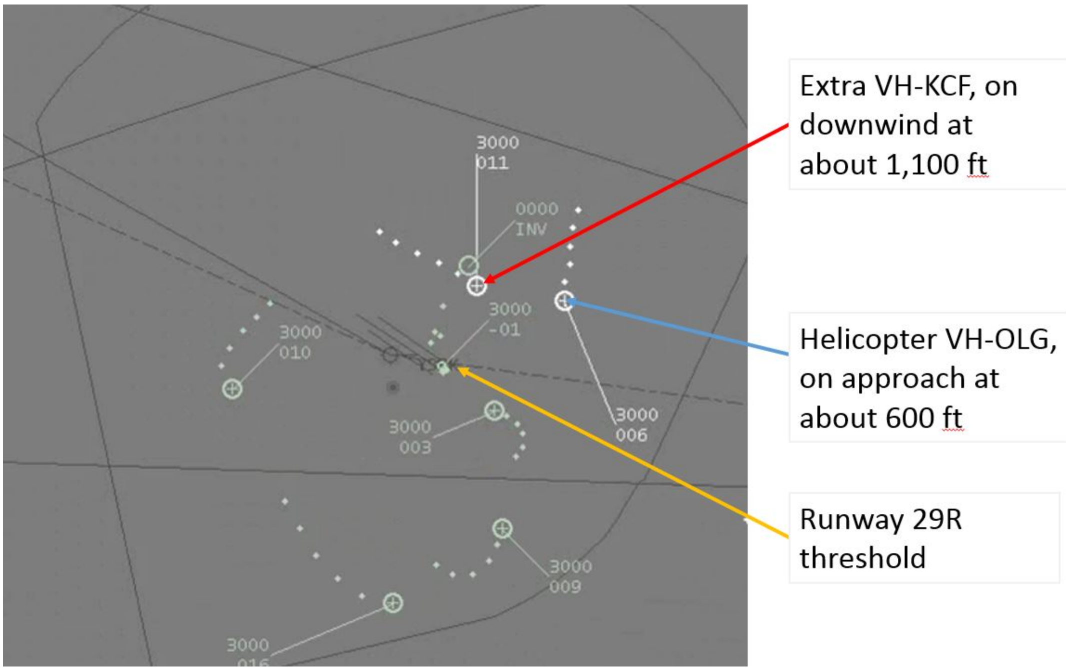
ATC again advised the pilot of the R44 to report after landing. The pilot replied to ATC that the Extra had just passed very close by them. The pilot of the Extra responded with a comment that they had seen the traffic.

The R44 pilot continued with the landing onto N1, reporting to tower after landing, and the pilot of the Extra, who was still not aware of the helicopter, continued with the touch and go prior to being cleared to land on runway 29C at the completion of another circuit.

Figure 3: An example of an Extra 300 L aircraft showing the seating position of the pilot. This gives an indication of the reduced visibility with the aircraft nose slightly raised, which occurs when the aircraft is at a slower speed

Source: Jim Groom

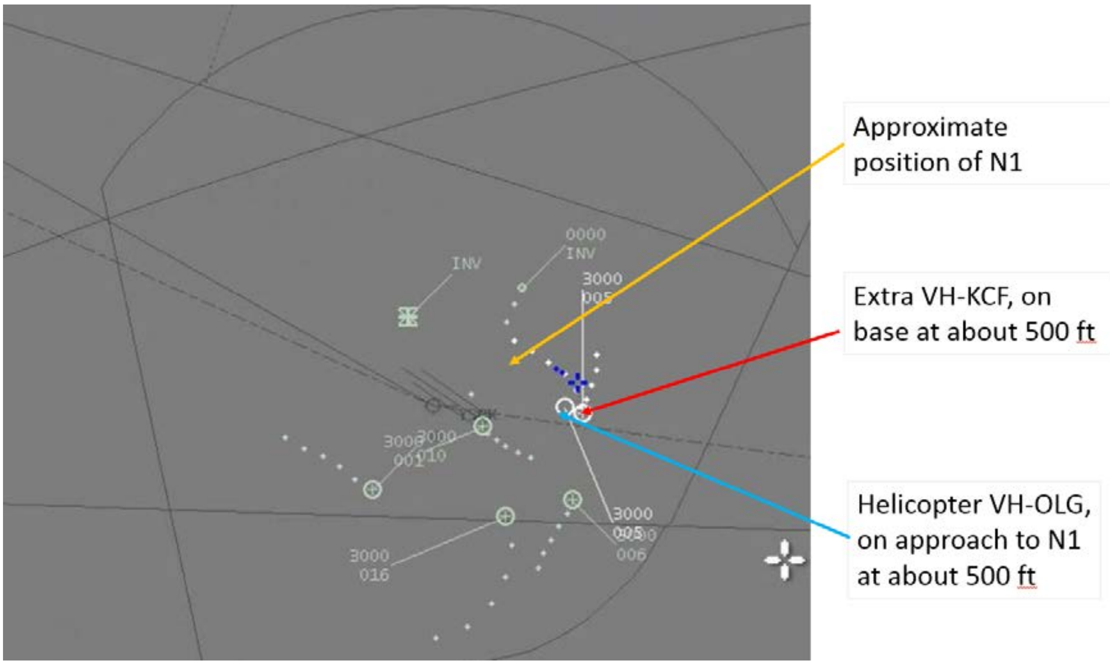
Figure 5: Radar plot showing both aircraft approaching their relative landing areas



Source: Airservices Australia

Note: Tower Situational Awareness Display (TSAD) was not available for the provision of separation to the controllers in Bankstown tower. These images are included to show what was recorded.

Figure 6: Radar plot showing the R44 VH-OLG (light blue) at about 500 ft tracking toward N1 and VH-KCF (red) on a continuous descending approach to runway 29R



Source: Airservices Australia

Note: Tower Situational Awareness Display (TSAD) was not available for the provision of separation to the controllers in Bankstown tower. These images are included to show what was recorded.

Airservices Australia

According to the Manual of Air Traffic Services, (MATS), in Class D airspace such as Bankstown, ATC should provide a traffic information service for visual flight rules (VFR) to VFR aircraft about other known or observed air traffic which may be in proximity to the position or intended route of flight and to help the pilot avoid a collision..

As per Bankstown ERSA section 14.1 (b), the helicopter was required to remain within the fixed wing circuit during the N1 arrival, thus traffic information would not normally have been provided.

Airservices Australia advised that the tower controller on duty did not assess the traffic to be in confliction, and did not sight the incident.

They also advised that the controller complied with the requirements of the Manual of Air Traffic Services (MATS) and the Aeronautical Information Publication (AIP) in relation to traffic information.

Extra, VH-KCF - Pilot comments

The pilot of the Extra held a Commercial Pilot's Licence for both fixed wing aircraft and helicopters. They had about 450 tailwheel aircraft hours and about 150 of these on the Extra, VH-KCF.

When flying the Extra, as on this day, the pilot completed a continuous descent once cleared for a visual approach on downwind. As per normal in the Extra, the pilot side-slipped the aircraft down final approach. Side-slipping allowed the pilot better forward visibility at the slower approach speed, while also keeping the runway threshold continuously in sight.

The pilot realised in hindsight, that when the potentially conflicting traffic (VH-OLG) was passed late in the circuit, they had assumed ATC was referring to the previous traffic alert involving the DR 107. The pilot was not aware of the R44, nor that a N1 arrival could cause a conflict.

R44 helicopter, VH-OLG - Pilot comments

The pilot held a Commercial Pilot's Licence (Helicopters) and a Grade 2 Instructor rating (Helicopter) with about 1,300 hours on helicopters. The pilot also held a private licence for fixed wing aircraft and had about 1,000 hours on this category of aircraft.

The pilot stated that Bankstown ATC manage both the fixed wing and helicopter circuits well. However, in recent times felt that there have been a few more 'near collisions'. This may be due to the increase in helicopter movements, and overall increase in aircraft movements.

The pilot commented that they thought that the pilot of the Extra would not have been able to see the helicopter during the sideslip.

ATSB Comment

A search of the ATSB's occurrence database for near collision incidents at Bankstown Airport between January 2013 and May 2015 did not reveal any near collisions involving helicopters.

There was one separation occurrence, (201408721), which involved the N1 approach. On that occasion, an inbound helicopter did not track as cleared to N1 and conflicted with another helicopter about to depart N1. ATC issued a safety alert to the helicopter departing N1.

The ATSB monitors trends on all occurrences recorded in its database, including near collisions. Recent trend monitoring identified that another Class D Airport, Jandakot, had a disproportionate rate of aircraft near- collisions. Specifically, between 2013 and 2015 Jandakot Airport had a near- collision rate that was at least three times higher than other similar metropolitan Class D airports across Australia. In response to this identified transport safety matter, the ATSB has commenced an investigation to identify the factors that increase the collision risk to aircraft operating at Jandakot Airport (see AI-2015-063 available at www.atsb.gov.au).

Safety message

This incident serves as a reminder to keep a good lookout at all times, including in Class D airspace. Pilots are responsible for maintaining separation in Class D airspace. The Civil Aviation Safety Authority pilot guide for Bankstown Airport, along with seven other Class D airports has been incorporated into the "On Track" pre-flight visualisation tool for both fixed and rotary wing pilots. This tool for VFR pilots is available on the CASA website.

A safety education publication and e-learning tutorials on Class D operations are also available on the CASA website. Note that all these publications are for safety education purposes and do not replace information in the Aeronautical Information Publication (AIP), the en-route supplement Australia (ERSA) and / or Notices to Airman (NOTAMS).

