Australian Government

Australian Transport Safety Bureau

Aviation Short Investigations Bulletin

Issue 35

Investigation

ATSB Transport Safety Report

Aviation Short Investigations

AB-2014-146

Final – 15 October 2014

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

Published by: Australian Transport Safety Bureau
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Jet aircraft

Flight envelope protection event involving an Airbus A320, VH-VFJ

What happened

On the morning of 7 September 2013, an Airbus A320 aircraft, registered VH-VFJ, was being operated on a scheduled passenger service from Christchurch to Auckland, New Zealand. The first officer (FO) was designated as the pilot flying. The crew was cleared by air traffic control (ATC) via the DAVEE 3C arrival for the Required Navigation Performance (RNP) Y[1] approach to runway 23 Left (23L) at Auckland.

During descent, the crew complied with an ATC request to maintain 280 kt until 5,000 ft above mean sea level (AMSL). Passing about 6,800 ft, and after having been cleared for the approach by ATC, the crew armed the auto-flight system final approach mode by pressing the approach (APPR) pushbutton on the flight control unit (FCU)[2] (Figure 1). Arming final approach mode sets the auto-flight system to capture and track the lateral and vertical final approach paths.

The crew slowed the aircraft to 250 kt nearing 5,000 ft to comply with a company speed restriction of 250 kt maximum below 5,000 ft. Passing about 4,200 ft, the auto-flight system sequenced to final approach mode and the crew set 3,000 ft in the FCU altitude window - the missed approach altitude associated with the RNP Y approach to runway 23L.[3]

Approaching 3,000 ft, the crew levelled the aircraft to further reduce speed by selecting 'PUSH TO LEVEL OFF' on the FCU. This speed reduction was required to comply with another company speed restriction of 210 kt maximum below 3,000 ft. Levelling the aircraft however, meant that the auto-flight system exited final approach mode – while still tracking the approach procedure laterally, the aircraft was no longer following the defined vertical approach path. Once the aircraft had slowed sufficiently, the crew resumed descent in managed descent mode, intending to allow the auto-flight system to continue descent and re-capture the vertical aspect of the final approach path. Immediately upon the resumption of the descent however, the auto-flight system captured and levelled the aircraft at 3,000 ft – the missed approach/go-around altitude previously set in the FCU altitude window.

Soon after altitude capture, the crew wound the FCU altitude window to 5,000 ft by rotating the altitude selector knob, then inadvertently pulled the altitude selector knob. This action caused the auto-flight system to engage in open climb mode[4] contrary to the intent of the crew which was to continue descent and resume the approach. In open climb mode, the auto-flight system (flight directors) commanded a climb to 5,000 ft – the altitude now set in the FCU altitude window. As engine thrust increased however, the FO initially maintained a shallow descent, having moments earlier disconnected the auto-pilot and assumed manual aircraft control. The combined effect of the increase in engine thrust and the shallow descent resulted in unwanted aircraft acceleration.

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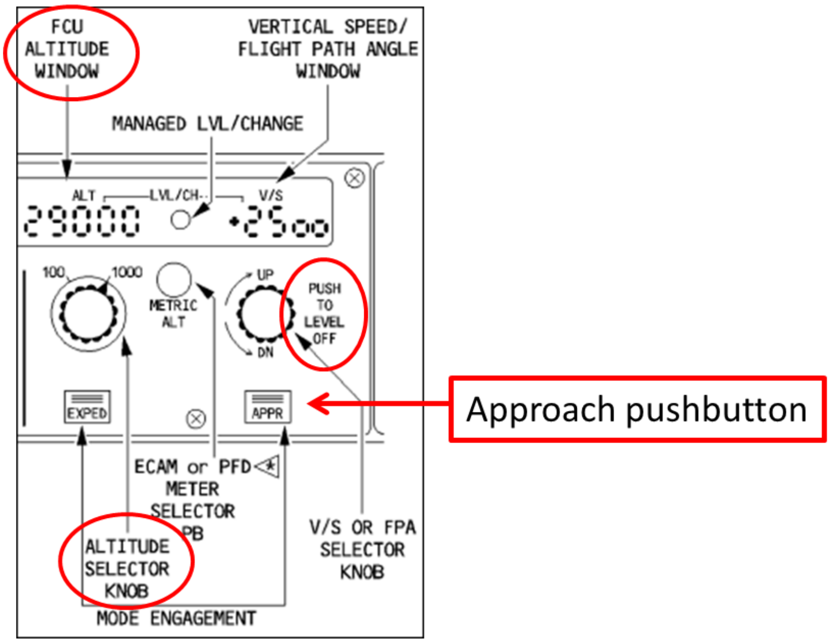
1 RNP approaches involve following a defined lateral and vertical approach path. RNP approach procedures require the application of performance-based navigation specifications requiring specific standards of equipment and on-board navigation system monitoring capabilities.

2 The FCU is located on the glare-shield and provides an interface between the crew and the flight management guidance computers. Among other things, different flight guidance modes and flight parameter targets such as speed and altitude can be selected on the FCU.

3 The missed approach altitude is the altitude to which the aircraft is required to climb in the event that the approach is discontinued. In the operator's procedural documents dealing with auto-flight system management, this altitude is commonly referred to as the go-around altitude. The operator's RNP Crew Review Card procedures allowed the crew to set the missed approach/go-around altitude after the auto-flight sequenced to final approach mode.

4 In open climb mode, the auto-flight system commands a climb to the altitude set in the FCU altitude window and the auto-thrust system sets climb thrust.

Figure 1: Relevant part of FCU panel (vertical control area)



Source: Airbus – highlights by ATSB

As the aircraft speed approached 230 kt (which was the maximum speed for the existing configuration),[5] the captain took control from the FO (continuing with manual control), retarded the thrust levers to the idle stop position and applied full speedbrakes.[6] Aircraft speed peaked momentarily at 230.7 kt, marginally above the 230 kt maximum speed for the existing configuration, but no over-speed warnings were triggered because the speed did not reach the over-speed warning activation threshold. By retarding the thrust levers, the captain reduced the maximum thrust available (to the auto-thrust system) and prevented what may have been a significant overspeed,[7] but in reaching the idle stop the captain inadvertently disconnected the auto-thrust system. A number of momentary alerts activated, intended to draw the attention of the crew to the disconnected status of the auto-thrust system, but none of these effectively captured their attention on this occasion.[8]

About 50 seconds after the captain took control, as the aircraft decelerated through about 180 kt, the auto-flight system re-captured final approach mode as intended, again tracking the lateral and vertical final approach paths. At about the same time, the crew selected the next stage of flap/leading-edge slat extension (configuration 2), retracted the speedbrakes and re-engaged the auto-pilot. Also at about this time, the captain handed aircraft control back to the FO, but the thrust levers remained at the idle stop, and neither pilot was aware that the auto-thrust system had been disconnected (and was therefore not controlling aircraft speed).

5 The existing configuration was wing leading-edge slats at 18 degrees and flaps up (flap lever position 1).

6 The captain later commented that there was insufficient time to re-engage the auto-pilot and use the auto-flight system (speed selection) to prevent an over-speed, instead initiating a more prompt response by retarding the thrust levers and applying speedbrake.

7 With the auto-thrust system active, retarding the thrust levers has the effect of reducing the maximum thrust that can be applied by the auto-thrust system. When the thrust levers are set below the climb detent (with both engines operating), repeating alerts draw the crew's attention to the limited thrust condition.

8 When the auto-thrust system is disconnected using an instinctive disconnect pushbutton on the thrust levers or setting the thrust levers to the idle stop, a single chime aural warning sounds, the master caution light illuminates momentarily, and the Electronic Centralised Aircraft Monitoring system briefly displays an amber A/THR OFF message.

Soon after handing back control, the captain's attention was directed to flight path monitoring and ATC communications as the pilot monitoring (PM). Although somewhat surprised at the handover of aircraft control, the FO resumed control and shifted attention from PM duties to aircraft profile and configuration management as the pilot flying. As the approach progressed and the aircraft decelerated, the crew continued to configure the aircraft in preparation for landing, still unaware that the auto-thrust system was disconnected.

The crew commented that they were aware that the aircraft was decelerating as it was configured, but expected the thrust to increase as speed neared the approach speed. The captain believed that the auto-thrust system was still active when control was handed to the FO, but neither pilot could recall confirming operation of the auto-thrust system on their respective flight mode annunciators (FMA) at that time.[9] The FO commented that deceleration toward the approach speed appeared normal as the aircraft was being configured for landing.[10] At about the same time, the attention of the FO was beginning to shift to an external visual scan of the runway environment. Just as the final stage of flap/leading-edge slat was selected (flap lever to the FULL position), speed reduced through the approach speed of 136 kt and the lowest selectable speed (see later section titled *airspeed indicator*), which at that moment was 133 kt.

As the aircraft descended through about 1,700 ft and reached a speed of 120 kt, the flight augmentation computers[11] generated an aural low-energy 'speed speed speed' warning. The captain responded to the low-energy warning by again taking control from the FO, disconnecting the auto-pilot and advancing the thrust levers toward the climb detent. Despite thrust lever advancement, aircraft speed briefly and marginally continued to reduce given the inertia of the aircraft and the finite time required (albeit very momentary) for the engines to deliver a thrust output that corresponded to the increased thrust lever setting. The aircraft slowed through the alpha[12] protection speed of about 117 kt, followed almost immediately by engagement of the alpha floor auto-thrust mode at 116 kt (which was the minimum speed reached). The nature of the low-energy warning, alpha protection speed and alpha floor auto-thrust mode, are described later in the report.

The alpha floor auto-thrust mode automatically re-activated the auto-thrust system and initiated the application take-off/go-around (TOGA) thrust, even though the captain was manually advancing the thrust levers at the same time. The captain disconnected the auto-thrust system using the instinctive disconnect pushbutton on the thrust levers about 5 seconds after alpha floor mode engagement, thereby allowing the crew to establish manual thrust control[13] and accelerate the aircraft to the approach speed. At the moment the captain disconnected the auto-thrust system, the aircraft was accelerating through about 129 kt and descending through about 1,600 ft. Manual thrust management was retained for the remainder of the flight, which continued from that point to an uneventful landing. A selection of recorded data that graphically represents the occurrence is shown in Figure 2.

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9 Among other things, the FMA displays the status of the auto-thrust system, and the mode of auto-thrust system operation.

