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Operational event involving an Airbus A320, VH-VNQ

What happened

During the evening on 15 February 2014, the crew of a Tiger Airways A320 aircraft, registered VH-VNQ, was preparing for a flight from Hobart, Tasmania to Melbourne, Victoria. The crew had earlier completed flights from Melbourne to Sydney, New South Wales, and return, and from Melbourne to Hobart. The return flight from Hobart to Melbourne was the crew's final flight for the day. The first officer (FO) was the pilot flying for the return flight to Melbourne.

The flight was operating as a training flight for the FO who had recently joined the operator and was undergoing line training. The FO had completed a number of flights with a safety pilot present as part of the operator's normal line training program. The flight from Melbourne to Hobart was the FO's first flight without a safety pilot present. That flight was uneventful, although the crew encountered some weather on arrival in the Hobart area, requiring minor track diversions.

During the turn-around at Hobart, the FO entered relevant data into the flight management guidance system (FMGS)[1] in preparation for the return sector to Melbourne. This data entry included the runway in use (runway 12), the planned departure procedure, which at that stage was the Launceston Alpha 3 Standard Instrument Departure (SID), and relevant take-off data. Take-off data entered by the crew included take-off reference speeds (commonly referred to as V speeds)[2] and a flexible (flex) temperature.[3] The captain checked the FMGS entries and the crew briefed the information in accordance with the operator's procedures prior to engine start. The crew started engines at about 2020 Eastern Daylight-saving Time and commenced taxi for runway 12 soon after. During the taxi, the crew completed the applicable parts of the operator's before take-off checklist,[4] which included a check to confirm that runway 12 was set in the FMGS as the departure runway (Figure 1).

With thunderstorms in the area, the captain elected to delay departure and wait at holding pilot Charlie for the weather to clear (Figure 2). The weather proved more persistent than anticipated, resulting in a delay of about 75 minutes, while the crew continued to wait at the holding point.

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1 The FMGS performs a range of functions including lateral and vertical navigation, flight plan management and aircraft performance prediction and optimisation. The system includes two Flight Management Guidance Computers (FMGCs), two (typically) Multipurpose Control and Display Units (MCDUs), a Flight Control Unit (FCU) and two Flight Augmentation Computers (FACs). The MCDUs (one available to each pilot on the centre pedestal) allow the flight crew to enter and display a wide range of navigation and performance data, and provide a flight crew interface to the FMGCs for flight path and speed management. The FCU (located on the glare-shield) provides another interface to the FMGCs, typically used for short term profile and speed management, and to allow flight crew to switch between managed and selected auto-flight modes.

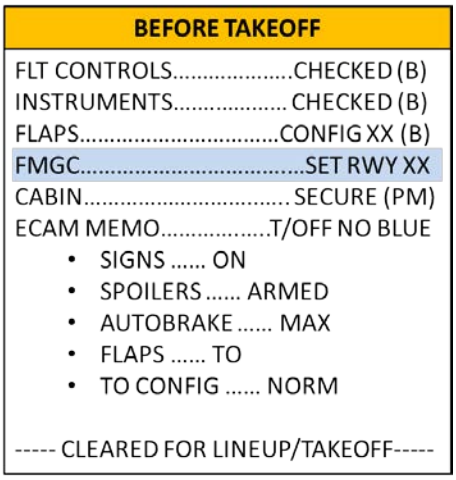
2 Take-off reference speeds (V speeds) are:

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

3 Flex temperature (higher than the actual ambient temperature) is entered by the crew to allow for a reduced thrust (flex temperature) take-off.

4 The before take-off checklist is broken into two parts – the first part, referred to as 'down to the line', is normally completed during taxi, before the aircraft enters the runway. The second part, referred to as 'below the line', is not completed until the crew is cleared to enter the runway by Air Traffic Control.