General details

Occurrence details

Date and time:	15 July 2015 at 1332 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	Bankstown Airport, New South Wales	
	Latitude: 33° 55.47' S	Longitude: 150° 59.30' E

Aircraft details – VH-KCF

Manufacturer and model:	Extra-Flugzeugbau GmbH EA300L	
Registration:	VH-KCF	
Serial number:	1182	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Nil	Passengers – N/A
Damage:	None	

Aircraft details – VH-OLG

Manufacturer and model:	Robinson Helicopter Company R44	
Registration:	VH-OLG	
Serial number:	10337	
Type of operation:	Charter - passenger	
Persons on board:	Crew – 1	Passengers – 3
Injuries:	Crew – Nil	Passengers - Nil
Damage:	None	

Near collision involving a Cessna 172, VH-EOT, and a Jabiru J120, 24-5340

What happened

On 6 September 2015, the pilot of a Jabiru 120 aircraft, registered 24-5340 (J5340), conducted a flight from Wangaratta to Latrobe Valley Airport, Victoria. Another Jabiru aircraft (J1) had departed Wangaratta about 2 minutes before J5340, and also travelled to Latrobe Valley. At about 1540 Eastern Standard Time (EST), the pilot of J5340 broadcast on the common traffic advisory frequency (CTAF) when 10 NM to the north of the aerodrome, stating the current position of the aircraft and advising that J5340 was on descent and inbound to Latrobe Valley. The pilot of J1 had broadcast about 2 minutes earlier inbound to the airfield at 10 NM, and reported hearing the broadcast from the pilot of J5340.

Following the broadcast by the pilot of J5340, the pilot of a Cessna 172 aircraft, registered VH-EOT (EOT), broadcast on the CTAF, that EOT was 10 NM from the aerodrome and inbound from the west. The pilot of EOT reported that he heard the broadcast from the pilot of J5340, who estimated his arrival time at the circuit at 1544. The pilot of EOT broadcast an estimated arrival time of 1543. The pilot of EOT reported that he then called the pilot of J5340 asking where he was, to which the pilot replied 'north'. The pilot of EOT did not see a Jabiru aircraft at that time.

The pilot of J5340 reported that he broadcast again, when 5 NM from the airfield, advising his intention to join the circuit on a long downwind for runway 03. Then, when approaching abeam the northern threshold of the runway and on the downwind leg of the circuit, the pilot of J5340 broadcast joining downwind at circuit height for runway 03.

The pilot of J1 reported also having broadcast at 5 NM and when joining downwind, and was on late downwind when J5340 joined the circuit.

The pilot of EOT reported hearing a Jabiru aircraft broadcast joining final for runway 21, and then amending that to turn right to join on downwind for runway 03. However, both Jabiru pilots reported that at no stage did they broadcast or intend to join on final or to use runway 21.

About 15 to 20 seconds after the pilot of J5340 broadcast joining downwind, the pilot of EOT broadcast joining on a midfield crosswind leg for runway 03 (Figure 1). The pilot of J1, then on late downwind, sighted EOT and reportedly called the pilot of EOT, asking whether he had J1 in sight, and received the response 'yes'. The pilot of J5340 then sighted EOT approaching from his left at the same height, about 300 m away, and reportedly also called asking whether the pilot of EOT had J5340 in sight. He reported that the pilot of EOT again responded 'yes', but the pilot of EOT later reported that he had not seen either Jabiru at that time.

The pilot of J5340 assessed that a collision with EOT was imminent, and immediately applied full power, conducted a steep climb and sharp right turn. As he levelled the aircraft off, after climbing about 200-300 ft, EOT passed directly underneath and then turned left onto downwind. The pilot of J5340 then broadcast a call to the pilot of EOT advising that he was above him and to his right and asked whether he had J5340 in sight. The pilot of EOT then sighted the Jabiru (J5340) above him to his right, and responded 'yes'.

The pilot of EOT asked what the Jabiru (J5430) pilot's intentions were. The pilot of J5340 responded that he would follow EOT, and extended the downwind leg to ensure adequate separation existed between the two aircraft. J1 had landed by that time, and both EOT and J5340 subsequently landed safely.

Pilot experience and comments

Pilot of VH-EOT

The pilot of EOT had recently passed his private pilot licence exam but had not yet received the associated paperwork. The pilot was conducting a navigation exercise towards the commercial pilot licence and had about 110 hours experience.

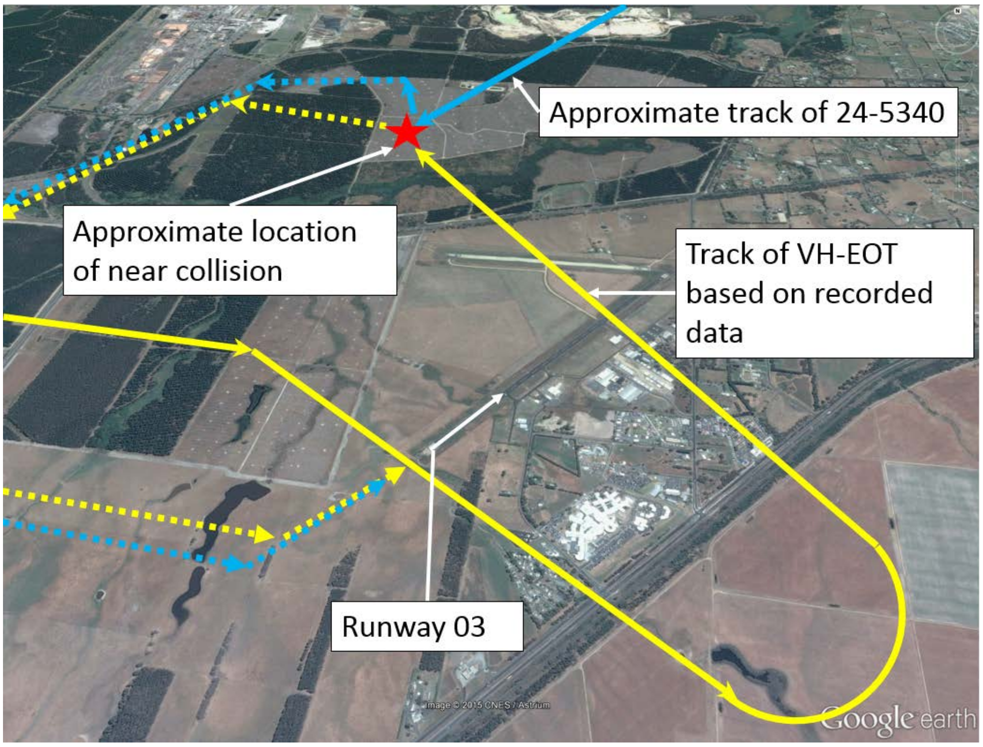
The pilot of EOT did not see J5340 until it had passed overhead. He did not see the other Jabiru (J1), or hear any broadcasts from the pilot of J1, at any time either in the air or after landing.

Pilot of Jabiru 24-5340

The pilot of Jabiru 24-5340 held a Recreational Aviation Australia licence and had approximately 700 hours experience as pilot in command.

The pilot of J5340 prefaced each broadcast with 'Jabiru 53-40' and the pilot of J1 also prefaced each broadcast with Jabiru and the aircraft registration number. The pilot of J1 reported that he read out each digit of the registration to make a clearer distinction between the two Jabiru aircraft.

Figure 1: Latrobe Valley Airport showing approximate aircraft tracks



Source: Google earth – annotated by the ATSB

ATSB comment

The CTAF at Latrobe Valley was not recorded, and the ATSB was unable to verify any of the reported transmissions. The pilots of both Jabiru aircraft reported hearing each other's broadcasts as stated. The ATSB obtained radar data, however none of the aircraft operating in the area at the time were visible. The operator of EOT provided recorded flight data of the aircraft track.

Safety message

Pilots operating under the visual flight rules are required to maintain vigilance so as to see and avoid other aircraft. Civil Aviation Advisory Publication (CAAP) 166-2(1), stated:

> *Lookout is the principal method for implementing see-and-avoid. Effective lookout means seeing what is 'out there' and assessing the information that is received before making an appropriate decision.*

Broadcasting on the CTAF is known as radio-alerted see-and-avoid, and assists by supporting a pilot's visual lookout for traffic. An alerted search is more likely to be successful as knowing where to look greatly increases the chances of sighting traffic.

Following a broadcast, it is important for other pilots in the vicinity to ensure they have the aircraft sighted. Issues associated with unalerted see-and-avoid have been detailed in the ATSB research report *Limitations of the See-and-Avoid Principle*.

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

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

The ATSB investigated a mid-air collision at Latrobe Valley Airport on 1 December 2007, AO-2007-065, in which a Cessna 172 collided with an Avid aircraft on final approach to runway 09.