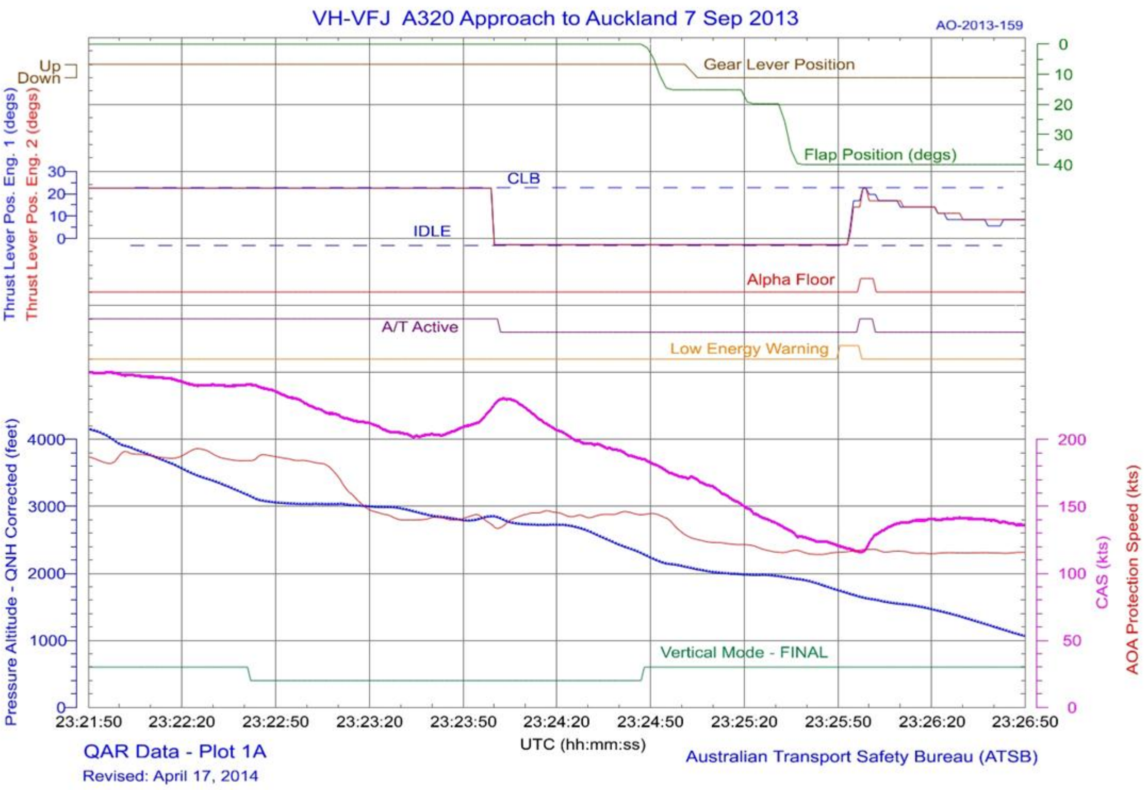
10 The FO indicated that the perception of aircraft deceleration toward the approach speed may have been influenced to some extent by an expectation that the auto-thrust system may not control deceleration accurately on this occasion. The FO had recently experienced less precise auto-thrust system speed control with this particular aircraft than was normally the case, although there was no entry in aircraft technical documentation to that effect.

11 The aircraft has two flight augmentation computers that perform a range of functions including yaw-related functions, flight envelope-related functions, and low energy warning and windshear detection functions.

12 Alpha refers to the angle-of-attack of an aircraft wing, measured as the angle between the wing chord line and the local undisturbed airflow. If alpha increases beyond a certain angle (commonly referred to as the stalling angle), the characteristics of the airflow over the wing change to the extent that the wing is said to have aerodynamically stalled. Broadly speaking, an aerodynamic stall typically results in a relatively sudden and substantial loss of lift.

13 If the auto-thrust system is not disconnected following engagement of the alpha floor auto-thrust mode, thrust increases to TOGA and remains locked at that thrust setting until crew intervention.

Figure 2: Quick access recorder data plot - selected parameters



Source: ATSB

Relevant warnings and flight envelope protection (normal law)[14]

Low-energy warning:[15] An aural low-energy 'speed speed speed' warning repeats at 5-second intervals to caution the crew that aircraft's energy state is below a threshold whereby increased thrust is required. Depending on the circumstances, the aircraft pitch attitude may also warrant adjustment. Activation of the low-energy warning is based on a number of parameters, including speed and rate of deceleration. During deceleration, the low-energy warning is triggered before alpha floor (unless alpha floor is triggered by stick deflection). The speed difference between the low-energy warning and triggering of the alpha floor auto-thrust mode depends on the rate of deceleration. During this incident, the low-energy warning activated at 120 kt, 4 kt before the alpha floor auto-thrust mode engaged.

High angle-of-attack protection: High angle-of-attack protection is intended to prevent an aerodynamic stall or loss of control. A320 high angle-of-attack protection includes the following:

- ***Alpha protection speed:*** Alpha protection speed corresponds to the angle-of-attack at which alpha protection activates. A number of things happen when alpha protection activates, including a change in flight control system pitch mode characteristics. Additionally, the auto-pilot will disengage if the angle-of-attack reaches one degree above the angle-of-attack at

[14] The Airbus A320 incorporates fly-by-wire technology. Crew flight control inputs are transmitted to flight control computers, which command appropriate flight control surface movement. The laws governing operation of the flight control system are known as flight control laws. The flight control system usually operates in 'normal law', which provides a number of flight envelope protection functions, including high angle-of-attack protection. Under certain conditions, operation of the flight control system may degrade to 'alternate law' or 'direct law'. When control laws are degraded, high angle-of-attack protection may be replaced by artificial low speed stability or lost entirely, depending upon the extent of control law degradation.

[15] The low-energy warning is only available with certain flap settings and is inhibited under some conditions. The conditions prevailing at the time of this incident did not inhibit the low-energy warning.

which alpha protection activates. During this incident, the alpha protection speed was 117 kt, 1 kt above the minimum recorded speed of 116 kt.

- ***Alpha floor mode:*** Alpha floor is an auto-thrust mode designed to assist in recovery from a high-alpha, low-airspeed condition. Activation of alpha floor mode is dependent on a range of parameters, including rate of deceleration. Activation of alpha floor mode leads to the automatic application of TOGA thrust, regardless of the existing thrust lever position and status of the auto-thrust system. TOGA thrust is locked (TOGA LK appears on the FMA as the active auto-thrust mode) until the auto-thrust system is disconnected by the crew. Activation of alpha floor mode also generates an associated 'A. FLOOR' annunciation in green, surrounded by a flashing amber box, on the FMA. 'A. FLOOR' is also annunciated in amber on the electronic centralised aircraft monitoring system (engine warning display). During this incident, alpha floor mode engaged at the minimum recorded speed of 116 kt and remained engaged for about 5 seconds before disconnection of the auto-thrust system by the captain.
- ***Alpha max:*** Alpha max is the maximum angle-of-attack that can be attained in normal flight control law. The speed corresponding to alpha max is referred to as the alpha max speed. To prevent the onset of an aerodynamic stall, the flight control system will not allow alpha max to be exceeded, even if the control stick is pulled fully back. Alpha max speed was not a recorded parameter, nor was it reached during this incident.

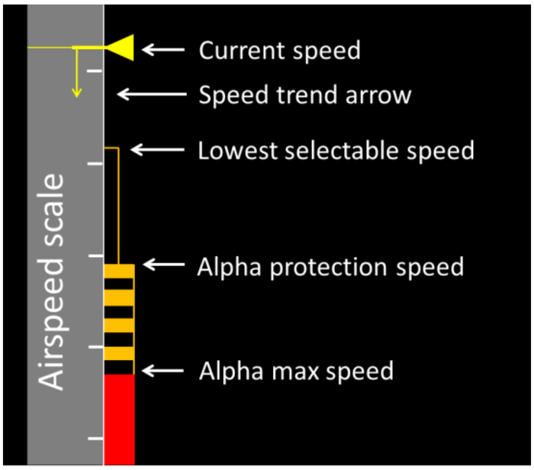
Airspeed indicator

The airspeed indicator is located on each pilot's primary flight display. In addition to current airspeed, the indicator includes references to predicted speed and high angle-of-attack protection speeds (normal law). Some relevant information includes (Figure 3):

- A speed trend arrow that indicates what the speed will be in 10 seconds at the current rate of acceleration or deceleration.
- Lowest selectable speed, which is the lowest speed that can be selected by the crew while maintaining a suitable margin above the aircraft stall speed.
- Alpha protection speed, represented by the top of an amber and black strip.
- Alpha max speed, represented by the top of a red strip.

Note that the speed at which the low energy 'speed speed speed' alert will sound and the speed at which alpha floor auto-thrust mode will engage are not depicted on the airspeed indicator.

Figure 3: Representation of primary flight display airspeed indicator low speed protection markings (normal law)



Source: ATSB

Operator’s investigation findings

The operator conducted an internal investigation into the incident and made a number of findings, some of which are broadly summarised as follows:

- The operator found that there may be some commonly-held misunderstandings (by flight crew in general) regarding some aspects of instrument approach management procedures, particularly their application to RNP approaches. The operator’s report included reference to procedures dealing with setting the missed approach/go-around altitude in the FCU altitude window, and the procedures related to capturing an approach path from above.
- The operator also made findings with respect to crew communication, aircraft energy state monitoring, wider automation management and mode awareness issues, and the procedures governing the reinstatement of aircraft control following intervention by the pilot not flying.

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 actions.

Operator

Since this occurrence, the operator has made a customised amendment the Flight Crew Operations Manual (FCOM) procedure with respect to the point at which the missed approach/go-around altitude may be set in the FCU altitude window during an RNP approach. Although the revised procedure was introduced for reasons not directly related to this incident, the amendment does address a procedural inconsistency between the FCOM and the operator’s RNP procedure Crew Review Card that was identified by the captain following this incident.

As a result of this occurrence, the aircraft operator has advised the ATSB that a number of safety actions have been, or will be undertaken, including:

- Communication to all flight crew regarding relevant procedures for setting the missed approach/go-around altitude, with appropriate explanatory information.
- Communication to all flight crew regarding procedural requirements dealing with FMA awareness and speed monitoring.
- Flight Safety and Standards Committee consideration of the issues surrounding transfer of aircraft control, and wider automation management and mode awareness issues.
- Inclusion of guidance dealing with reinstatement of aircraft control (following control intervention by the other pilot) in appropriate documentation.

Safety message

To operators of highly automated aircraft, this incident highlights the importance of robust approach management procedures, and clear guidance dealing with associated management of aircraft auto-flight systems. Effective and comprehensive operational procedures that are clearly documented, well understood, regularly practised and consistently applied are fundamental to safe aircraft operations. The incident also highlights the need for clear procedural guidance regarding communication protocols following a transfer of aircraft control between pilots, particularly following intervention by the pilot not flying.

For flight crew, this incident highlights the importance of consistent attention to the status and mode of operation of the auto-thrust system, particularly following manipulation of the thrust levers. This incident also highlights the importance of consistent attention to aircraft energy state. With respect to aircraft energy state, a recent ATSB report (Aviation Research Report AR-2012-172 dated 01 November 2013) titled *Stall warnings in high capacity aircraft: The Australian context*, included the safety message:

> *To avoid higher risk stall warning events, pilots are reminded that they need to be vigilant with their awareness of angle of attack and airspeed, especially during an approach on the limits of being stable.*

A copy of ATSB Aviation Research Report AR-2012-172 is available on the ATSB website at www.atsb.gov.au/publications/2012/ar-2012-172.aspx.

Additionally, this incident serves as a reminder of the importance of effective crew communication, particularly following a disruption to the normal sequence of events.