Figure 1: Operator's before take-off checklist (down to the line)



BEFORE TAKEOFF

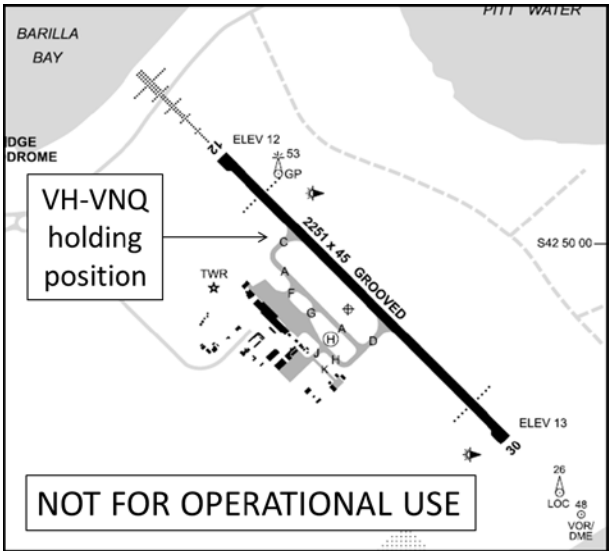
FLT CONTROLS....................CHECKED (B)
INSTRUMENTS................... CHECKED (B)
FLAPS.................................CONFIG XX (B)
FMGC....................................SET RWY XX
CABIN.................................. SECURE (PM)
ECAM MEMO..................T/OFF NO BLUE

- SIGNS ...... ON
- SPOILERS...... ARMED
- AUTOBRAKE ...... MAX
- FLAPS ...... TO
- TO CONFIG ...... NORM

----- CLEARED FOR LINEUP/TAKEOFF-----

Source: Operator – layout modified by the ATSB

Figure 2: Hobart airfield diagram illustrating VH-VNQ’s holding position (holding point Charlie)



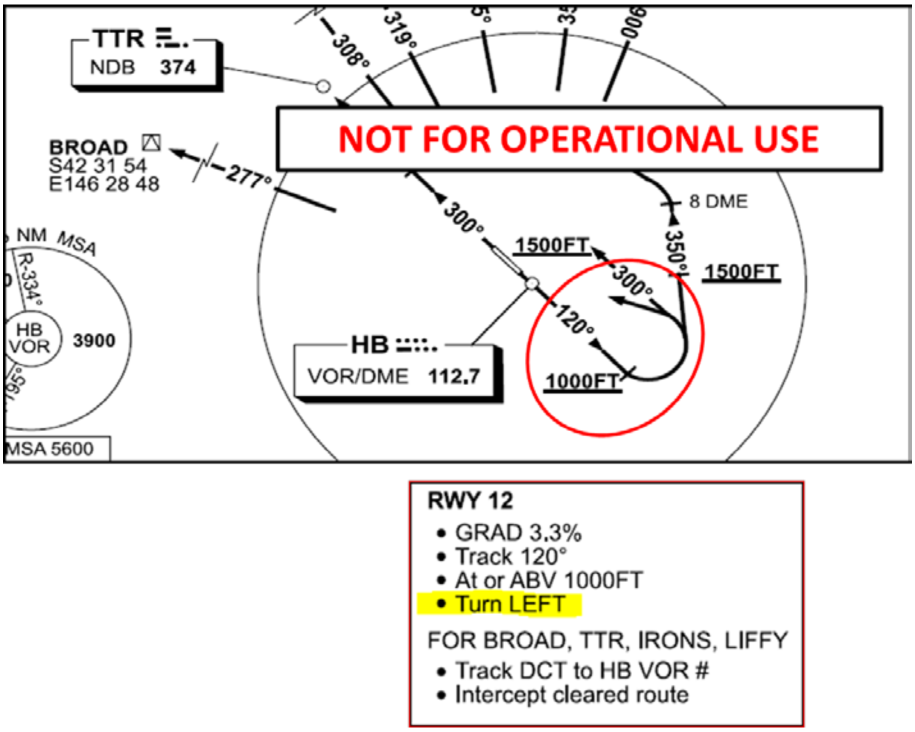
Source: Airservices Australia – modified by the ATSB

At about 2140, satisfied that the weather had cleared sufficiently to facilitate a safe departure, the crew entered the runway and back-tracked toward the threshold of runway 12. As they back-tracked on the runway, the crew were able to build a better appreciation of the weather to the north of the airport and along the intended departure route. The captain discussed the weather and departure options with Air Traffic Control (ATC), and the crew were subsequently re-cleared to conduct the Tea Tree (TTR) One SID (Figure 3).