General details

Occurrence details

Date and time:	6 September 2015 – 1545 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	Latrobe Valley Airport, Victoria	
	Latitude: 38° 12.43' S	Longitude: 146° 28.22' E

Aircraft details: VH-EOT

Manufacturer and model:	Cessna Aircraft Company, 172S	
Registration:	VH-EOT	
Serial number:	172S10317	
Type of operation:	Flying training	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Aircraft details: 24-5340

Manufacturer and model:	Jabiru Aircraft J120-C	
Registration:	24-5340	
Serial number:	004	
Type of operation:	Private – Pleasure/Travel	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Collision with terrain involving a Cirrus SR22, VH-OPX

What happened

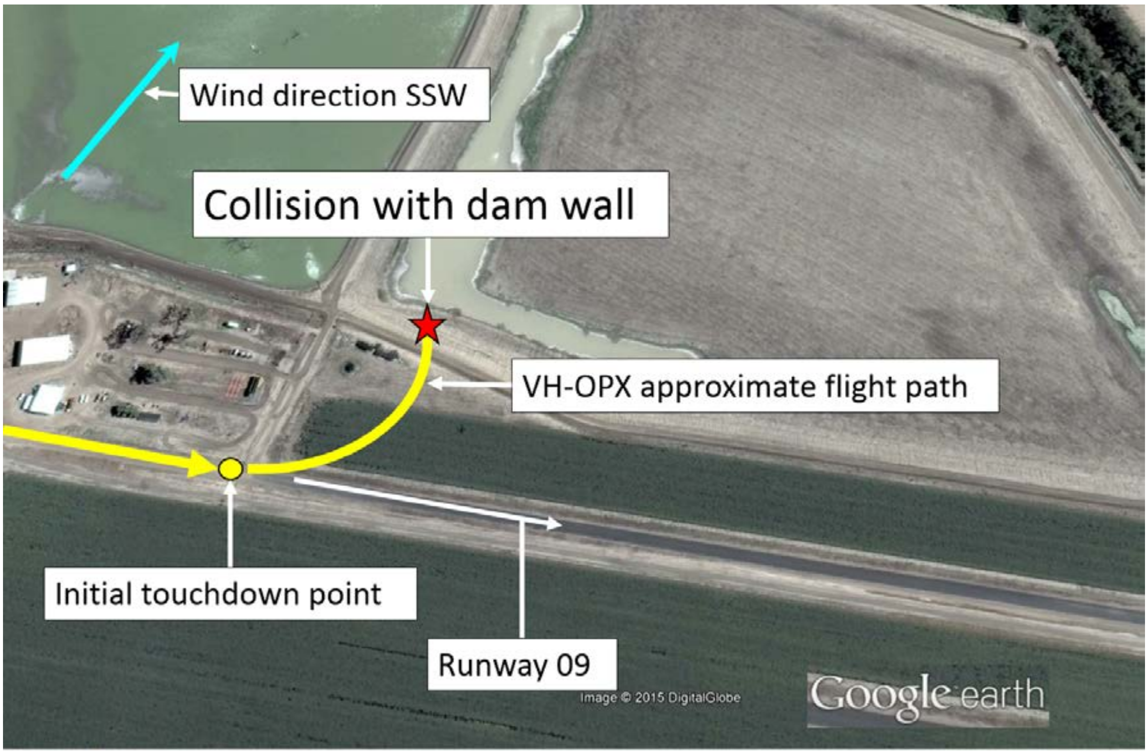
On 17 September 2015, at about 1330 Eastern Standard Time (EST), the pilot of a Cirrus SR22 aircraft, registered VH-OPX (OPX), conducted a short flight from Moree Airport, New South Wales, to a private airstrip about 6 NM to the north. The pilot was the sole occupant of the aircraft.

The aircraft approached the airstrip from the south, and the pilot elected to overfly the runway at the eastern end, then turn left and join the circuit on a left downwind for runway 09. The pilot had observed the wind at Moree Airport to be from a southerly direction at about 15 kt, and therefore anticipated having a crosswind for the landing at the airstrip.

The pilot reported that the circuit and approach were normal. On final approach, the pilot extended full flap, and commenced the flare at an airspeed of about 80-90 kt. To align the aircraft with the runway, the pilot reported applying almost full left rudder and right aileron due to the crosswind.

The right main landing gear touched down first, and the aircraft bounced back into the air. The pilot immediately applied full power to initiate a go-around. However, the left wing dropped and the aircraft yawed to the left. The aircraft's left wing and propeller then collided with a dam wall (Figure 1). The aircraft stopped abruptly and spun around. The engine separated from the aircraft and came to rest about 20 m away, the tail broke off and the nose landing gear collapsed. The pilot suffered minor injuries, and the aircraft sustained substantial damage (Figure 2).

Figure 1: Accident site



Source: Google earth – annotated by the ATSB

Figure 2: Damage to VH-OPX

Source: NSW Police Force

Pilot experience

The pilot held a private pilot licence and had about 1,400 hours of aviation experience, with 80 hours experience in the Cirrus aircraft. The pilot had not flown into that airstrip before the accident flight.

Airstrip information

Prior to conducting the flight to the private airstrip, the pilot contacted the owner and obtained information about the runway condition.

The runway was about 850 m long – unsealed for about 150 m at the western end, then sealed with bitumen for about 700 m. The runway was situated east-west, and the pilot elected to land towards the east. The aircraft initially touched down on the dirt, just prior to the start of the sealed part of the runway, which was slightly beyond where the pilot anticipated it to land.

As the aircraft overflew the runway, the pilot looked for, but did not see, a windsock by which to verify the conditions at the airstrip. The owner of the airstrip reported that there were three windsocks located at various positions near the runway.

Wind

The Bureau of Meteorology provided the ATSB with the wind recorded at Moree Airport. Table 1 depicts the calculated downwind and crosswind components based on the runway direction of 090° magnetic (101° true) of the airstrip 6 NM north of Moree. As seen in the table, at 1334, a significant wind gust of 22 kt from 242°, would have equated to a downwind component of 17 kt and a crosswind of 15 kt. If the aircraft had encountered similar conditions during the landing, this may have affected the pilot’s ability to control the aircraft.

Table 1: Wind direction, speed, gusts and calculated downwind and crosswind components

Time (EST)	Wind direction degrees true	Wind speed (over 1 minute) knots	Maximum wind gust (over 1 minute) knots	Crosswind component speed/gust knots		Downwind component speed/gust knots	
1330	206	16	18	15	17	4	5
1331	200	16	21	16	21	3	3
1332	213	16	17	15	16	6	6
1333	218	15	17	13	15	7	8
1334	242	19	22	12	14	15	17
1335	234	19	22	14	16	13	15
1336	211	20	22	19	21	7	8
1337	209	18	20	17	19	6	6
1338	201	18	20	18	20	3	3
1339	201	17	19	17	19	3	3
1340	216	15	17	14	15	6	7

Safety message

This incident highlights the importance of the identification and management of risks associated with operating into unfamiliar airfields. Pilots should carefully assess the environmental conditions, runway surface and surrounds before attempting to land at an airfield.

The Civil Aviation Safety Authority *Out-N-Back* video Aircraft landing areas and precautionary search and landing, stated: 'A precautionary inspection of an unfamiliar airstrip before landing is a logical and effective way to satisfy yourself that you have chosen a suitable landing area for your aircraft, and for your skill level'. This airborne inspection includes assessing the wind velocity and direction, and whether any terrain surrounding the field may affect a go-around.

General details

Occurrence details

Date and time:	17 September 2015 – 1338 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	near Moree, New South Wales	
	Latitude: 29° 24.32' S	Longitude: 149° 53.50' E

Aircraft details

Manufacturer and model:	Cirrus Design Corporation SR22	
Registration:	VH-OPX	
Serial number:	2509	
Type of operation:	Private – Pleasure/Travel	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – 1 Minor	Passengers – Nil
Damage:	Substantial	

Partial power loss and forced landing involving a Cessna 172, VH-FPZ

What happened

Early in the morning on 10 September 2015, the pilot refuelled and prepared a C172 aircraft, registered VH-FPZ, for a private flight departing Carlton Hill Station aircraft landing area (ALA), Western Australia (Figure 1). The pilot, the sole person on board, had planned a routine flight around the station to check stock water supplies. After conducting the before take-off checks, the pilot taxied the aircraft from the hangar to the threshold of runway 12, just before 0550 Western Standard Time (WST).

Figure 1: Location of Carlton Hill ALA

Source: Google earth annotated by the ATSB

The pilot configured the aircraft with 10° flap, and commenced the take-off run in good weather conditions, with a head wind of about 10 kt and a temperature of about 18°C. The aircraft reportedly accelerated normally, with lift-off occurring at around 65-70 kt. As per normal, the pilot allowed the aircraft to accelerate toward the cruise climb speed of about 75-80 kt prior to establishing it in the climb.

At about 150-200 ft above the ground, the aircraft performance rapidly deteriorated. The pilot reported that the revolutions per minute (RPM) dropped from about 2,700 rpm to about 2,000 rpm, and the engine was making an abnormal mechanical sound. The pilot immediately checked the fuel and mixture control settings and applied carburettor heat. However, the aircraft was not able to maintain altitude. With the pilot unable to determine the cause of the partial engine failure, they prepared for a forced landing.

With limited time and options available, the pilot selected a space between trees at the end of the runway to land. They then turned off the fuel, pulled the mixture control to idle cut off, and selected full flap. In the seconds remaining, the pilot steered the aircraft between trees to keep the cabin intact. The wings struck the trees, resulting in the outboard section of the left wing breaking off.

The aircraft travelled a further 20 m, before coming to rest (Figure 2). The pilot, who was not injured, was able to exit via the passenger door. The aircraft was substantially damaged (Figure 3).

Figure 2: VH-FPZ after the forced landing with part of the left wing in the foreground

Source: Pilot

Figure 3: VH-FPZ damage. Note the substantial damage to the left wing and tree impact on right wing

Source: Pilot

Pilot experience and comments

The pilot held a Private Pilot's Licence (Aeroplane) and had a total of about 518 hours at the time of the accident. VH-FPZ was the dedicated aircraft for Carlton Hill station, and the pilot had been flying it since the start of 2015, with about 150 hours on the aircraft.

The pilot reported that everything appeared routine and there were no abnormalities with the aircraft during the pre-take-off engine and instrumentation checks.

The pilot commented that the engine malfunction was unexpected and the event unfolded very quickly.