General details

Occurrence details

Date and time:	07 September 2013 – 1126 NZST	
Occurrence category:	Incident	
Primary occurrence type:	Flight envelope protection event	
Location:	Near Auckland, New Zealand	
	Latitude: 37° 01.85' S	Longitude: 147° 53.04' E

Aircraft details

Manufacturer and model:	Airbus A320	
Registration:	VH-VFJ	
Operator:	Jetstar Airways	
Serial number:	5311	
Type of operation:	Air transport - high capacity	
Persons on board:	Crew – Unknown	Passengers – Unknown
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

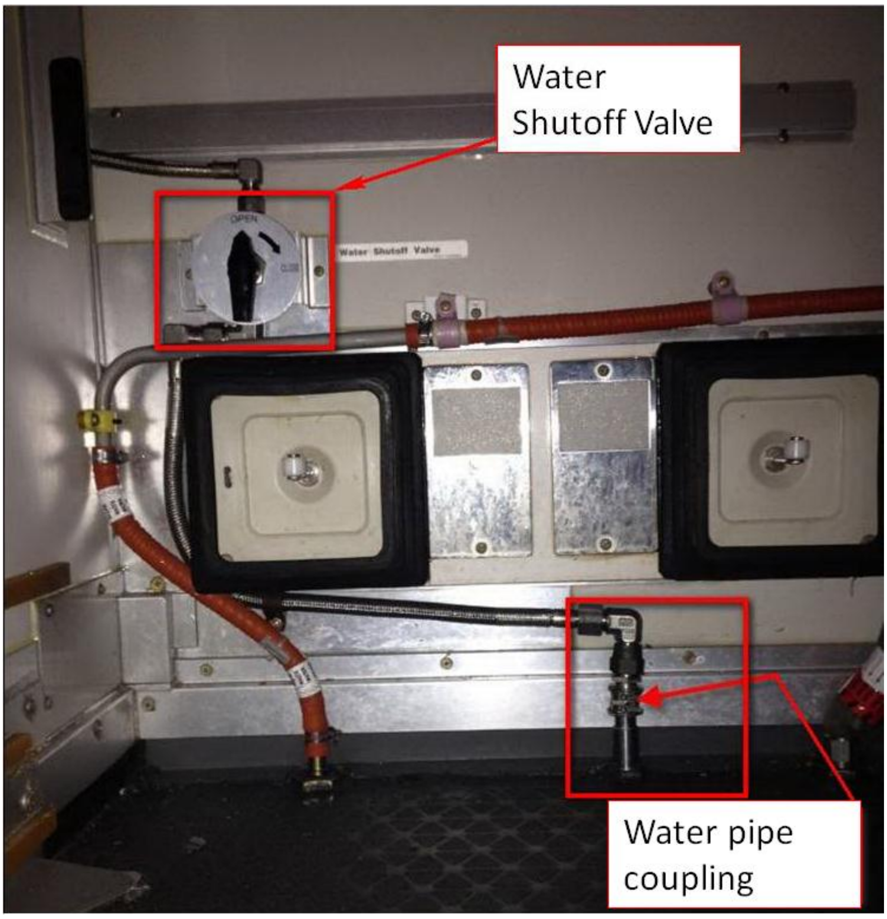
Aircraft cabin water leak event involving an Airbus A380, VH-OQD

What happened

On 2 July 2014, a Qantas Airbus A380 aircraft, registered VH-OQD, departed Los Angeles, USA, for Melbourne, Victoria. During the climb, the captain switched off the seatbelt sign. A few minutes later, a cabin attendant entered the business class galley to retrieve hot towels for the passengers. As the attendant switched the hot water on, she observed water leaking out from under the meal carts.

The cabin supervisor then entered that galley and pulled the carts forward to access and switch off the water shut off valve (Figure 1), but that did not stem the flow of water. The cabin attendant contacted the flight crew and alerted them to the situation. The cabin crew used blankets and pillows in an attempt to direct the water down the drain; however the water flow rate was too high and the water continued to flow into the aircraft cabin.

Figure 1: Galley shut off valve and clam shell location



Source: Operator

A second officer went back into the cabin to determine how much water had leaked and confirmed that the valve was switched off. He advised the captain that there was quite a large flow of water coming from a loose water pipe coupling (Figure 1). The flight crew contacted maintenance watch ground staff who advised the crew that there was a main switch to the potable water on the flight attendants' panel (FAP). The cabin crew located the switch and selected it to 'OFF', which then stopped the water flow. The second officer observed the tank quantity indicator on the FAP showing that about 40% of the potable water remained, which after taking off with 80% of the total capacity, indicated about 700 L of water had leaked into the cabin.

Maintenance watch advised that the water would drain towards the bilges and away from the aircraft's main electronic systems, which were located at the front of the aircraft, and they had no immediate concern for the safety of the aircraft. The crew then assessed the discomfort of passengers in the cabin, the quantity of water remaining for the planned flight to Melbourne, and the potential impact on the aircraft systems of the leaked water. The aircraft continued towards the destination during the troubleshooting phase, while the crew assessed the situation.

As a precaution, the cabin crew switched off the in-flight entertainment system and the power to all controls in the seats. The water had progressed through the upper deck floor and water was 'raining' on passengers in the vicinity of row 65 of the main deck. The cabin crew moved passengers from the central seats to the side seats. With the potable water supply switched off, there was no water available for the toilets or basins for the duration of the flight. The cabin crew determined that it was therefore untenable to continue the 14 hour flight. Leakage of that quantity of water had not occurred previously, and the eventual impact of the water on the aircraft was unknown.

The first officer and was able to secure the water pipe coupling in the galley that had come undone and caused the leak. However, the potable water remained switched off as a precaution. The crew did not receive any electronic centralised aircraft monitor (ECAM) indications or warnings. The crew conducted a decision making process in accordance with their crew resource management (CRM) procedures, and decided that the best option was for the aircraft to return to Los Angeles. The flight crew jettisoned some fuel to reduce the overall landing weight to 445 tonnes, which was above the maximum landing weight of 391 tonnes. The flight crew then prepared to conduct an overweight landing.

As the aircraft commenced descent, a cabin crew member advised the flight crew that the leaked water was moving forwards in the aircraft. The flight crew then conducted a slow speed descent to keep the water stabilised and prevent it flowing forwards. The aircraft landed without further incident.

The following day, the flight from Los Angeles to Melbourne was to be operated by a different Airbus A380 aircraft. During pre-flight maintenance, a maintenance engineer checked the same coupling that had leaked on the previous day. As aircraft power was switched on at the time, the potable water supply was pressurised. As the engineer tested the coupling, it came undone and some water leaked out. The engineers attempted to dry out the leaked water in the cabin, resulting in the aircraft arriving about one hour late at the departure gate. Conscious that the water may affect the same passengers from the previous day, the crew alerted the passengers prior to departure, that the coupling had been checked and secured, but that some water had escaped during the process.

As the flight crew increased the thrust during the take-off run, some water came down from the overhead bins in the main deck; however the quantity was similar to that normally arising from condensation and not considered to be significant. The flight continued to Melbourne.

Engineering report

An initial engineering inspection found that the coupling that joins the water pipe at the floor level where the water supply enters the galley was unlatched.

There was evidence that the rope-style mops used by cleaners may have contributed to the coupling coming undone. Fleet-wide inspection of the fittings found strands of cleaning mops tangled in the brackets, with evidence of couplings rotated in opposing directions.

Safety action

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

Aircraft operator

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

Initial fleet wide inspection

Within 72 hours of the incident, a fleet wide inspection of all Qantas A380 aircraft was carried out and temporary preventative action taken on all similar galley installations. Each clamp was inspected, cleaned and refitted and then tested with the water tanks pressurised. When nil leakage was ensured, the clamp was then protected.

Cleaning and coupling protection

As an interim measure and in consultation with Airbus, aluminium tape has been double wrapped around the couplings to avoid the likelihood of unintentional disturbance. The aircraft are to be cleaned under the galley bench areas using sponge style mops instead of cotton rope mops.

Subsequent fleet wide inspection

A subsequent fleet wide inspection will be carried out on 14 September 2014. At this inspection, Qantas proposes fitment of lock-wire to prevent the clamp coming adrift.

Aircraft manufacturer

Airbus is working on providing an interim and a permanent solution.

Safety message

This incident provides an excellent example of effective crew resource management techniques. The crew were faced with an abnormal and unusual situation. Communication between flight crew, cabin crew and ground maintenance staff enabled a variety of scenarios and options to be considered. The ultimate decision to turn back to Los Angeles rested with the Captain and he was able to make that decision using all available resources and in a collaborative way.

General details

Occurrence details

Date and time:	2 July 2014 – 0830 UTC	
Occurrence category:	Incident	
Primary occurrence type:	Furnishings and fittings	
Location:	near Los Angeles International Airport, USA	
	Latitude: 33° 56.55' N	Longitude: 118° 24.48' W

Aircraft details

Manufacturer and model:	Airbus A380-842	
Registration:	VH-OQD	
Operator:	Qantas Airways	
Serial number:	0026	
Type of operation:	Air transport high capacity	
Persons on board:	Crew – 24	Passengers – 377
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Minor	

Turboprop aircraft

Runway incursion involving a Bombardier DHC-8, VH-QOP

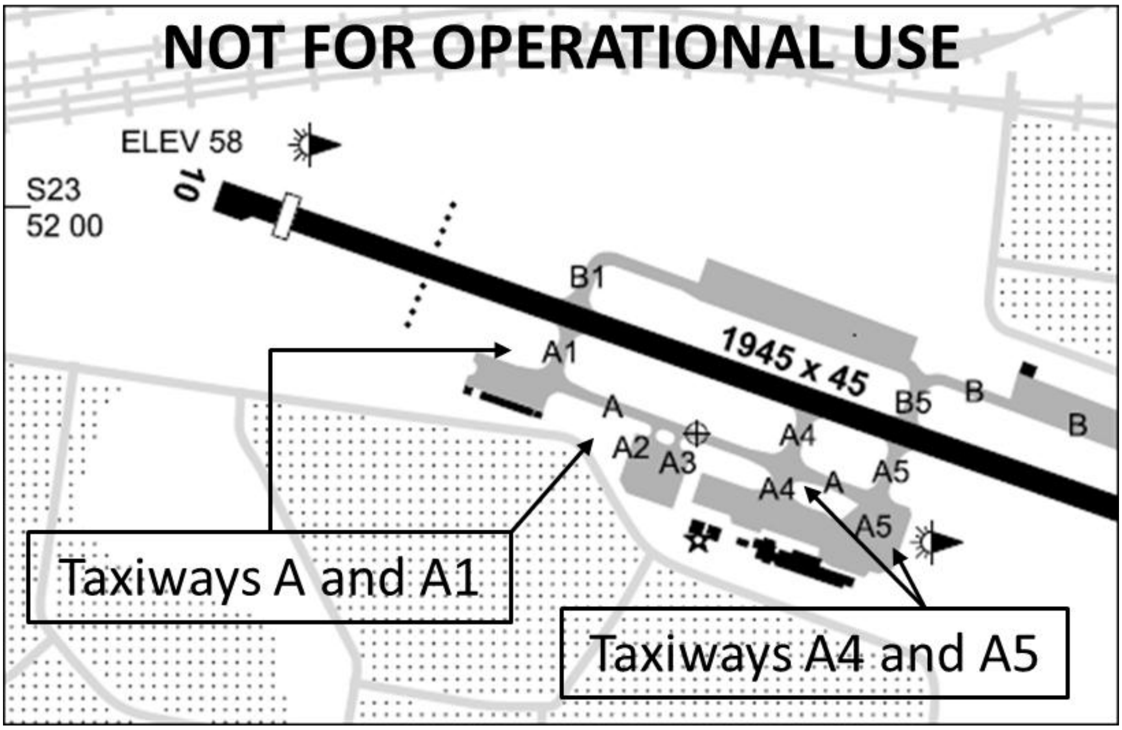
What happened

On 17 April 2014 at about 1705 Eastern Standard Time, the crew of a Bombardier DHC-8, registered VH-QOP, commenced taxiing at Gladstone Airport, Queensland, for a scheduled passenger service to Sydney, New South Wales. Although the sector was to be flown by the first officer as the pilot flying, the captain was taxiing the aircraft because the aircraft has a single nose-wheel steering tiller, accessible to the left seat pilot only.