The initial part of the TTR One SID required that the aircraft climb straight ahead after take-off, before making a left turn at or above 1,000 ft. Upon loading the TTR One SID into the FMGS however, the crew noticed that the navigation display[5] indicated a right turn during the departure, contrary to the left turn required by the published procedure. The captain was aware that all Hobart runway 12 SIDs required a left turn after take-off to avoid high terrain to the west, and that the indicated right turn was clearly incorrect.

5 Each pilot has a navigation display that presents a range of information including the FMGS-programmed lateral track.

Figure 3: Excerpt from the Hobart SID North chart showing key points of the TTR One SID



Source: Airservices Australia – modified by the ATSB

In an attempt to clear the anomaly, the captain selected the reciprocal runway (runway 30) in the FMGS as the departure runway, before re-selecting runway 12. This was unsuccessful, and the navigation display continued to indicate that a right turn was required during the departure.

The crew were concerned at this point that the apparent break in the weather may be relatively brief and were mindful that another aircraft was also waiting for an opportunity to depart. In view of the circumstances, rather than persist with further attempts to clear the anomaly, the crew elected to continue with the departure, planning to use heading (HDG) mode to command a left turn in accordance with the published procedure, rather than allowing the auto-flight system to command a right turn in navigation (NAV) mode.[6] The crew planned to climb straight ahead to an appropriate altitude before pulling the heading/track selector knob on the FCU to engage HDG mode, and then command a left turn using the heading selector knob to continue the departure.

The crew were unaware at the time, but by momentarily changing the runway in an attempt to clear the apparent departure anomaly, take-off reference speeds and the flex temperature previously entered into the FMGS (on the PERF TAKE OFF page of the MCDU) had been removed. The FMGS stores the previously entered data and displays it on the PERF TAKE OFF page in a reduced font size adjacent to the position in which the active data is normally displayed. Under these conditions, the take-off reference speeds are removed from each pilot's primary flight display airspeed indicator and an amber message 'CHECK TAKE OFF DATA' appears in the scratchpad of the MCDU.[7] A 'CONFIRM TO DATA' prompt also appears on the PERF TAKE OFF page to allow the crew to revert to the previously entered take-off data by pushing a single line select key (adjacent to the 'CONFIRM TO DATA' prompt).

As the crew positioned the aircraft at the threshold of runway 12, they were heavily occupied with weather assessment (including use of the aircraft weather radar) and communication with ATC,

6 NAV is a managed mode. In NAV mode, the auto-flight system follows the FMGS-programmed lateral path. HDG is a selected mode. When HDG is selected by the crew, the FMGS steers the aircraft according to the heading selected by the crew on the FCU.

7 The MCDU scratchpad refers to the bottom line of the MCDU display window, used among other things to facilitate MCDU data entry, and to display FMGS messages.

reviewing departure requirements and managing normal checklist procedures. The crew had completed the remainder of the before take-off checklist (below the line) after entering the runway in accordance with the operator's procedures, but nothing in that checklist required the crew to conduct another review of the FMGS take-off data, and nothing drew their attention to the 'CHECK TAKE OFF DATA' message in the MCDU scratchpad.

The take-off was commenced at about 2142, with the FO advancing the thrust levers to the flex temperature take-off thrust/maximum continuous thrust (FLX/MCT) detent – the setting used during a flex temperature (reduced thrust) take-off. As the take-off was commenced however, a number of things happened at about the same time:

- The crew noticed that flight mode annunciator (FMA)[8] indications were not as they would normally appear during a flex temperature take-off when the thrust levers are set to the FLX/MCT detent (Figure 4):
  - Auto-thrust mode (column 1) normally displays MAN FLEX XX (where XX represents the flex temperature entered by the crew). In this case, available data indicates that no auto-thrust mode information initially appeared on the FMA.
  - Vertical auto-flight mode (column 2) normally displays SRS (speed reference system), which provides guidance to maintain speed within defined parameters after take-off. In this case, available data indicates that no vertical auto-flight mode information initially appeared on the FMA.
  - Lateral auto-flight mode (column 3) normally displays RWY (runway) which provides guidance with respect to the runway centre-line during take-off.[9] In this case, available data indicates that no lateral auto-flight mode appeared on the FMA until the thrust levers were further advanced as the take-off continued (see following account).
  - Column 5 normally indicates that both flight directors are engaged (1FD2) and that the auto-thrust system is armed (A/THR appears in blue). In this case, available data indicates that both flight directors were engaged as normal (although the flight director bars do not appear on the primary flight displays until the corresponding vertical or lateral mode is active), but the auto-thrust system status annunciation initially remained blank (the auto-thrust system did not arm as it normally would when the thrust levers were advanced).
- The crew received an electronic centralised aircraft monitoring (ECAM) system caution (ENG THR LEVERS NOT SET) alerting them that the thrust levers were not set in accordance with the Full Authority Digital Engine Control system thrust mode.
- The crew noticed that the take-off reference speeds were not displayed on the primary flight display airspeed indicators as expected.

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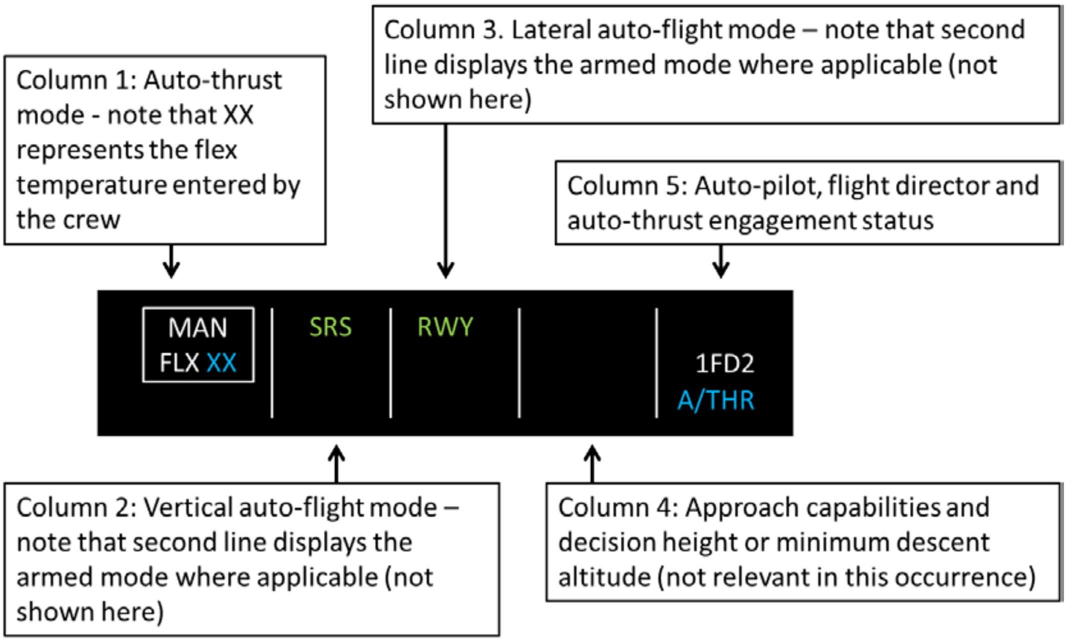
8 The FMA is positioned at the top of each pilot's primary flight display. It provides a range of information, including the auto-thrust system mode of operation, active and armed vertical and lateral auto-flight (auto-pilot/flight director) modes, and the engagement status of the auto-pilot, flight directors and auto-thrust system.

9 RWY is only displayed if the runway in use is equipped with a localiser (a ground installation normally associated with an instrument landing system that can be used to provide lateral guidance with respect to the runway centre-line). If the runway is not equipped with a localiser, RWY TRK (runway track) is normally displayed. Runway 12 at Hobart is equipped with a localiser.