The aircraft, VH-FPZ

The pilot reported that there were no outstanding defects on the maintenance release and that the aircraft had completed all scheduled maintenance. In the time the pilot had been operating this aircraft, it had had one previous instance of degraded performance. However, in that instance, a post flight engineering inspection was unable to determine a cause.

Weather

The two aerodrome weather reports (METAR) obtained from the Bureau of Meteorology for nearby Kununurra Airport (approximately 20 NM to the south-east of Carlton Hill ALA) did not indicate conditions suitable for carburettor icing.

Post-accident inspection

While a full engine examination has not yet been completed, an examination by a Licenced Aircraft Maintenance Engineer found that the left magneto had failed. This most likely contributed to the aircraft's deteriorated performance.

Safety message

Simulated total loss of power and a subsequent practice forced landing is at the core of a pilot's emergency training. However, data shows that for light single engine aircraft a partial power loss is three times more likely to occur than a complete engine failure.

Confronted with minimal options at low altitude, the pilot in this occurrence had to make important decisions in a short space of time. The ATSB's publication and You Tube video "Managing partial power loss after take-off in single-engine aircraft" is available on the ATSB website. This information highlights the importance of pre-flight decision making and planning, for emergencies and abnormal situations, for each particular aerodrome.

General details

Occurrence details

Date and time:	10 September, 2015 at 0550 WST	
Occurrence category:	Accident	
Primary occurrence type:	Partial power loss	
Location:	Carlton Hill ALA, Western Australia	
	Latitude: 15° 28.83' S	Longitude: 128° 32.38' E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company C172N	
Registration:	VH-FPZ	
Serial number:	17273069	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – N/A
Damage:	Substantial	

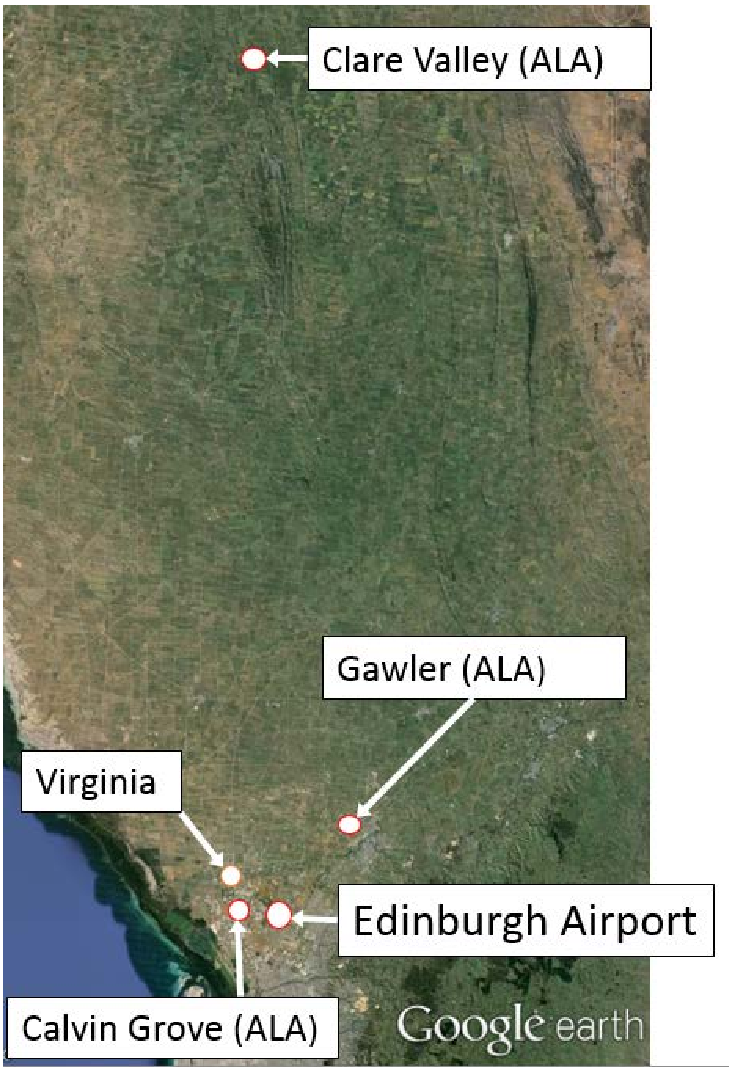
Helicopters

Near collision involving a Schweizer 269, VH-JXO, and a Military Lockheed AP-3C

What happened

On 31 August 2015, the pilot, and sole occupant, of a Schweizer 269C helicopter, registered VH-JXO (JXO), was conducting aerial spraying in the Edinburgh area, South Australia, and operating under the visual flight rules (VFR). The helicopter departed from Calvin Grove aeroplane landing area (ALA) at about midday Central Standard Time (CST), and the pilot obtained a clearance from Edinburgh Airport air traffic control (ATC) to track to Virginia (Figure 1). The pilot conducted spraying operations in that area, and then requested and obtained a clearance to track to an area south of Gawler. The operations included regular take-offs and landings to refuel and reload with chemical. The pilot continued spraying operations about 3.5 NM southeast of Gawler aeroplane landing area (ALA), which was outside the Edinburgh control zone, below the 1,500 ft lower limit of restricted airspace, and therefore in Class G airspace.

Figure 1: Locations relevant to VH-JXO

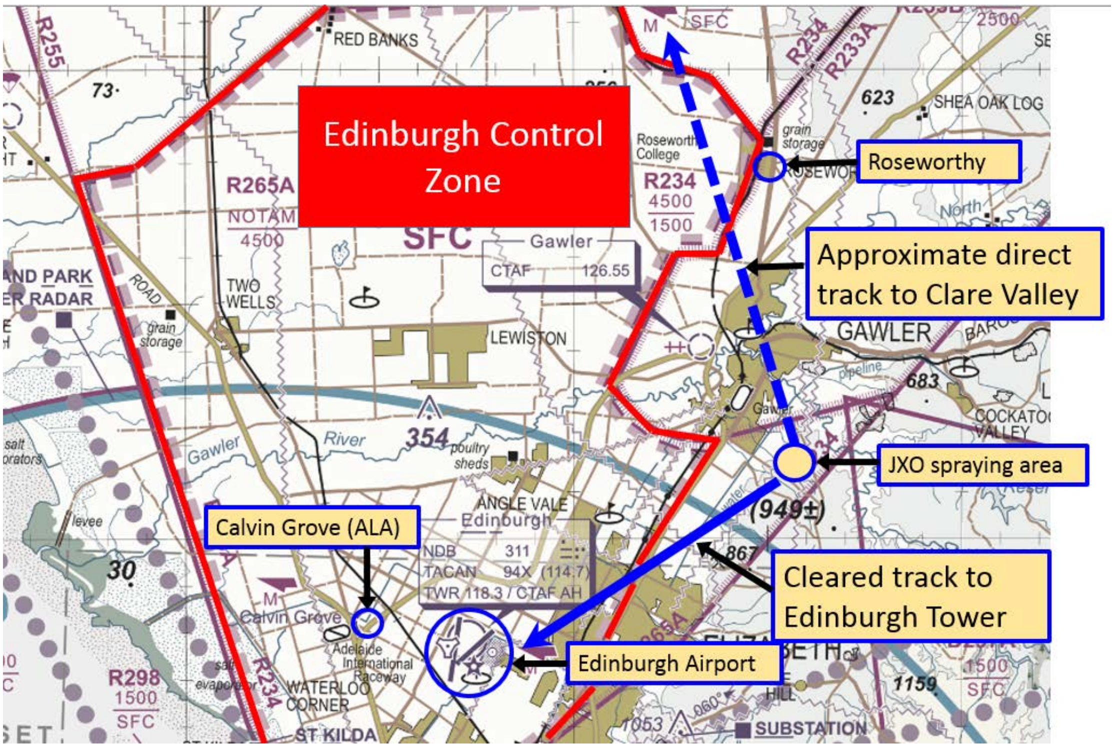


Source: Google earth – annotated by the ATSB

At about 1503 CST, a Military Lockheed AP-3C aircraft (Orion) was about 15 NM northeast of Edinburgh, at 6,500 ft, tracking for the runway 18 instrument landing system (ILS) –Y approach to Edinburgh Airport. The Orion, with 5 crewmembers and 14 passengers on board, had departed about 10 hours earlier on an international flight bound for Edinburgh, and was operating under the instrument flight rules (IFR).[1] The weather conditions at Edinburgh at the time, included no cloud below 5,000 ft and visibility greater than 10 km.

At about 1504, the pilot of JXO called Edinburgh Tower air traffic control, and requested a clearance to track to 'Clare' (Clare Valley), South Australia. In order to track direct to Clare Valley, which was about 45 NM to the north-northwest, the pilot needed a clearance through a corner of the Edinburgh control zone (Figure 2).

Figure 2: Operating area of JXO, Edinburgh Control Zone and relative tracks



Source: Airservices Australia – annotated by the ATSB

The tower (TWR) controller 1, mistook the pilot's request to 'Clare' for 'Calvin Grove', and cleared the pilot of JXO to track direct to Edinburgh Tower, not above 1,000 ft in order to be able to visually separate the helicopter with the arriving Orion and another aircraft conducting circuit operations at the airfield. The pilot complied with the instruction, even though this was not the direction requested, nor the clearance expected. However, being new to the area and concerned about the direction of the clearance, the pilot attempted, unsuccessfully, to contact their company via UHF radio to ask for advice.