Prior to taxi, the crew made a radio call on the Gladstone Common Traffic Advisory Frequency (CTAF)[1] indicating their intent to use runway 10 for departure. As they commenced taxiing, the crew were aware that an ATR-72 was inbound to Gladstone. Soon after the crew of VH-QOP reported that they were taxiing, the crew of the ATR-72 reported that they were 5 NM from Gladstone, on final approach to runway 10.

Noting the position of the ATR-72, the crew of VH-QOP elected to taxi in a westerly direction along taxiway A, planning to enter the runway via taxiway A1 after the ATR-72 had landed. The crew commented they would probably have used taxiway A4 or A5 to enter the runway had it not been for the inbound ATR-72. Although they were not all that familiar with Gladstone Airport, the crew of VH-QOP were aware that runway entry via taxiway A4 or A5 was more common, if the air traffic situation allowed (Figure 1).

Figure 4: Excerpt from Gladstone aerodrome chart



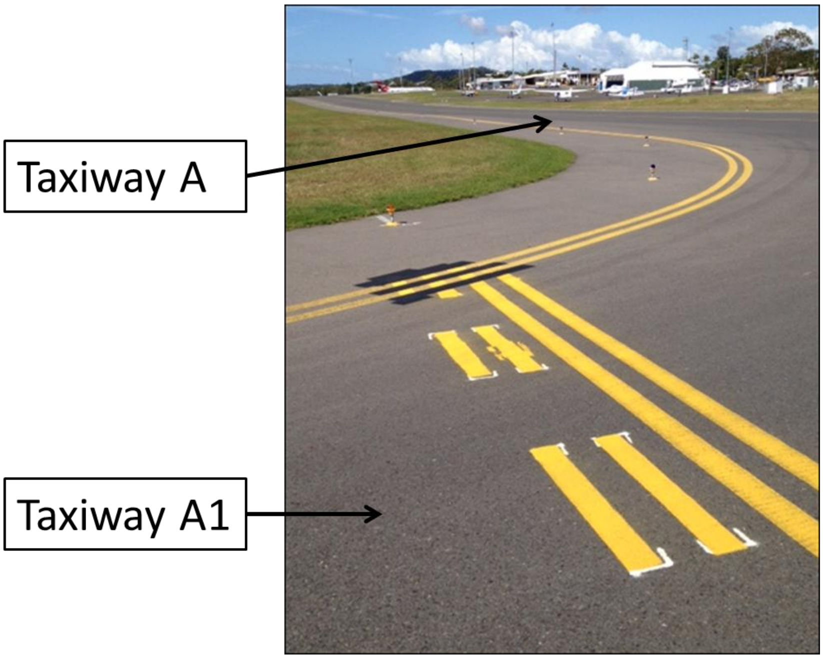
Source: Airservices Australia – modified by the ATSB

[1] The CTAF is the frequency on which pilots operating at a non-towered airport should make positional broadcasts.

Heavy isolated showers were passing over the airport at around the time the crew of VH-QOP were preparing for departure. The crew noted that weather to the east of the airport appeared to be more intense than weather to the west and with this in mind, they contemplated using runway 28 for departure. As they taxied, the crew discussed departure options and reviewed performance data to assess the suitability of using the opposite-direction runway 28 under the prevailing conditions. At the same time, they remained mindful of the ATR-72 on final approach to runway 10.

The crew of VH-QOP made a right turn from taxiway A onto taxiway A1 as the ATR-72 was on late final approach, but did not notice the holding point line near the commencement of taxiway A1 (Figure 2). The crew inadvertently continued over the holding point line before coming to a stop on taxiway A1, as the ATR-72 continued its approach and landed.[2]

Figure 5: Holding point line on taxiway A1 (looking in a south-easterly direction)



Source: Gladstone Airport Corporation

A ground-based observer noticed VH-QOP continue over the holding point line, and was concerned that the aircraft may be about enter the runway in front of the ATR-72 on late final approach. The observer monitored the progress of VH-QOP until it came to a stop, noting that the main wheels of the aircraft were just beyond the holding point line as the ATR-72 landed. The observer also commented that a shower of rain was passing over the airport at about the time that VH-QOP entered taxiway A1.

After the ATR-72 landed, the crew of VH-QOP made a call on the CTAF advising of their intention to enter and back-track for a departure from runway 10. The crew taxied forward onto the runway as the ATR-72 exited via one of the centre taxiways (A4 or A5). The crew of VH-QOP momentarily turned to the east as they entered the runway to allow further assessment of the weather in that direction, before turning to the west and back-tracking to the threshold of runway 10 for departure. VH-QOP then departed without further incident.

2 The crew of the ATR-72 were not interviewed during this investigation. It's unclear if the crew of the ATR-72 noticed that the DHC-8 had continued over the holding point line before stopping.

Crew comments

The crew were aware of the position of the ATR-72 as they taxied, and aware that the ATR-72 was on final approach to runway 10 as they neared taxiway A1. At all times, the crew planned to hold clear of the runway until after the ATR-72 had landed.

The crew of VH-QOP were not aware that they had taxied over the holding point line with the ATR-72 on final approach, until later advised of the incident. The crew commented that a number of factors may have led them to inadvertently continue beyond the holding point line on this occasion, including:

- The crew were busy as they taxied, assessing how weather in the area might affect their departure, and assessing the suitability of runway 28 for departure (including a review of relevant performance data).
- The tarmac surface was wet following heavy showers. As such, the holding point line may have been less prominent than might normally be the case, particularly noting the time of day (late afternoon) and possibly the position of the sun in relation to their taxi direction.
- The crew were not particularly familiar with Gladstone Airport, and even less familiar with taxiways A and A1. They were not aware of the position of the holding point line on taxiway A1.

ATSB comment

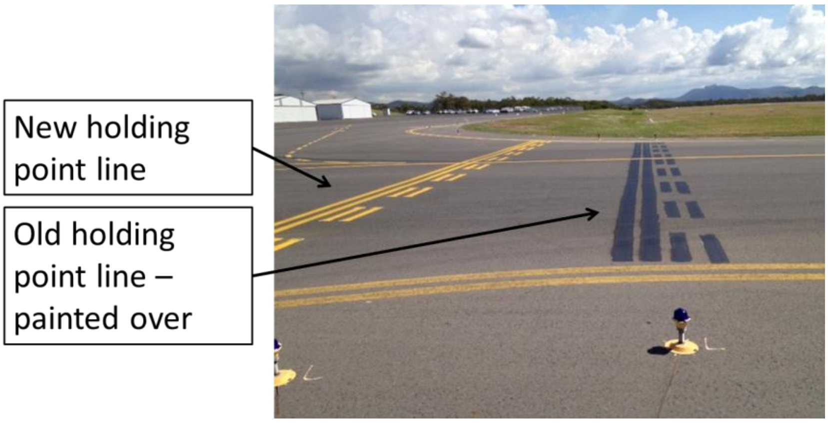
A runway incursion is defined in *Procedures for Air Navigation Services — Air Traffic Management - Doc 4444* as:

> *Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.*

Although the crew of VH-QOP stopped well short of the runway surface and were aware of the aircraft on final approach, the incident still falls within the definition of a runway incursion given the 'incorrect presence' of the aircraft within the runway flight strip[3] as the ATR-72 landed.

While it does not appear to have been a factor in this incident, it is noteworthy that the holding point on taxiway A1 had been moved back from the runway a small distance about a week prior to this incident (associated with airport infrastructure improvements). A new holding point line was painted, and the old line painted over with dark grey paint.

Figure 6: New and old holding point line on taxiway A1 (looking in a westerly direction)



Source: Gladstone Airport Corporation

[3] In general terms, the flight strip is known as the area surrounding the runway which is cleared of obstructions to reduce the risk to aircraft using the runway for take-off or landing.

Available data indicates that the airfield lighting was active at the time VH-QOP inadvertently proceeded over the holding point line.[4] Although the airfield lighting was active, the holding point lights (amber lights adjacent to the holding point line) and other surface movement lighting may not have been illuminated because the lights are also controlled by a daylight sensing system.

Safety message

This incident highlights the importance of careful attention to airfield markings during ground manoeuvring, especially when crew workload is elevated, and when a crew is unfamiliar with the airport layout. This message applies equally to all airside vehicle operators.

ICAO Doc 9870 *Manual on the Prevention of Runway Incursions* provides a considerable amount of information regarding the contributory factors often associated with runway incursions. A copy of the manual, along with a wide range of other information regarding runway incursions, is available at www.skybrary.aero/index.php/Portal:Runway_Incursion.

A range of information regarding runway safety (including runway incursions) is also available on the Airservices Australia website at www.airservicesaustralia.com/flight-briefing/pilot-and-airside-safety/runway-safety/

General details

Occurrence details

Date and time:	17 April 2014 – 1705 EST	
Occurrence category:	Incident	
Primary occurrence type:	Runway incursion	
Location:	Gladstone Airport, Queensland	
	Latitude: 23° 52.18' S	Longitude: 151° 13.37' E

Aircraft details

Manufacturer and model:	Bombardier DHC-8-402	
Registration:	VH-QOP	
Operator:	Sunstate Airlines	
Serial number:	4238	
Type of operation:	Air Transport High Capacity	
Persons on board:	Crew – Unknown	Passengers – Unknown
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

[4] Airfield lighting was activated by the Airport Safety Officer at the request of another aircraft inbound to Gladstone, about 15 minutes before VH-QOP taxied.

Piston aircraft

Loss of control during landing, involving a Diamond DA40, VH-CGT

What happened

VH-CGT in paddock

Source: Operator

On 16 May 2014, a Diamond Aircraft Industries DA40 aircraft, registered VH-CGT (CGT) departed Bankstown Airport, New South Wales, for the local training area. On board the aircraft were an instructor and student.

The primary focus of the dual exercise was for the student to refine the maintenance of aircraft directional control during stalls and incipient spin recovery, and also to monitor attitude and directional control consistency during landing.

After the satisfactory completion of the upper air sequences, CGT was returned to the airport, with the student conducting the landing. The instructor reported the landing was satisfactory, but the student was still not flaring[1] the aircraft sufficiently prior to touchdown. To consolidate previous extra dual instruction to address this difficulty, he authorised the student to conduct four practice touch and go solo circuits.

At the time, the weather was CAVOK [2] and the wind variable at about 3 knots. Runway 29[3] was the duty runway, with runway 29 L, a left circuit pattern, as the runway nominated for circuits.

At about 0924 Eastern Standard Time (EST), the student commenced the first solo circuit. The initial, crosswind and downwind legs of the circuit were reported as normal. After the turn onto base, the airspeed was reduced to about 80 knots with take-off flap set[4] and as intended, the turn onto final was between 600-700 ft above ground level (AGL). The plan was to maintain 70 knots on final approach, reduce power if necessary to obtain that airspeed, and select landing flap when required. The student was confident the approach was going well, however also held the mindset, that a go-around would be initiated if at any time it was felt that the acceptable parameters had been exceeded and the approach unstable.