Figure 4: Representation of typical FMA indications during a flex temperature take-off when the thrust levers are set to the FLX/MCT detent



Source: ATSB

In response to the ECAM caution message, the captain advanced the thrust levers to the take-off/go-around (TOGA) setting.[10] This action took place as the aircraft was accelerating through about 60 kt. RWY appeared as the lateral auto-flight mode as the thrust levers were advanced to the TOGA setting, but the vertical auto-flight mode annunciation remained blank, and the auto-thrust system did not arm.

The captain noticed the 'CHECK TAKE OFF DATA' message on the MCDU scratchpad and immediately selected the MCDU line select key corresponding to 'CONFIRM TO DATA' on the MCDU PERF TAKE OFF page. This action restored the previously entered take-off data and enabled display of the take-off reference speeds on the airspeed indicators, but the FMA vertical auto-flight mode still remained blank.

The crew continued the take-off and, in the absence of vertical auto-flight mode SRS guidance, the FO set the pitch attitude to about 15° nose up after lift-off (consistent with the manufacturer's guidance with respect to a typical take-off pitch attitude after lift-off, with both engines operating). Soon after the aircraft lifted off, the lateral auto-flight mode sequenced to runway track (RWY TRK) mode (consistent with normal system behaviour), essentially guiding the aircraft straight ahead, on the track that existed at the time of mode engagement.

Soon after RWY TRK mode engaged, the vertical auto-flight climb (CLB) mode engaged. In CLB mode, flight guidance is determined by the vertical path defined in the FMGS. The crew engaged the auto-pilot soon after the aircraft climbed through about 1,000 ft, and at about the same time, RWY TRK was replaced by navigation (NAV) as the lateral auto-flight mode. In NAV mode flight guidance is determined by the lateral path defined in the FMGS.

[10] The captain took control of the thrust levers after the FO had set them to the FLX/MCT detent, in accordance with the operator's procedures. The captain commented that the ECAM message 'ENG THR LEVERS NOT SET' sometimes appears because the thrust levers have not been positioned accurately in the FLX/MCT detent. The captain's response was to advance the thrust levers to TOGA based upon experience with similar training scenarios. By advancing the thrust levers to the TOGA setting, maximum available engine thrust was commanded.

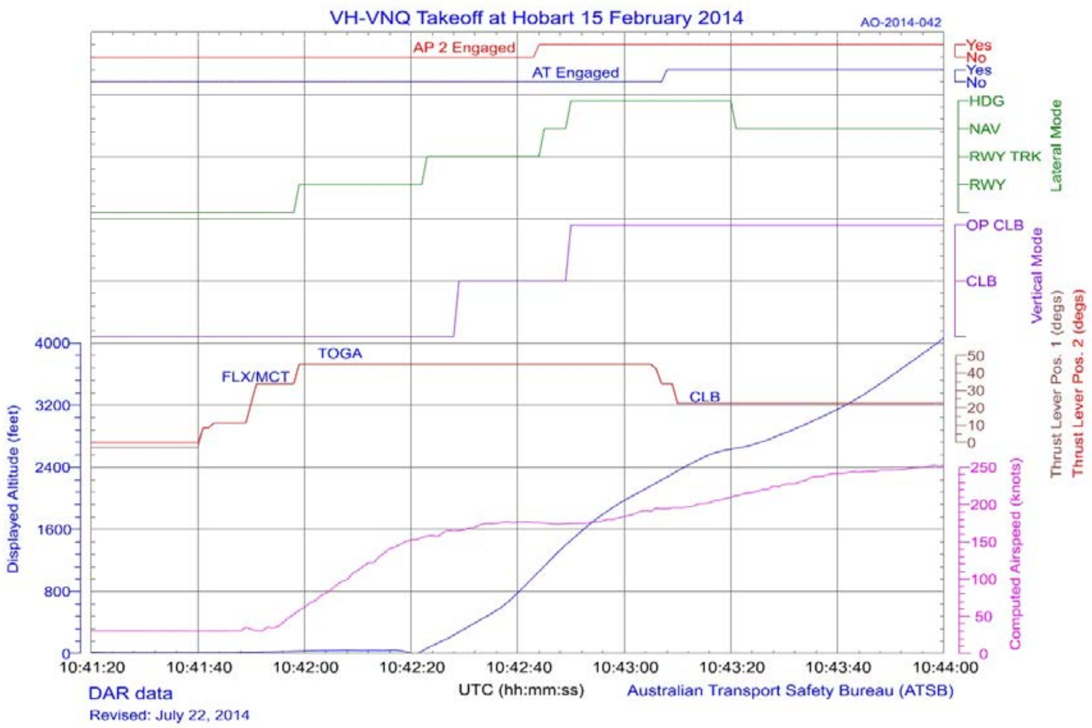
Moments after NAV mode engaged, the crew pulled the heading/track selector knob on the FCU to engage HDG mode as planned. When HDG mode was selected, the vertical auto-flight mode sequenced to open climb (OP CLB), consistent with normal system behaviour. In OP CLB mode, the aircraft climbs to the altitude selected by the crew on the FCU, disregarding any intervening altitude constraints. In HDG mode, the crew steered the aircraft into a left turn using the heading selector on the FCU to comply with the documented departure procedure.