At about 1506, the TWR controller 1 completed their shift and conducted a handover to tower (TWR) controller 2. The TWR controller 1 advised TWR controller 2 of JXO, tracking to the tower then for Calvin Grove, and stating that they planned to track JXO 'over the top' (of the airfield) to separate with the Orion and could hold JXO if necessary, depending on the requirements of the aircraft conducting circuits. About 2 minutes later, the crew of the Orion reported established on the ILS.

1 In accordance with the Manual of Air Traffic Services (MATS) para. 2.4.2.2, air traffic control is responsible for providing separation between IFR and VFR aircraft.

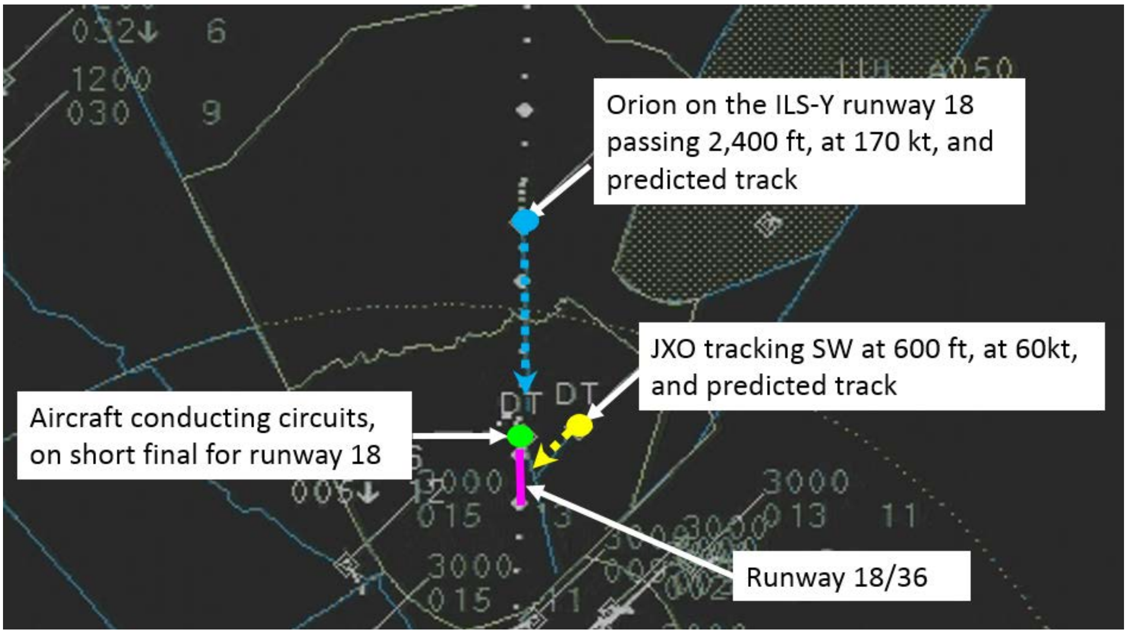
At about 1509, when about 5 NM from the tower, the pilot of JXO reported the helicopter's position to the tower controller, hoping to prompt the controller for a clearance towards Clare Valley, but the TWR controller 2 directed the pilot to continue tracking direct to the control tower. The pilot then again attempted to contact their company via UHF radio to seek guidance on Edinburgh operations.

About 1 minute later, the TWR controller 2 advised the aircraft conducting circuit operations at Edinburgh of both the Orion, then at 12 miles on the ILS, and JXO, as traffic, stating that JXO was for Calvin Grove. During that transmission, the pilot of JXO was trying to communicate on UHF radio and did not assimilate the information about the Orion. Soon after that transmission, the flight crew of the Orion, which was then at 9 NM, advised they were on the ILS-Y passing 3,200 ft[2] on descent.

The circuit aircraft then turned onto base leg for runway 18, was cleared for a touch-and-go, and advised they had the (Orion) aircraft in sight.

At about 1512, the Orion was passing 2,400 ft, on a 6.5 NM final and travelling at 170 kt. JXO was at 600 ft and travelling at 60 kt (Figure 3). Based on the expected tracking of the three aircraft, the TWR controller 2 assessed that JXO would safely cross the runway centreline in front of the Orion, and behind the aircraft conducting circuits (then on a short final). Consequently, the TWR controller 2 cleared JXO to track to Calvin Grove. The pilot heard the call and responded, but the radio was still selected to transmit on UHF not VHF, so the controller did not receive a response. The pilot was flustered and expecting an onwards clearance to Clare Valley, consequently had turned right to track northwards to Clare Valley.

Figure 3: Aircraft positions when JXO was cleared to Calvin Grove (time 1512)



Source: Department of Defence – annotated by the ATSB

Having not received a response, the TWR controller 2 repeated the call to JXO, and again did not receive a response. The TWR controller 2 then made two more attempts to communicate with the pilot of JXO, including requesting a 'radio check', without receiving a response. The pilot of JXO could hear the calls and eventually realised they had the incorrect radio selected to transmit.

2 All altitudes in the report are in feet above mean sea level (AMSL). Edinburgh Airport elevation is 67 ft AMSL. The radar display shows altitude to the nearest 100 ft.

While attempting to establish communications with JXO, the TWR controller 2 monitored JXO's tracking using binoculars. About the time of the radio check, JXO appeared to turn right, then fluctuate between north-westerly and westerly headings. Due to the small size of JXO and its distance from the tower, its exact tracking was difficult to determine visually. Furthermore, the tower radar situation data display (SDD) did not provide a true representation of the helicopter's tracking, due to its slow speed. The SDD did indicate that JXO had tracked further north than cleared, which increased the closure rate between the helicopter and the Orion.

At about 1513, the pilot of the Orion reported at the outer marker on the ILS (4.2 NM from the runway threshold), and the TWR controller 2 cleared the Orion to land (Figure 4). JXO was then tracking north-northwest, about 3 NM from the Orion, and converging. The TWR controller 2 was then apprehensive about JXO's tracking. Although the crew of the Orion had heard the controller's attempts to contact JXO, as the controller had not provided them with directed traffic information, they were unaware of JXO's position, and assumed it was not a consideration for their tracking.

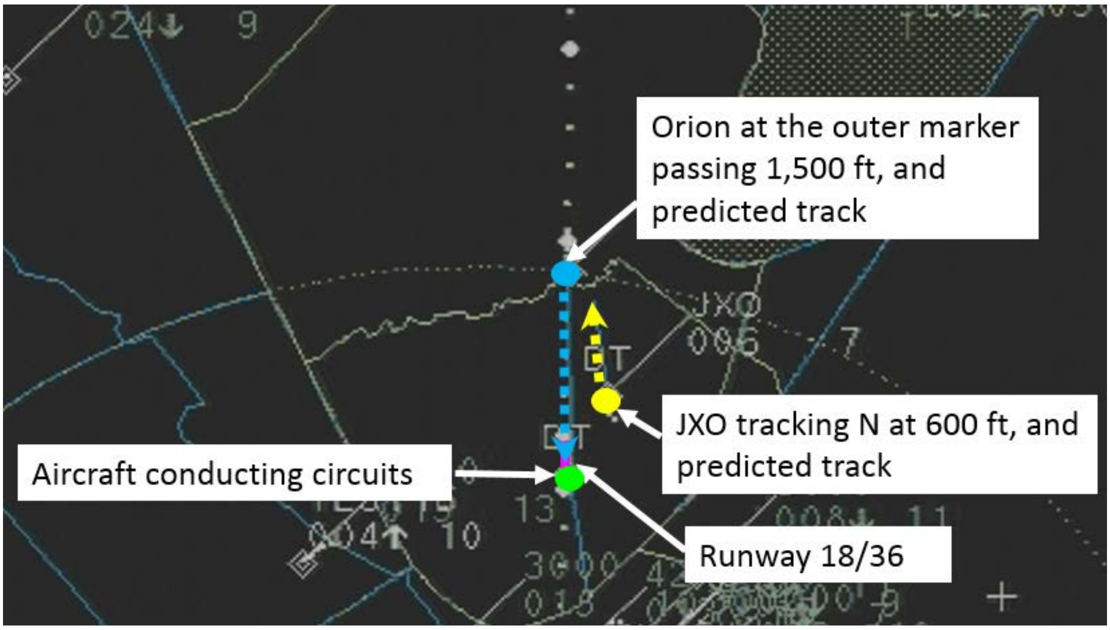
Separation Standards

According to the Manual of Air Traffic Services (MATS), separation is the concept of ensuring aircraft maintain a prescribed minimum from another aircraft (or object), while meeting the associated conditions, and requirements of the standard. A separation standard is a prescribed means to ensure separation between aircraft using longitudinal, lateral, vertical and visual standards.

Use of the Situation Data Display

Edinburgh Tower controllers did not hold approach endorsements and therefore were not able to use the radar situation data display (SDD) to vector aircraft to achieve separation. The controllers were required to achieve separation through the issue of tracking instructions, level assignment or through visual observation. The radar SDD could be used to monitor separation and achieve situational awareness.