The approach was steeper than usual, and as the student commenced the flare, it became evident that the change of aircraft attitude during this phase had been premature, leaving the aircraft too high above the ground, in a nose high, low airspeed configuration. Recognising that the aircraft was too high, the student initiated a go-around. Full power was applied, and almost immediately the aircraft tail struck the runway. Minimal, if any, adjustment had been made to the aircraft to compensate for the effect of the increase to full power.

Within seconds, the aircraft rolled rapidly to the left and stalled, resulting in the left wingtip striking the ground (Figure 1). The aircraft then turned further left through about 100 degrees, and the wings levelled. It continued in this direction, crossing over taxiway Bravo, then through a wire perimeter fence, coming to rest about 25 m later, in the long grass of an open paddock (Figure 2).

The student, began to shut down the aircraft, and contacted the Chief Flying Instructor (CFI) by mobile phone. He instructed the student to completely shut down, and exit the aircraft. When an

1 Final nose-up pitch of landing aeroplane to reduce rate of descent to approximately zero at touchdown.

2 Ceiling and visibility OK, meaning that the visibility, cloud and present weather are better than prescribed conditions. For an aerodrome weather report, those conditions are visibility 10 km or more, no significant cloud below 5,000 ft or cumulonimbus cloud and no other significant weather within 9 km of the aerodrome.

3 At Bankstown Airport, runway 29 consists of Runway 29 L (left), 29 C (centre) and 29 R (right).

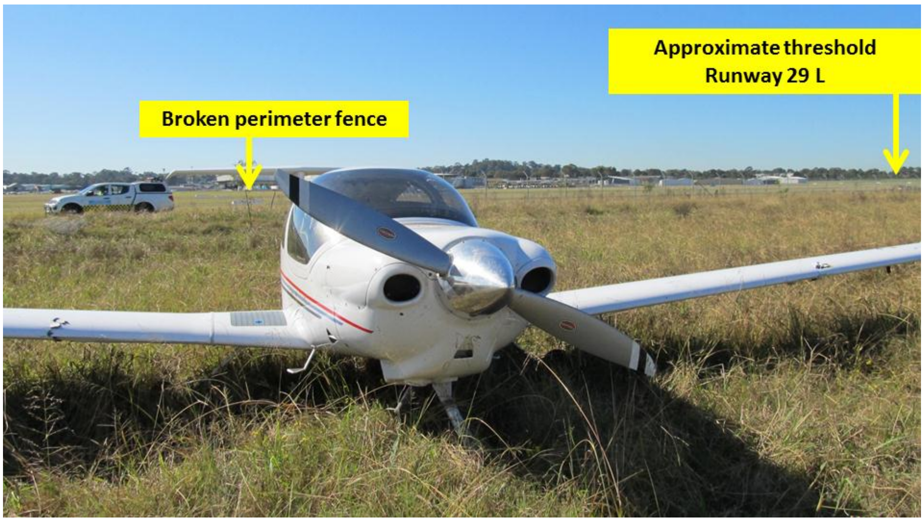
4 This is the first stage of flap for this aircraft, displayed on the flap selector as ‘take-off flap’

airport officer arrived on the scene, the student was still in the aircraft. Emergency services arrived shortly after. The student was not injured; however, the aircraft was substantially damaged.

Figure 1: Left wingtip damage

Source: Operator

Figure 2: VH-CGT approximate path of travel



Source: Operator

Student pilot experience and comments

The student commenced flying training in January 2014, and had accrued about 60 hours of dual and 10 hours of solo flight time. All experience had been gained in DA40 aircraft.

When flying the solo circuit, the student reported being satisfied with the aircraft's profile and configuration, up until commencing the flare. Realising the aircraft was too high, a go-around was initiated. The student recalled applying full power, then diverging slightly to the left of the runway, to allow any following traffic behind CGT to be able to continue with an approach and landing.

However when the tail struck the ground, the student reported feeling totally overwhelmed, and recalls little else except the aircraft coming to a stop in the paddock.

Flying school management comments

The student was in the second year of the Professional Pilot Program. During this year, students commence their flight training in the DA40.

The student had been receiving extra dual tuition to improve competency with the maintenance of directional control of the aircraft during some flight sequences. The following points regarding the accident were also noted:

- During the accident circuit, after turning final the student was high on the approach, and the approach was unstable.
- The student commenced a go-around from a low height, with the aircraft at a high pitch attitude and low airspeed
- The tail strake contacted the runway as the engine power was increased, probably distracting the student

As this was the first serious accident involving the School's DA40 aircraft, the intent is to learn from it, and prevent similar occurrences. The school has reviewed all relevant procedures, and has initiated several measures (further outlined in the Safety Action section) to support this approach.

Garmin G1000 data download

Data from the Garmin G1000 electronic flight instrument system (EFIS) fitted to CGT was provided to the ATSB.

The G1000 provides all primary instrument and engine parameter information, but not information regarding the position of the flight controls.

An overview of the information extracted from the accident approach is as follows:

Table 1: Garmin 1000 data extract

Position	Altitude (ft) Elevation 19 ft	Airspeed (knots)	Pitch attitude (°)	Rate pf descent (fpm)
Turn onto final	700	80	-7	800-900
Final	400	80	-8	1000
	300	70	-8	800-900
	50	70	-4	
	25	45	+8	
Go-around power	22	35	+12	

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.

Flying School management

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

Training

- It is recommended that during initial training and consolidation training, the correct sequence of events for go-arounds, from any height or position in the circuit be reinforced, with the emphasis on the correct values of pitch attitude and airspeed, and the application of engine power

- There will be greater emphasis placed on stabilised approaches
- There will be greater emphasis placed on appropriate control input during go-around
- Greater emphasis to be placed on:
  a. The Human Factors of timely and correct decision making within the theory program
  b. And in the practical flying phase

Operations Manual update

- This emphasis will be reflected in the wording of the mandatory go-around conditions, in Section E of the Operations Manual

Future Assessment, Selection and Monitoring Processes for the Professional Pilot Program

- The school will enhance the assessment process for applicants to the Professional Pilot Program, by implementing 5 hours of flight screening. This phase must be passed before applicants are formally accepted into the program.
- Students in the program, whose progress is unsatisfactory, currently undergo a review process to make a case for continuing within the flying program. The school have now implemented a risk matrix to make this process more objective and transparent.

Safety message

A go-around, the procedure for discontinuing an approach to land, is a standard manoeuvre performed when a pilot is not completely satisfied that the requirements for a safe landing have been met. The need to conduct a go-around may occur at any point in the approach and landing phase, but the most critical go-around is one initiated close to the ground.

This incident highlights the importance of conducting a go-around as soon as landing conditions appear unfavourable.

The following link provides some useful information on go-arounds: *Aviation safety explained – Go-arounds* www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD:1001:pc=PC_91481.

General details

Occurrence details

Date and time:	16 May 2014 – 0924 EST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	Bankstown Airport	
	Latitude: 33° 55.47’ S	Longitude: 150° 59.30’ E

Aircraft details

Manufacturer and model:	Diamond Aircraft Industries DA40CS	
Registration:	VH-CGT	
Serial number:	40.1108	
Type of operation:	Flying Training - solo	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Fuel exhaustion involving a Piper PA-25, VH-SSO

What happened

At about 1525 Eastern Standard Time on 18 May 2014, the pilot of a Piper PA-25 (Pawnee) aircraft, registered VH-SSO, took off from Bacchus Marsh aeroplane landing area (ALA), with a glider in tow. This was the pilot's seventh glider tow of the afternoon, following six uneventful glider launches. The conditions were clear, but there was a gusty wind from the north-north-west generating considerable turbulence, particularly in the circuit area.

The climb out was normal up to about 1,500 ft above ground level (AGL) when the pilot noticed a momentary engine power loss. The pilot had his hand on the throttle at the time, and initially thought that the power loss may have resulted from an inadvertent reduction in throttle setting. In response to the momentary power loss, the pilot lowered the nose of the aircraft and applied more throttle. At about the same time, the glider pilot sensed a reduction in speed and noticed that the tow rope had gone slack. In response, the glider pilot released the tow rope and turned to the right, away from the Pawnee.

The Pawnee pilot turned left after the glider released and re-joined the circuit via a left downwind for runway 27. The pilot later commented that the engine responded normally to throttle inputs following the momentary power loss, but after the pilot turned onto the base leg of the circuit at about 800 ft AGL, the engine surged briefly then stopped. The pilot immediately commenced tracking directly toward the ALA, believing that he had sufficient altitude to make a glide approach, and transmitted a MAYDAY[1] call on the Bacchus Marsh ALA Common Traffic Advisory Frequency.

As the aircraft descended through about 300 ft AGL, the pilot noticed a substantially increased rate of descent and was concerned he may not be able to reach the ALA. He identified a cleared area short of the ALA in which to land, and transmitted another MAYDAY call. As he neared the selected area however, the pilot grew concerned about a possible collision with trees. He was able to clear the trees, but immediately beyond the trees the aircraft aerodynamically stalled[2] and landed heavily in a cleared area adjacent to the ALA (Figure 1).

As the aircraft impacted the ground, the right main landing gear collapsed and the aircraft slewed to the right, coming to rest facing towards the east-south-east. As the right landing gear collapsed it impacted the right wing, damaging the leading edge (Figure 2). One of the propeller blades was also damaged when it struck the ground during the accident. After the aircraft came to a stop, the pilot turned off the electrical system and exited the aircraft uninjured. Subsequent inspection found that the aircraft fuel supply was exhausted.

1 MAYDAY is an internationally recognised radio call for urgent assistance.
2 An aerodynamic stall is the term used to describe a condition whereby the wing is no longer producing sufficient lift to support the weight of the aircraft.

Figure 7: Approximate flight path of VH-SSO after the engine stopped

Source: Google Earth – modified by the ATSB using information supplied by the Gliding Federation of Australia

Figure 8: Damage to VH-SSO

Source: Gliding Federation of Australia

Fuel management

The gliding club that operated the Pawnee used aircraft flight time (air-switch time) as a basis for determining when a refuel was required. This method of fuel management was established in part because pilots found the aircraft fuel gauges difficult to read with accuracy. Each time the aircraft was refuelled (to full tanks), 90 minutes was added to the existing flight time, and that figure was noted on a card that was retained in the aircraft for ongoing reference. Although normally over 2 hours of glider towing was available with full tanks, the gliding club used 90 minutes flight time as a reference time for refuelling purposes, to provide some operational flexibility and to provide a safety margin to guard against fuel exhaustion. The Gliding Federation of Australia (GFA) report dealing with the accident indicated that at the time of the accident, the card indicated that a refuel was required at 1284.1 hours flight time. The flight time reading following the accident was almost 1284.9 hours.

The aircraft was fitted with a warning light to alert pilots to a low fuel level condition (initially flashes then becomes steady). The pilot stated that the light did not flash or illuminate during flight on this occasion, but he noticed that it was illuminated after the accident, before he exited the aircraft. The light again illuminated when electrical power was subsequently re-established after the accident. The reasons for which the light did not flash or illuminate during flight are unclear.

Pilot comments

The pilot attended the gliding club on the day of the accident to visit colleagues. He was not intending to fly and only offered his assistance when made aware that there was no other pilot available to fly the Pawnee that afternoon. Because it was a relatively short-notice opportunity, the pilot overlooked his usual pre-flight routine, which normally included a physical check of the aircraft fuel quantity. Additionally, there was no hand-over discussion with the pilot who had flown the Pawnee earlier during the day. Such a discussion may have heightened the pilot's awareness of the existing aircraft fuel state before he commenced flying that afternoon.

The pilot indicated that he was familiar with gliding club procedures regarding the 90 minute flight time refuel requirement and annotation of the time on the card stored in the cockpit. He recalled looking at the card prior to commencing flying that afternoon, but was unsure why the noted figure did not effectively draw his attention to the requirement to refuel during the subsequent glider launches. The pilot also indicated that had the low fuel level warning light alerted him to the low fuel state, it would have provided a trigger to refuel the aircraft. He had seen the low fuel level warning light illuminate during another flight about a year or more prior to this accident, and on that occasion, it provided sufficient warning to allow at least completion of a normal circuit.

The pilot commented that he may have been suffering from an elevated level of fatigue after having very little sleep during the evening prior to the accident. He believed that fatigue may have affected his alertness, and played a role in the accident.

Safety action

Gliding Federation of Australia

As a result of this occurrence, the GFA indicated that they intended to remind all glider towing pilots of the importance of fuel management and fatigue awareness.

Safety message

This accident highlights the following key safety messages:

Pre-flight preparation. Pilots should be particularly cautious when their usual pre-flight preparation is interrupted or abnormal. Under such circumstances, normal checks and practices can easily be overlooked.

Fatigue. The International Civil Aviation Organisation defines fatigue as:

> *A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a crew member's alertness and ability to safely operate an aircraft or perform safety-related duties.*

Fatigue affects people in different ways, but commonly affects such things as judgement, concentration and the ability to perceive and interpret information. Pilots are encouraged to carefully consider the possible effects of fatigue that may result from limited or disrupted sleep, before engaging in flying operations or any other safety-critical activity.

Fuel management. Pilots are reminded of the importance of careful attention to aircraft fuel state. ATSB Research report AR-2011-112 Avoidable Accidents No 5 *Starved and exhausted: Fuel management aviation accidents* discusses issues surrounding fuel management and provides some insight into fuel related aviation accidents. The report includes the following comment:

> *Incidences of fuel exhaustion often happen close to a flight's destination and, if it occurs when the aircraft is close to landing, it may offer the pilot less time and opportunity to successfully manage the situation.*

A copy of the ATSB Research report AR-2011-112 is available on the ATSB website at www.atsb.gov.au/publications/2012/avoidable-5-ar-2011-112.aspx.

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 relates to aircraft fuel management (www.atsb.gov.au/safetywatch/ga-pilots.aspx).

General details

Occurrence details

Date and time:	18 May 2014 – 1535 EST	
Occurrence category:	Accident	
Primary occurrence type:	Fuel exhaustion	
Location:	Near Bacchus Marsh ALA	
	Latitude: 37° 44.0' S	Longitude: 144° 26.2' E

Aircraft details

Manufacturer and model:	Piper PA-25	
Registration:	VH-SSO	
Serial number:	25-7405602	
Type of operation:	Aerial work	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Ground collision with a refuelling vehicle, involving a Grob G-115, VH-ZYM

What happened

VH-ZYM and fuel vehicle

Source: Refuelling operator

On 6 June 2014, a Grob G-115 CS aircraft registered VH-ZYM, departed Merredin for Jandakot, Western Australia on a dual navigation exercise. An instructor and a student pilot were on board.

The flight progressed without incident, and after landing at Jandakot, the crew taxied the aircraft to company parking on the southern apron (Figure 1). The student then had a break for lunch.

After the break, the student was briefed on circuit procedures at Jandakot from another instructor. This briefing included runway procedures, radio calls, and a reminder about appropriate taxi speeds. After the briefing, the student conducted a dual session of circuits with a third instructor, followed by 3-4 solo circuits.

At the completion of the solo circuits, at about 1530 western standard time (WST), the student taxied back to the southern apron, to park the aircraft. As the aircraft arrived at the company parking area, the student saw the fuel truck operator refuelling an aircraft on the left side of the taxiway. He assessed that there was sufficient room to taxi past the vehicle, and entered this taxiway, with the vehicle on his left (Figure 1).

Shortly after, the aircraft's left wing struck the front grille of the vehicle and the aircraft swung rapidly left. The student quickly applied the brakes, and the aircraft came to a stop with the propeller a few centimetres from the trucks diesel tank (Figure 2). The diesel tank was located directly beneath an 8,450 L Avgas tank. The fuel vehicle operator had seen the aircraft taxiing in, and realising a collision was imminent, had pressed the emergency stop button to stop the flow of Avgas through the refuelling hose. He ran around the front of the truck and called to the pilot to shut down the aircraft. He also sought assistance from nearby students to help convey that message. About half a minute later, the student (who later reported being in shock) shut down and then exited the aircraft. The student pilot was not injured; however, the aircraft and fuel vehicle sustained minor damage.

Student pilot comments

The student commented that it was several months since he had flown out of Jandakot and he was not current, nor familiar with all the procedures.

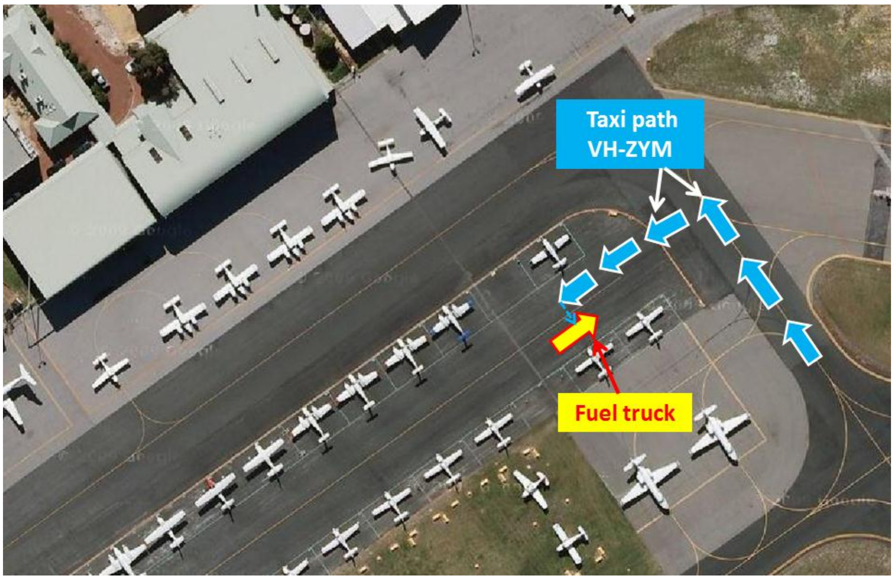
When he first noted the fuel vehicle, as it was parked close to the left of the taxiway, he felt there was sufficient space for the aircraft to taxi past. He had heard other students calling to him as he turned and started to taxi past the truck, but could not understand what they were saying.

He stated he was not specifically briefed on the rule regarding how close to the fuel truck the aircraft should taxi.

He also reported feeling tired, as he had undertaken three separate training flights during that day.

In hindsight, he conveyed the importance of having a full understanding of all the relevant procedures at an unfamiliar airport.

Figure 1: Jandakot Airport southern apron parking area



Source: Flying College and Fuel Company

Figure 2: Position where VH-ZYM came to a stop

Source: Fuel Company

Operator of refuelling vehicle

The operator of the refuelling vehicle reported that a similar incident had occurred in July 2013. A Grob had taxied into his vehicle. Hence, when refuelling on the southern apron, he keept a vigilant eye on traffic movements. He felt it was this heightened awareness that led to him pressing the emergency stop button as quickly as he did.

The fuel vehicle was parked about 1.5 -2 metres off the taxiline for that taxiway, and the taxiway was about 10 metres wide.

He was surprised at the amount of people that arrived on the scene post-incident, and had to remind some personnel of the dangers of using electronic equipment, such as mobile phones, in the area. The refuelling operator's procedures require that no electronic device be operated within 15 metres of the vehicle.

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.

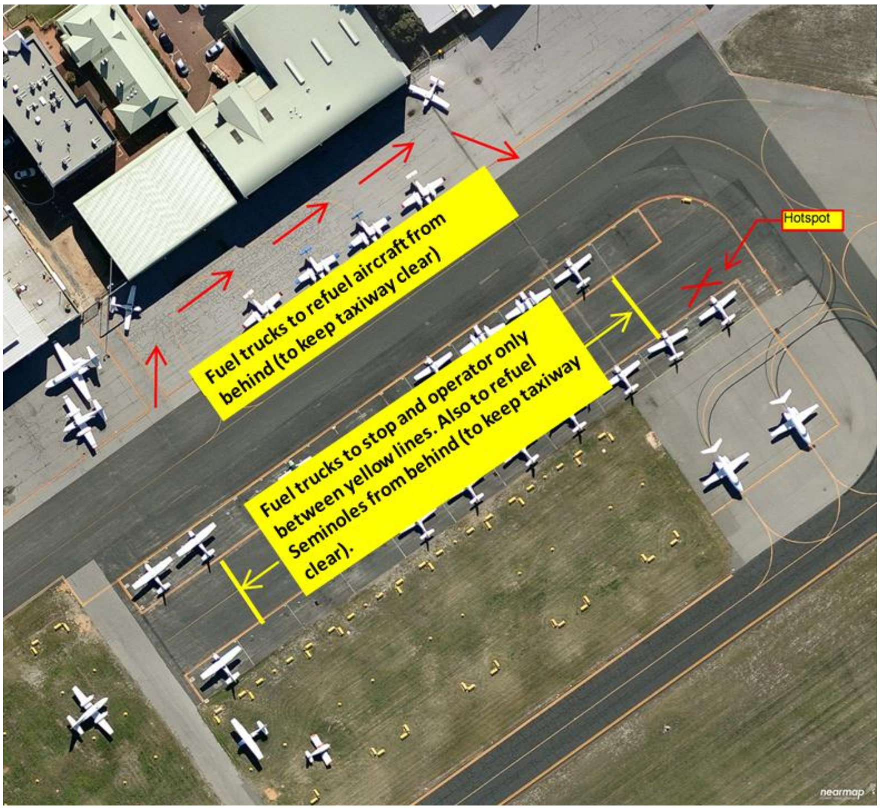
Collaborative Safety Action: Airport operator / Flying College / Refuelling Company

As a result of the three key stakeholders working toward risk mitigation against future occurrences, a new refuelling and taxiing plan has been developed for the southern apron area at Jandakot Airport.