Figure 4: Orion at the outer marker (time 1513)



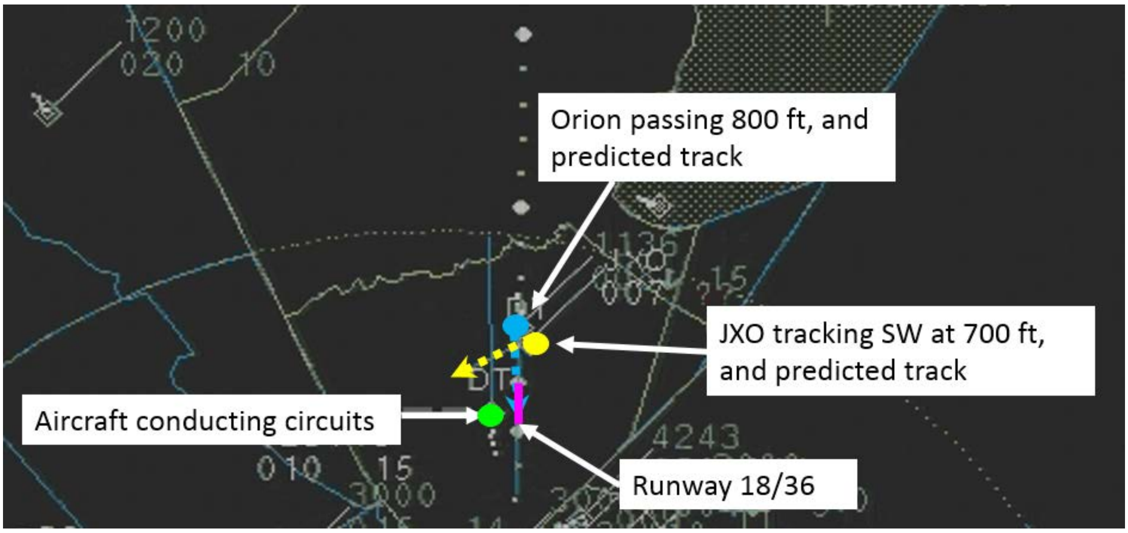
Source: Department of Defence – annotated by the ATSB

The TWR controller 2 then conducted another radio check with the pilot of JXO in an attempt to re-establish communications. The Orion and JXO were about 1.5 NM apart, and their flight paths were merging. On the radar SDD, JXO was indicating about 700 ft and the Orion was passing 1,100 ft on descent. The TWR controller 2 then conducted another radio check using an alternative handset, to ascertain whether the communications issue may be due to ATC equipment.

The pilot of JXO responded, apologised, advised they had the radio selected to an incorrect frequency, and that they had requested a clearance to track to Clare Valley, not Calvin Grove. During that transmission, the distance between JXO and the Orion reduced to about 1 NM laterally, and 200 ft vertically.

Immediately following the pilot of JXO's response, the TWR controller 2 asked whether the pilot had the 'P3' (Orion) in sight, advising that it was then in the pilot's 1 o'clock[3] position at about 2 miles. The pilot queried the aircraft type, and the TWR controller 2 advised that the 'P3 Orion' was now at about 1 mile in the pilot's 2 o'clock position. The pilot was initially unable to sight the Orion, as it was below, to the right, and behind the helicopter, and therefore not in the pilot's 1 or 2 o'clock position (Figure 5). The pilot then saw the Orion's shadow on the ground and sighted the Orion. The pilot of JXO responded having the aircraft in sight, and the TWR controller 2 directed the pilot to pass behind that aircraft.

Figure 5: Relative positions when ATC advised JXO of the Orion (time 1514)

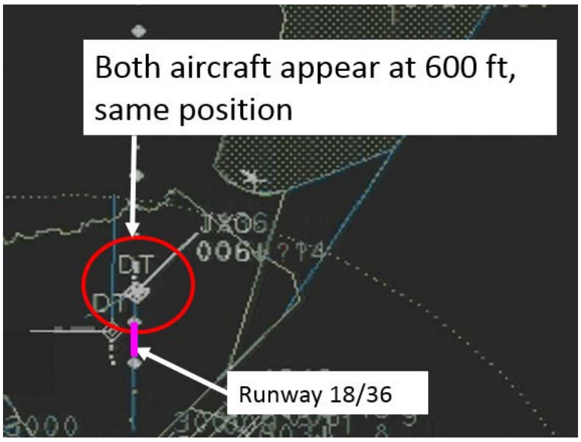


Source: Department of Defence – annotated by the ATSB

By the time the controller completed that transmission, JXO had passed overhead the Orion. On sighting the Orion, the pilot of JXO had immediately initiated a climb to avoid a collision, and estimated the Orion passed about 100 ft below. On hearing the controller pass the Orion as traffic to the pilot of JXO, the Orion crew immediately became concerned about the helicopter's proximity, and looked for it. The co-pilot (non-flying pilot) of the Orion sighted JXO, assessed there was a risk of collision, and called 'go low, go low, go low'. The captain (flying pilot), also sighted JXO, and increased the rate of descent to pass beneath the helicopter. The Orion crew estimated that JXO passed about 50 ft directly above the Orion, and were concerned it may collide with the Orion's vertical tail fin. On the radar SDD, at 1514:25, both aircraft appear in the same position at 600 ft (Figure 6).

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

Figure 6: Aircraft collocated on radar SDD



Source: Department of Defence – annotated by the ATSB

The Orion landed without further incident on runway 18. The pilot of JXO was subsequently cleared to depart the Edinburgh control zone tracking to Clare Valley.

Pilot comments

The pilot of JXO provided the following comments:

- The pilot could have tracked around the restricted airspace towards Clare Valley, by going via Roseworthy. The pilot was new to the area, unsure of the local landmarks, and therefore requested a clearance to track direct.
- The pilot was nervous about operating in military controlled airspace and therefore did not question the clearance to track towards the Tower, even though it was not where they wanted to go. The pilot reported feeling 'a bit rattled'.
- The pilot had selected Clare Valley on the GPS, and was unsure exactly where Calvin Grove was from their current position. If JXO had tracked to Calvin Grove, it would have remained clear of the aircraft approaching runway 18.

Department of Defence investigation

The Department of Defence conducted an investigation and made a number of findings. Some of those findings are detailed here.

Initial airways clearance issued to JXO

The TWR controller 1 interpreted JXO's destination as Calvin Grove. Two hours prior to the incident, the TWR controller 1 had processed JXO from Calvin Grove, thereby associating JXO with Calvin Grove. Additionally, JXO could have tracked from their location near Gawler to Clare, with only a small deviation east of Roseworthy to remain clear of the restricted airspace (see Figure 1). Therefore, the controller would not have expected a request of an airways clearance to Clare from JXO.

Communications issue

The TWR controller 2 made six attempts to re-establish two-way communications with the pilot of JXO over a period of 92 seconds. The loss of two-way communications was due to the pilot transmitting on an alternative frequency.

The loss of two-way communications with JXO meant that the TWR controller 2 was unable to pass instructions to the pilot to sight, and maintain separation with, the Orion. The attempts of the pilot of JXO to communicate with their company on UHF radio also diminished the pilot's ability to maintain situational awareness of other traffic within the control zone from the radio calls of the circuit aircraft, the Orion crew, and the controller.

The combination of communication difficulties and clearance towards an incorrect destination, led to the pilot of JXO becoming flustered. The pilot therefore turned towards Clare instead of the cleared destination of Calvin Grove. Shortly before returning to Tower frequency, the pilot realised the last clearance issued was to Calvin Grove, and turned onto a westerly heading, thereby converging with the Orion.

Visual separation

The TWR controller 2 assessed that sufficient time and distance existed for JXO (tracking for Calvin Grove) to cross final ahead of the Orion while maintaining the visual separation standard. However, the disparate sizes and speeds of the Orion and JXO, combined with their relative positions and distance from the control tower, made it difficult to maintain separation by visual observation.

> ***Visual separation (MATS)***
>
> *Separation may be reduced in the vicinity of aerodromes when adequate separation can be provided using visual observation and each aircraft is continuously visible to the aerodrome controller.*

After the Orion crew reported at the outer marker, it became apparent to the controller that visual separation would be lost. However, due to the proximity and relative tracks of the helicopter and the Orion, it was then impossible to introduce an alternative separation standard such as vertical displacement[4] or assigning separation responsibility to the pilot.

Compromised separation recovery

In accordance with the Manual of Air Traffic Services (MATS), the Orion had a higher priority because it was operating under IFR flight rules. This influenced the TWR controller 2's decision to allow the Orion to continue the ILS-Y approach, while attempting to communicate with JXO. However, MATS also required controllers not to compromise safety in order to meet the priorities.

The TWR controller 2 did not pass traffic information on JXO to the crew of the Orion, as the controller did not intend to assign responsibility for separation to them. The controller intended for the pilot of JXO to sight the Orion and accept responsibility for separation. Passing traffic information to the smaller aircraft on the larger aircraft conformed to the compromised separation recovery techniques taught to the controller.

The combination of incorrect application of visual separation, ATC priorities, and the decision not to amend the Orion's tracking, led to a loss of separation between the Orion and JXO, including a loss of wake turbulence separation.

The TWR controller 2 assessed that instructing the Orion to go around from the approach would not solve the confliction, as the aircraft may not achieve sufficient climb performance to overfly JXO. The controller also assessed that the Orion crew may not safely have been able to conduct a hard right turn as the aircraft was in the landing configuration and at a critical stage of flight. The Orion flight crew later advised that a right turn manoeuvre to avoid the confliction would have been within the capabilities of the aircraft.

The TWR controller 2 did not issue a safety alert. The controller reported that they were about to issue a safety alert to the Orion crew, when the pilot of JXO returned to the Tower frequency, and made a transmission that lasted 10 seconds. At that time, the aircraft were 1.2 NM apart laterally, and 400 ft vertically. A safety alert issued at that time may have allowed the Orion crew to increase the vertical separation between the aircraft. If the controller had issued a safety alert earlier, it would have increased both lateral and vertical distances between them.

The clock positions provided to the pilot of JXO were incorrect and delayed the pilot's ability to sight the Orion. The preferred compromised separation recovery technique is to provide a bearing and distance of the other aircraft to the pilot, which was available from the radar SDD.