The main points from this collaborative safety action are:

- As per Figure 3, when refuelling aircraft on the main apron, fuel vehicles will refuel from behind the aircraft
- When refuelling in between the two other sealed parking areas, refuelling must only occur between the two marked yellow lines (that is, not next to the two parking bays either end of the line)

Figure 3: Direction of travel for refuelling truck

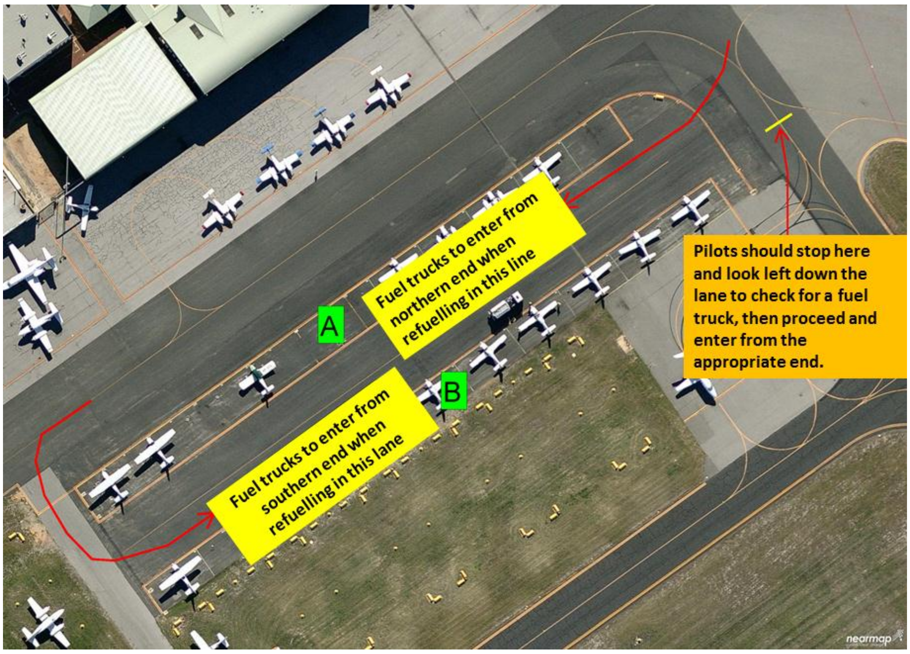


Source: Airport operator

In addition (Figure 4), refuelling vehicles wishing to refuel aircraft in lane A should enter from the northern end and refuel from behind the parked aircraft. When refuelling in lane B, vehicles are to enter from the southern end and refuel from in front of parked aircraft.

Pilots taxiing aircraft into the southern apron area from taxiway Golf, should momentarily stop and check for refuelling vehicles in either lane A or B. If there is any issue or parking congestion, they are to continue to taxi and park either on an open parking bay on the apron or continue to the grassed parking area and hold until the fuel truck has completed its duties and left the apron.

Figure 4: New procedures when accessing lane A or B



Source: Airport operator

Flying College

As a result of these occurrences, the flying school management has advised the ATSB that they are taking the following safety actions:

Use of taxiways in the southern apron parking area

Temporarily, to mitigate any possible future occurrences, the taxiways into the parking lines have ceased to be used. Operational staff have been briefed and trained on safe manoeuvring of aircraft in this area.

Also, as part of the company Safety Induction Training, all students will participate in a Fuel Hazards training course conducted by the fuel company. Students will have to complete all relevant training modules, before they commence flying training.

Management have recommended to all operational personnel, the importance of maintaining a focus until the aircraft has been completely shut down. The necessity to maintain situational awareness is just as relevant on the ground as it is in the air.

There is now a restriction of no longer than 8 hours of duty for students.

They also advise that the Airport Proprietors are currently conducting a survey of the apron and taxiway areas of the southern apron. A possible contribution to the solution may be to extend the apron width to allow more room.

Refuelling company

The refuelling company advised that a procedure was already in place, advising that an aircraft under power cannot be within 15 m of the refuelling vehicle, whether it was actively refuelling or not.

The company advised they had a meeting with the flying college management a few days after the incident, and the following was discussed:

- The fuel vehicle operators may return to the practice of placing cone markers around the vehicle during refuelling
- The fuel company will continue and expand on the Fuel Hazards induction courses to each new intake of students, covering safety and best practice around aircraft and fuel vehicles. Students

Refuelling regulations

Further information on Aircraft Safety Precautions during Fuelling Operations can be found in the CASA Civil Aviation Orders 20.9 part 4.5 at:

- www.comlaw.gov.au/Details/F2011C00881/Download

General details

Occurrence details

Date and time:	6 June 2014 – 1530 WST	
Occurrence category:	Serious incident	
Primary occurrence type:	Ground operations – taxying collision	
Location:	Jandakot Airport, Western Australia	
	Latitude: 32° 05.85’ S	Longitude: 115° 52.87’ E

Aircraft details

Manufacturer and model:	Grob – Burkhart Flugzeugbau	
Registration:	VH-ZYM	
Serial number:	82015/C2	
Type of operation:	Flying training - solo	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Minor	

Potential fuel exhaustion event involving a DHC Beaver, VH-AWI

What happened

On 2 August 2014, the pilot of a de Havilland DHC-2 (Beaver) aircraft, registered VH-AWI, prepared to conduct two return charter flights from Shute Harbour to Whitehaven Beach, Queensland as specified on the company schedule for that day (Figure 1).

Figure 1: VH-AWI

Source: Operator

The pilot calculated the fuel required based on the two return flights. The company operations manual specified that standard route times of 12 minutes from Shute Harbour to Whitehaven Beach and 13 minutes for the reciprocal flight were to be used. For planned flights of less than 30 minutes flight time, 30 minutes fixed reserve fuel was to be carried and the aircraft fuel consumption rate was 100 L per hour. The pilot calculated the two return flights of 25 minutes plus 4 minutes of taxiing for each sector and 30 minutes reserve equated to a total of 96 minutes of fuel. He then filled the rear tank which held 130 L and added fuel to the front tank to carry a total of 170 L of fuel. The pilot crosschecked his fuel calculations with another company pilot and both verified the fuel quantity required and that the total fuel endurance on board was 102 minutes.

The pilot planned to fly one group of five passengers plus a staff member to Whitehaven Beach, return solo to Shute Harbour, and take a second group of five passengers to Whitehaven Beach. The pilot would then wait at Whitehaven beach for about one hour before returning to Shute Harbour with the first group of passengers. After disembarking the passengers, the pilot would return solo to Whitehaven Beach, collect the second group of passengers and return to Shute Harbour. During the planning, the pilot had omitted to include the solo ferry flights in the fuel calculations.

During the cruise on the final flight to Whitehaven Beach, the pilot updated the fuel log and realised that he had planned for two return flights and omitted to allow additional fuel for the two empty sectors. He calculated that although he may have to use some of the reserve fuel to complete the return flight, he expected to land back at Shute Harbour with about 7 minutes of fuel remaining on board. The pilot conducted a risk assessment and elected to collect the passengers from Whitehaven Beach and return to Shute Harbour as planned.

At that time, the fuel gauge indicated the rear tank in excess of ¼ full, or with about 35 L. Prior to arriving at Whitehaven, the pilot ensured all remaining fuel in the front tank was used and then switched to the rear tank.

The pilot landed the aircraft close to the passenger pick-up point to reduce taxi time, collected the passengers for the flight and conducted a short taxi and take-off for the estimated 12 minute flight to Shute Harbour. The pilot was mindful of the low fuel status and climbed to about 1,500 ft to increase the height available if a glide approach was required.

The aircraft landed at Shute Harbour at 1708 Eastern Standard Time (EST) and the pilot and passengers disembarked. The following day, the pilot added 124 L of fuel to the rear tank, which indicated that about 6 L of fuel had been in the tank when the aircraft landed the previous day, significantly less than the required 50 L reserve.

Pilot comments

The pilot of AWI provided the following comments:

- On the solo flights he was making up time by flying on a direct route and landing close to the shoreline to reduce taxi distance.
- The fuel system at Shute Harbour was not operational and an airport staff member was required to attend when pilots were refuelling aircraft. The airport staff had left for the day and the expected time required for their attendance may have resulted in the passengers not being collected prior to last light and therefore being stranded overnight at Whitehaven Beach.
- As the entire flight was conducted over water in a seaplane, he had the option to land at any stage if required.
- The front fuel tank gauge did not provide an accurate indication of fuel quantity.
- There was no means to 'dip' the rear fuel tank or externally verify the fuel quantity remaining.
- The first flight was scheduled to depart at 1230 but was delayed about one hour due to a delay earlier in the day. He was attempting to expedite the turnaround times to ensure the passengers had the allotted two hours at the beach and to return well before last light.
- Only the passenger flights were recorded on the company flight schedule, not the solo sectors. Both company pilots based calculations on two return flights not three.
- He had been distracted by organisational concerns during the fuel planning stage.

Operator comments

The operator of AWI provided the following comments:

- Last light on the day was 1810.
- Other options available for refuelling existed at Hayman and Hamilton Islands.
- As a standard procedure, company pilots carried a minimum of 130 L of fuel for a return flight to Whitehaven Beach. There was substantially less than 130 L fuel on board when the aircraft departed Shute Harbour for the third return flight to Whitehaven Beach.
- A company aircraft was at Whitehaven Beach when the pilot of AWI realised the low fuel status. The pilot of the other aircraft was not made aware of the situation and may have been able to return to retrieve the remaining passengers.
- Conducting all checks thoroughly and maintaining an accurate fuel log may assist in preventing similar incidents occurring in the future.

Safety message

This incident highlights the importance of establishing a known fuel status regularly and the impact distractions can have at critical times including during flight planning. The report *Avoidable Accidents No. 5 – Starved and exhausted: Fuel management aviation accidents*, describes procedures that pilots can use before and during a flight to ensure they have sufficient fuel to land at their destination with reserve fuel intact. The publication is available at www.atsb.gov.au/publications/2012/avoidable-5-ar-2011-112.aspx.

General details

Occurrence details

Date and time:	2 August 2014 – 0900 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Low fuel	
Location:	Shute Harbour (ALA), Queensland	
	Latitude: 20° 16.70' S	Longitude: 148° 45.33' E

Aircraft details

Manufacturer and model:	de Havilland Canada DHC-2	
Registration:	VH-AWI	
Serial number:	298	
Type of operation:	Charter	
Persons on board:	Crew – 1	Passengers – 5
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

VFR into IMC involving a Cessna 206, VH-NCR

What happened

On 26 July 2014, the pilot of a Cessna 206, registered VH-NCR, prepared to conduct a private flight from Dubbo, New South Wales, to Gold Coast and Archerfield, Queensland, with three passengers on board. The pilot planned to conduct the flight under the visual flight rules (VFR) and obtained the relevant weather forecasts for the route including area and aerodrome forecasts. Low cloud on the ranges was forecast, including broken stratus cloud with tops around 5,000 ft, scattered cumulus and stratocumulus cloud with tops around 12,000 ft and isolated cumulonimbus clouds with tops around 25,000 ft were forecast associated with a passing front.[1]

The aircraft departed Dubbo at about 1340 Eastern Standard Time (EST), and when about 15 NM south of Inverell, the pilot observed the weather deteriorating and low cloud about the ranges, and elected to climb and operate VFR on top of the cloud.[2] He expected to be able to navigate around the isolated towering cumulonimbus cells. However, as the aircraft climbed above 5,000 ft, the pilot observed a widespread frontal mass of cloud with tops around 12,000 ft. At about 1550 EST, the pilot contacted Brisbane Centre air traffic control (ATC) and advised them of the situation. He requested navigation assistance and ATC provided updated weather information for Armidale and Coffs Harbour airports. ATC advised that the lowest safe altitude in that area was 6,000 ft above mean sea level.

The pilot initially considered a diversion to Moree, however he was able to descend through a break in the cloud and elected to divert to Inverell. When about 5 NM from Inverell, the pilot was unable to sight the airport and became concerned about the lowering cloud base in the area. He decided to turn to track south-west and commenced a turn however, while passing about 3,800 ft during the turn, the aircraft entered cloud. The pilot immediately applied full power and commenced climbing until the aircraft became clear of cloud at about 5,000 ft. While in cloud the pilot switched off the aircraft strobe lights.

The pilot advised ATC that he had inadvertently entered cloud and ATC provided updated weather forecasts for Tamworth and Gunnedah airports. The pilot then commenced a diversion to Tamworth, however the weather was deteriorating at Tamworth and, at about 1626 EST the pilot diverted to Gunnedah and was able to remain in visual meteorological conditions (VMC) for the duration of the flight. The aircraft landed in Gunnedah at about 1650.

Pilot comments

The pilot provided the following comments:

- The main difference between his expectation of the weather based on the forecast and the actual weather he was confronted with was that rather than isolated cumulonimbus clouds, there appeared to be a full front of towering clouds with no gaps.
- Despite having read many publications regarding inadvertent flight into IMC and how to avoid it, he was unprepared for the actual experience of entering marginal conditions. Without set criteria of when to turn back, he was uncertain how far to continue on, particularly when within 5 NM of Inverell aerodrome.

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

2 For provisions regarding VFR flight on top of cloud, see www.casa.gov.au/wcmswr/_assets/main/pilots/download/vfr/vfrg-whole.pdf

- In future he would be more decisive and act earlier when electing to turn back.

Safety message

Pilots are encouraged to make conservative decisions when considering how forecast weather may affect their flight. If poor weather is encountered en route, timely and conservative decision making may be critical to a safe outcome. VFR pilots are also encouraged to familiarise themselves with VMC criteria detailed in *Aeronautical Information Publication (AIP) Australia*, and carefully consider available options where forecast or actual conditions are such that continued flight in VMC cannot be assured.

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is flying with reduced visual cues, www.atsb.gov.au/safetywatch/flying-with-reduced-visual-cues.aspx.

Under visual flight rules (VFR), it is crucial that pilots have sufficient visual reference to see and avoid obstacles. Visual cues are required for VFR pilots to maintain orientation and therefore control of the aircraft. Cloud can reduce visibility to the extent that a pilot may be unable to see and avoid obstacles.

The ATSB recently published *Avoidable Accidents No. 4 – Accidents involving Visual Flight Rules pilots in Instrument Meteorological Conditions* www.atsb.gov.au/publications/2011/avoidable-4-ar-2011-050.aspx. A key message outlined in the report is:

> *Pressing on in to IMC conditions with no instrument rating carries a significant risk of severe spatial disorientation due to powerful and misleading orientation sensations in the absence of visual cues. Disorientation can affect any pilot, no matter what their level of experience.*

General details

Occurrence details

Date and time:	26 July 2014 – 1550 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	VFR into IMC	
Location:	28 km S of Inverell aerodrome, New South Wales	
	Latitude: 30° 08.05' S	Longitude: 151° 05.30' E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company 206G	
Registration:	VH-NCR	
Serial number:	U20605336	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 3
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Helicopters

Ground strike and loss of control involving a Robinson R22, VH-HAY

What happened

VH-HAY

Source: Operator

On 18 May 2014, a Robinson Helicopter Company R22 Beta aircraft, registered VH-HAY, was being operated to conduct cattle mustering on GoGo Station, near Fitzroy Crossing, Western Australia. The pilot was the sole person on board.

Nearing the end of the day, at about 1645 Western Standard Time (WST), as the pilot was manoeuvring the helicopter at low level to muster the cattle into a yard; the tail rotor struck the ground.

The helicopter commenced a severe right yaw. The pilot kept the helicopter in a clear area, while it rapidly completed about four full 360° rotations to the right. During this process it gained height to about 50 ft above the ground.

To arrest the yaw, the pilot immediately closed the throttle, resulting in a rapid rate of descent. In an attempt to lessen the rate of descent, the pilot raised the collective. The helicopter struck the ground heavily, and then rolled onto the right side. The pilot sustained serious injuries and the helicopter was substantially damaged (Figure 1).

Pilot comments

The pilot reported that the movement of the cattle in the yard made the conditions very dusty. This, along with the operation being toward the end of daylight, reduced the visibility.

Operator comments

The operator advised that the helicopter was operating a little too close to the ground. Also, as the pilot initiated the turn just prior to the tail strike, the tail rotor was too close to the ground.

Tail rotor anti-torque system

On United States designed single rotor helicopters such as the Robinson R22, the main rotor rotates counter clockwise as viewed from above. The torque to drive the main rotor causes the fuselage of the helicopter to rotate in the opposite direction (nose right). The anti-torque system (tail rotor) provides thrust, which counteracts this torque and provides directional control.

In this accident, once the tail rotor struck the ground, the helicopter was without this anti-torque system, resulting in the helicopter fuselage yawing nose right.

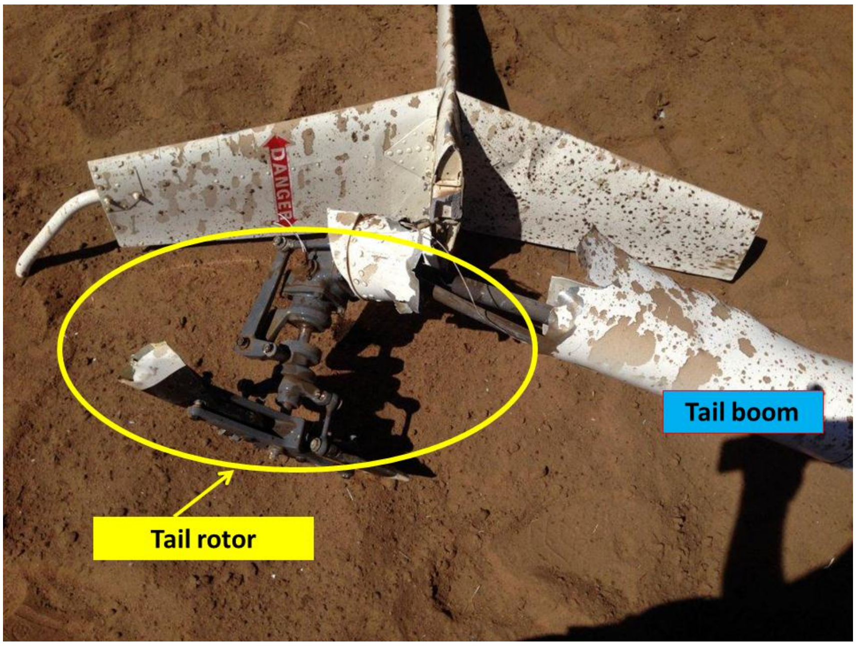
ATSB comment

The risks in low level mustering are well known. Low level operations leave little margin for error. The added risk factors of operating in a dusty environment, and in the hour before last light would have reduced that margin.

Figure 1: VH-HAY damage

Source: WA Police

Figure 2: Tail rotor damage



Source: WA Police

General details

Occurrence details

Date and time:	18 May 2014 – 1645 WST	
Occurrence category:	Accident	
Primary occurrence type:	Ground strike	
Location:	Fitzroy Crossing Aerodrome 168° T 37 km	
	Latitude: 18° 10.92.' S	Longitude: 125° 33.52' E

Aircraft details

Manufacturer and model:	Robinson Helicopter Company - R22 BETA	
Registration:	VH-HAY	
Serial number:	4412	
Type of operation:	Aerial work - mustering	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Serious	Passengers – Nil
Damage:	Substantial	

Wirestrike involving a Robinson R66, VH-JRX

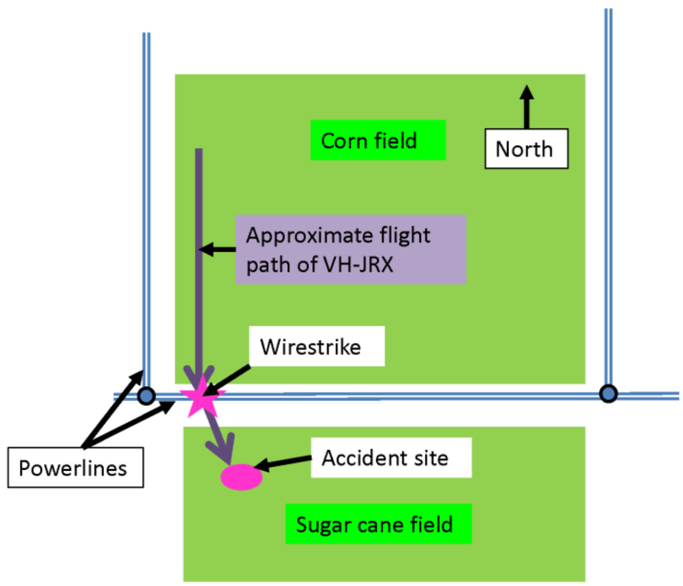
What happened

On 20 August 2014, the pilot of a Robinson R66 helicopter, registered VH-JRX, conducted a site inspection from a vehicle prior to commencing aerial spraying near Giru, Queensland. The pilot identified powerlines running along the eastern, southern and western boundaries of the paddock to be sprayed. He then conducted a flight over the paddock and assessed the hazards in the area and confirmed he was able to see all of the powerlines he had identified from the ground.

As the wind was from the east-north-east, at about 1500 Eastern Standard Time (EST), the pilot commenced aerial spraying in an east-west direction. At the end of each run, the pilot climbed the helicopter up and over the powerlines, turned north then descended once clear of the powerlines and sprayed the paddock in the opposite direction.

At about 1645, after completing 14 loads of spraying, the pilot commenced the final clean-up run. The helicopter was operating from north to south along the western boundary of the paddock, parallel to the powerlines (Figure 1). The pilot was aware of those powerlines, however when about 5 m from the southern boundary, he sighted the powerlines running perpendicular to the direction of flight. The pilot assessed that it was too late to climb over the powerlines and elected to fly underneath them. The crop was about 6 ft tall and the pilot wanted to ensure the helicopter remained above the crop.

Figure 1: Approximate flight path of VH-JRX



Source: Pilot recollection

The main rotor blade hub struck the powerlines and the helicopter collided with the ground. The helicopter was substantially damaged (Figure 2) and the pilot sustained minor injuries.

Figure 2: Damage to VH-JRX

Source: Operator

Pilot comments

The pilot of VH-JRX provided the following comments:

- He had sprayed parallel to the wire which JRX struck and his attention was on the other powerlines that he had to climb over on each run.
- Normally he would do an extra check of the paddock prior to commencing the clean-up run, but he omitted it on this day.

Safety message

Research conducted by the ATSB identified 180 wirestrike accidents between 2001 and 2010. Of these, 100 occurred during agricultural operations. The research report cautioned pilots to conduct an aerial reconnaissance to confirm wire locations and other hazards. Having a plan and a procedure to minimise the risk of wirestrike is a valuable mitigation strategy. The ATSB report *Wirestrikes involving known wires: A manageable aerial agriculture hazard* is available at www.atsb.gov.au/publications/2011/avoidable-2-ar-2011-028.aspx.

For further risk management strategies for agricultural operations, the Aerial Application Pilots Manual is available from www.aerialag.com.au/Home.aspx.

General details

Occurrence details

Date and time:	20 August 2014 – 1700 EST	
Occurrence category:	Accident	
Primary occurrence type:	Wirestrike	
Location:	near Giru, Queensland	
	Latitude: 19° 35.15' S	Longitude: 147° 05.20' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R66	
Registration:	VH-JRX	
Serial number:	0151	
Type of operation:	Aerial agriculture	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – 1 (Minor)	Passengers – Nil
Damage:	Substantial	

Australian Transport Safety Bureau

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

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

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

Purpose of safety investigations

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

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

About this Bulletin

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

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

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

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

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

Conducting these Short investigations has a number of benefits:

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

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Short Investigations
Aviation Short Investigations Bulletin Issue 35
AB-2014-146
Final – 15 October 2014