4 The minimum vertical separation required at that time, would have been 1,000 ft.

Traffic collision avoidance system

The Orion is fitted with a traffic collision avoidance system (TCAS). In accordance with standard operating procedures, the crew of the Orion had selected low sensitivity mode on the TCAS when established on the ILS, and prior to contacting Edinburgh Tower. This mode provides no audible alert to the aircrew of potentially conflicting traffic. The captain and the co-pilot both observed the circuit aircraft on the TCAS display indicating that the system was functioning normally, but JXO did not appear. While JXO had a functioning transponder, the reason that it was not being displayed on the Orion’s TCAS could not be determined.

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.

Department of Defence

As a result of this occurrence, the Department of Defence advised the ATSB that they are taking a number of safety actions. These include the following:

Compromised separation recovery training

The Department of Defence has released a Standing Instruction that mandates annual compromised separation recovery training for all air traffic controllers.

Controller briefing

All controllers will be briefed on the events and findings of the incident as an element of compromised separation recovery training.

Tower simulation capability

Tower simulation capability is being introduced to enhance compromised separation recovery training.

Additionally, simulation will be used to:

- compensate for low traffic levels and to facilitate controller attainment and retention of skills associated with processing complex traffic scenarios
- compensate for low traffic levels and to facilitate controller attainment and retention of skills associated with application of ATC priorities
- assess controller proficiency when live traffic levels are below that required to judge controllers’ abilities to process complex traffic scenarios
- provide controllers with regular exposure to compromised separation recovery scenarios, to improve decision making and ensure the associated actions become instinctive.

Airspace procedure briefings

The Edinburgh controllers will provide airspace procedure briefings to pilots who conduct airwork within and around Edinburgh airspace. The Airservices Australia Aeronautical Information Publication (AIP) En Route Supplement Australia (ERSA) entry for Edinburgh will be amended to include a section detailing the requirements for pilots of civil aircraft intending to conduct airwork within, or near, the Edinburgh control zone, to have airspace briefing.

Safety message

This incident highlights the importance of communication, and demonstrates the potential consequences of a loss of communication. Whether pilots are communicating with each other, or with air traffic control, it is essential to understand what is being said and how that potentially affects them. In particular, if an instruction from air traffic control is not as expected, pilots should request clarification.

For controllers, having tactical separation assurance in place reduces the likelihood of a loss of separation, particularly in the event of communications failure.

Compromised separation recovery is a critical skill for air traffic controllers, which needs to be practiced often and in sufficiently complex scenarios to be applicable and implemented when necessary.

The Australian Transport Safety Bureau (ATSB) research report AR-2012-032 titled *Loss of separation between aircraft in Australian airspace January 2008 to June 2012* found that aircraft separation is a complex operation with many levels of defences to avoid errors and safely manage the results of errors made by air traffic controllers and pilots.

General details

Occurrence details

Date and time:	31 August 2015 – 1550 CST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	Edinburgh Airport, South Australia	
	Latitude: 34° 42.15' S	Longitude: 138° 37.25' E

Aircraft details: Lockheed AP-3C

Manufacturer and model:	Lockheed Martin Corporation AP-3C Orion	
Registration:	Unknown	
Operator:	Royal Australian Air Force	
Serial number:	Unknown	
Type of operation:	Military	
Persons on board:	Crew – 5	Passengers – 14
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Helicopter details: VH-JXO

Manufacturer and model:	Schweizer Aircraft Corporation 269C-1	
Registration:	VH-JXO	
Serial number:	0352	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Loss of control involving a Robinson R44 helicopter, VH-ZWA

What happened

VH-ZWA on right side

Source: Operator

Late in the afternoon of 7 October 2015, a pilot prepared the Robinson 44 helicopter, registered VH-ZWA (ZWA), for a solo training flight. The local flight from Darwin Airport, Northern Territory, was to consolidate the pilot's knowledge of the local area, and become more familiar with the helicopter, as it was the pilot's first day in a new job. Earlier in the day, the chief pilot had conducted an acceptance flight with the pilot in ZWA.

The pilot refuelled the helicopter and conducted a pre-flight inspection, before boarding, and completing the pre-start checklist.

The pilot then conducted the following engine start checklist from memory.

Engine start (main actions)

- engaged the starter until it fired
- engaged the clutch and turned the alternator on
- when the clutch light went out, increased the rotor RPM to 79%
- conducted a magneto check; and noted that all warning lights were out
- began to increase the rotor RPM toward 100% and turned the governor on

Just as the pilot was about to conduct the next checklist item, a low rotor horn check[1], the pilot reported that the helicopter yawed slightly to the left. The pilot quickly checked that the pedals were neutral and put some 'weight' on the collective to confirm that it was fully down.

However, the helicopter continued to yaw left rapidly, through about 90° (Figure 1). The pilot applied full right pedal but the helicopter did not respond and continued the yaw, through about 180°, before falling onto its right side. The pilot, who sustained minor injuries, quickly exited the helicopter and the helicopter was substantially damaged (Figure 2).

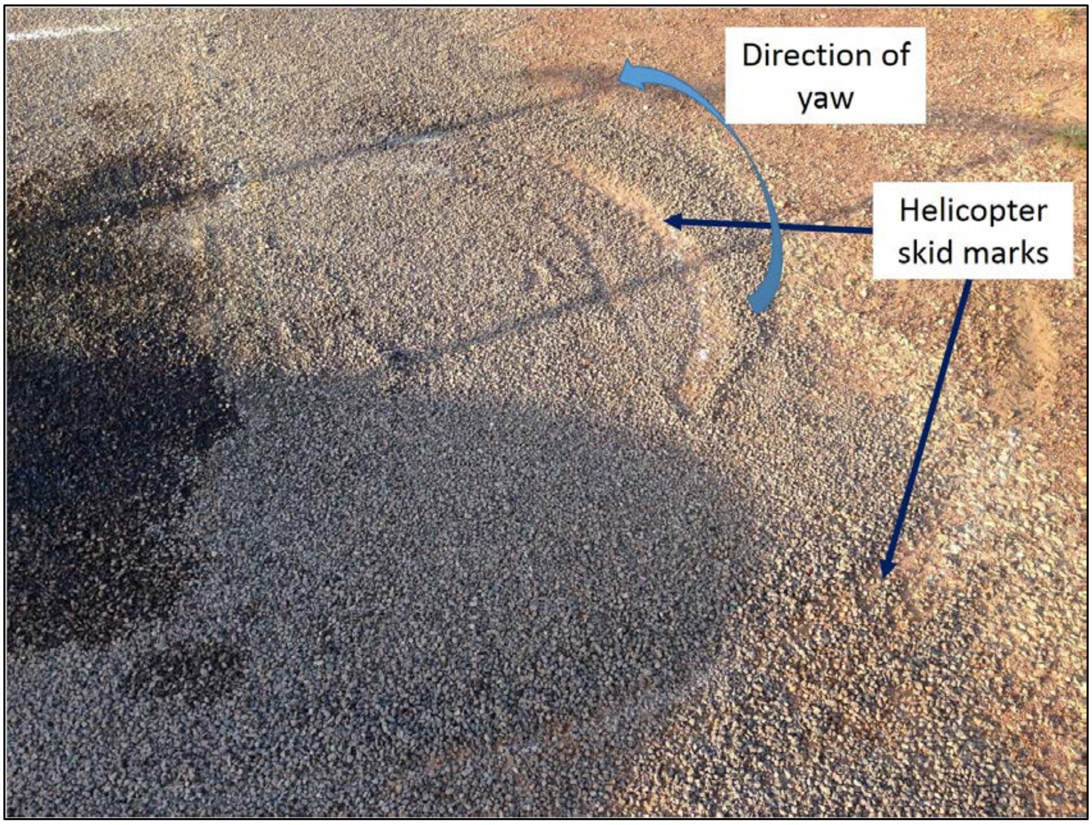
Pilot experience

The pilot held a Commercial Pilot Licence (H) and a Private Pilot Licence (A). The pilot had logged about 340 hours in helicopters, with about 16 hours of these in the Robinson R44 and about 15 hours in the Robinson R22 helicopter.

Apart from the acceptance flight earlier that day, and a check flight a couple of weeks earlier, the pilot had not flown a R44 for more than three years. The pilot's most recent helicopter experience was in a MD 520N helicopter. Although the pilot had flown two separate one-hour flights in the last three weeks, the pilot stated they were not current nor experienced on the R44. The pilot reported that flying opportunities had been limited, and spread out over about 4-5 years. During this time, the pilot had also worked as a helicopter support person and as a teacher of commercial helicopter theory subjects.

1 This check requires a slight lift of the collective and a slight reduction in RPM. The warning horn/ light should occur at 97% RPM

Figure 1: Skid marks made by VH-ZWA yawing to the left



Source: Operator

Figure 2: VH-ZWA on right side showing damage to main rotor and cabin

Source: Operator

Pilot comments

The pilot arrived from interstate at 0100 on the morning of the accident, ready to start the new job. They signed on for duty at 1000 after 7 hours of sleep. After completing some paperwork, the pilot underwent a one-hour company acceptance flight with the chief pilot. This flight was conducted in ZWA.

After a lunch break, more paperwork was completed before the chief pilot suggested the pilot go for a solo flight, to consolidate their knowledge of the local area and become more comfortable with the R44. The pilot reported feeling a little uncomfortable conducting the solo, but reasoned that it would be a good opportunity to gain some more practice. In addition, the pilot stated being slightly fatigued, and affected by the extra pressure of ‘new employee expectations’.

The pilot made a number of comments regarding different factors of the occurrence, these included:

- at the time of the accident, not understanding why the helicopter turned to the left, or yawed so rapidly, particularly after full right pedal had been applied. The pilot later reflected that the pedals must not have been as neutral, as first thought and that this had allowed the yaw leading to the resultant loss of control
- suggesting the left yaw may have been from the collective lock being jammed under the collective just enough for the control to feel fully down, but actually have sufficient play to allow the yawing movement.
- felt that the helicopter falling onto the right side was consistent with dynamic rollover

Operator comments

The operator acknowledged that the new pilot had low total flying hours and low time on the R44 helicopter. This was combined with only 1.9 hours of flying logged in the last 90 days. Although two recent dual checks had been carried out, the additional solo practice was suggested to allow the pilot some consolidation time. In hindsight, the company realised that the pilot required even more dual time prior to being authorised for any solo practice.

A post-accident engineering inspection did not reveal any mechanical defects with ZWA.

ATSB comment

The ATSB did not conduct an onsite investigation to this accident. The pilot reported not being aware of making any errors during the engine start, but noted that a helicopter is unable to move if the collective is fully down.

In researching several databases for like occurrences, the ATSB found a Robinson 44 accident with similarities, in the United Kingdom. In this accident, the helicopter yawed to the left and fell onto the right side during an engine start. The UK Air Accidents Investigation Branch (AAIB) commented that a rapid yaw to the left could be induced, if too much left pedal is applied at the point of governor engagement, due to the effectiveness of the tail rotor.

The fact that the pilot’s most recent helicopter experience was on a MD 520N, also supports this possibility. The MD520N does not have a traditional tail rotor; it is fitted with a NO Tail Rotor (NOTAR) system, and requires very little pilot input on the pedals. It is probable that the pilot defaulted to this more relaxed pedal pressure during the accident flight.

Other R44 accidents, with relatively inexperienced solo pilots at the controls, were attributed to the pilot’s lack of recency, or inexperience, managing the different handling characteristics of the helicopter, due to the weight shift, which occurred without a person occupying the left seat.

Safety action

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

Operator

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

Operations manual amendment

All pilots recruited with under 500 hours total time and / or 30 hours in the previous 90 days, must fly with a Grade 1 instructor. This flight is to assess the pilot's practical and mental status. The Grade 1 instructor is to provide a report on the flight to the Chief Pilot prior to the new pilot undergoing company induction.

General details

Occurrence details

Date and time:	7 October 2015 – 1718 CST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	Darwin Airport, Northern Territory	
	Latitude: 15° 28.83' S	Longitude: 128° 32.38' E

Aircraft details

Manufacturer and model:	Robinson Helicopter Company R44 II
Registration:	VH-ZWA
Serial number:	11752
Type of operation:	Training - solo

Remotely piloted aircraft systems

In-flight break-up involving a DJI S900 remotely piloted aircraft

What happened

On 19 September 2015, the flight controller of a DJI 'Spreading Wings' S900 remotely piloted aircraft (RPA), prepared to conduct aerial photography in Toowoomba, Queensland.

As part of the preparations, the flight controller identified potential hazards associated with the planned operation. The flight was to be conducted over a populated area, and within 3 NM of the Toowoomba aerodrome. The risk assessment included the identification of suitable emergency landing sites for the RPA. The RPA was designed to be capable of flight in the event of one rotor failure, and was also fitted with a parachute. The parachute deploys automatically in certain conditions, and deployment can also be commanded by the flight controller.

DJI Spreading Wings S900

Source: dii.com

The flight controller conducted a daily inspection of the RPA, and found it to be serviceable, including no evidence of damage or cracking to the arms.

Prior to the flight, the flight controller conducted the pre-flight checks and made the appropriate broadcasts on the Toowoomba common traffic advisory frequency (CTAF). The flight controller performed control checks and verified that the controls were working correctly on the ground.

At about 1415 Eastern Standard Time (EST), the flight controller launched the RPA from the rooftop of a nine-storey building. The flight controller again performed control checks, and then commanded the RPA to climb out to the north-northeast. About 30 seconds after becoming airborne, the flight controller heard a loud crack and observed the RPA roll rapidly onto its back. The flight controller commanded the parachute to deploy, but the RPA descended rapidly and collided with the roof of a parked car in the street below.

The RPA was destroyed, the car roof was dented, and no one was injured.

RPA serviceability

The RPA had a total time in service of 10.1 hours prior to the incident flight. Six arm tubes connect the motors to the main frame. The No. 5 arm, constructed of carbon fibre, was fractured, but remained attached to the main frame by the motor cable running through it.

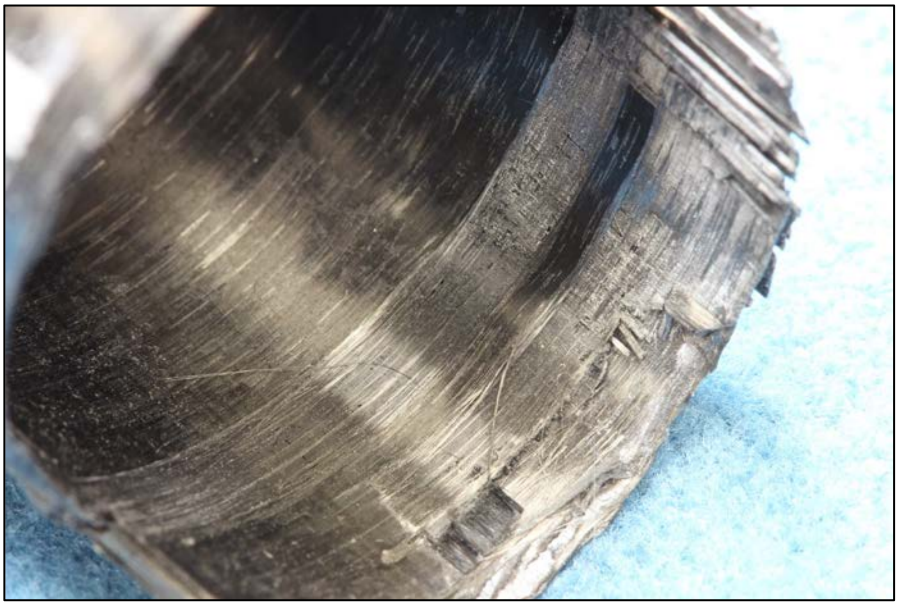
The parachute had deployed and the gas canister used to deploy it was empty, but the parachute did not effectively decelerate the RPA. This was probably due to the RPA being on its back and preventing the parachute from opening properly.

Arm inspection

The ATSB conducted a visual inspection of the fractured arm. The arm was primarily comprised of plies of unidirectional carbon fibre tape. The ply orientation alternated between running parallel to the tube length and 90° to the tube length. The outer layer of the tube was woven carbon fabric with a clear gel coat.

Within the unidirectional plies around the fracture site, there were regions where the carbon fibres were not well consolidated or bonded with the resin matrix. Figure 1 shows some of the loose filaments observed on the innermost layer of the tube.

Figure 1: Innermost layer showing loose filaments



Source: ATSB

Distributor comments

The Australian distributor of the DJI S900 advised that their pre-sales testing included the following.

- During the process of assembly and configuration of the UAV system, all arms were raised and lowered numerous times.
- Upon installation of each arm, each arm was tested individually to ensure correct tension on the arm screws, light horizontal pressure was applied to ensure there is no lateral movement in the arm when it is locked, and to listen for any stress sounds that may emanate from the carbon fibre and/or connecting joints.
- The UAV system was tested to ensure proper and consistent functionality of the system. This included flying ‘full stick’ in all directions, and sudden stops.

Australian Certified UAV Operators Incorporated (ACUO) comments

The ACUO advised that they had no known issues regarding motor arm failures of DJI products.

ATSB comment

The ATSB was unable to determine whether or not pre-existing damage was present from prior operation or transit. However, the ATSB identified regions close to the fracture surface where fibres were not well consolidated within the resin. This may have affected the strength of this arm, possibly resulting in the in-flight failure.

The observed lack of bonding between fibre and resin is a result of manufacturing processes and would not have been caused by damage during transport or operation.

Even under maximum loads, the flight tests performed by the distributor may not necessarily identify defects (such as poor bonding between fibre and resin) within the manufactured carbon fibre tube, regardless of whether or not these defects ultimately result in failure. This is because subsurface cracks can propagate unpredictably in fibre composites. Failure can occur at a later time and even when the arm is experiencing loads below its designed maximum.

Despite this, the ATSB is unaware of any other arm failures on this model RPA, indicating that the design and properties of the arms are probably appropriate for the intended application.

Safety message

This incident highlights the importance of appropriate RPA operational controls and procedures. These are particularly important where operations are intended in the vicinity of populous areas or other traffic. The careful application of operational controls and procedures, underpinned by robust risk assessment, is essential as RPA use increases.

Information about remotely piloted aircraft systems (RPAS) is available from the CASA website.

General details

Occurrence details

Date and time:	19 September 2015 – 1415 EST	
Occurrence category:	Accident	
Primary occurrence type:	In-flight break-up	
Location:	Toowoomba, Queensland	
	Latitude: 27° 32.48' S	Longitude: 151° 54.75' E

Aircraft details

Manufacturer and model:	DJI Spreading Wings S900
Type of operation:	Aerial work – Survey/Photography
Damage:	Destroyed

Australian Transport Safety Bureau

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

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

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

Purpose of safety investigations

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

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

About this Bulletin

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

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

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

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

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

Conducting these Short investigations has a number of benefits:

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

Australian Transport Safety Bureau

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

Investigation

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Aviation Short Investigations

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