During the initial part of the climb, the aircraft continued to accelerate, before the speed stabilised at about 175 kt. While the initial climb speed of the aircraft was higher than the speed that would have been commanded by SRS guidance had that mode been active, the initial climb angle still substantially exceeded the minimum climb performance requirements. The crew allowed the aircraft to accelerate further passing about 2,000 ft, following which the thrust levers were retarded to the climb (CLB) detent. The auto-thrust system was armed by the crew as the thrust levers were retarded, and sequenced to active when the thrust levers reached the CLB detent.[11] The crew re-engaged NAV mode as the aircraft climbed through about 2,700 ft and the flight to Melbourne continued uneventfully. A graphical representation of some relevant flight parameters, thrust lever position and auto-flight system modes is included below (Figure 5).

Crew comments

Leading up to the time the crew entered the runway for departure, they were mindful of the aircraft fuel state, given the amount of fuel consumed while they waited at the holding point and some concern about weather variations and the associated holding fuel requirements at the destination (Melbourne). At the same time, the crew were constantly assessing the weather situation surrounding Hobart, and departure options.

Figure 5: Flight data illustrating selected parameters and auto-flight guidance modes



Source: ATSB

11 The thrust levers are normally set to the FLX/MCT detent or TOGA position for take-off, then retarded to the CLB detent as the aircraft passes the thrust reduction altitude or otherwise as required by the crew. When both engines are operative and the thrust levers are retarded to the CLB detent, the auto-thrust system sequences from armed to active.

The crew commented that they were busy following runway entry, reviewing the planned departure procedure, addressing the departure anomaly, reviewing weather in the direction of departure (including use of the aircraft weather radar) and completing checklist requirements. Additionally, the crew were concerned that the window of opportunity for departure may be limited given the unpredictable nature of the surrounding weather.

Although both pilots were compliant with the operator's duty and rest requirements, they were both feeling the effects of a relatively long day, and were nearing the end of a demanding series of duty days. The FO had been under training during the days leading up to the incident, imposing a greater cognitive workload on both the FO and the captain than might normally be the case.

The captain did not consider that the FMGS and FMA anomalies (that only became apparent after the take-off had been commenced) were sufficiently serious to reject the take-off. The captain commented that the decision to continue the take-off was based on an immediate assessment that the aircraft was able to be safely flown under the circumstances, and that a rejected take-off may be difficult given the combined effects of a relatively heavy aircraft and a wet and relatively short runway.

Had the captain been unable to quickly restore the take-off reference speeds, the crew could have referenced the take-off and landing data (TOLD) card for take-off reference speed information. Take-off reference speeds are written on the TOLD card during departure preparation, and the card is visible to both pilots during take-off and departure.

Operator's investigation

The operator made several comments and observations regarding the incident, some of which are broadly summarised as follows:

- There had been no previous reports indicating a database discrepancy with respect to the direction of turn during the TTR One SID at Hobart, and attempts to replicate the discrepancy in a simulator using the same database were unsuccessful.
- The operator's before take-off checklist requires that the crew confirm that the correct runway is set in the FMGS, before entering the runway. The checklist does not require the crew to review take-off reference speeds or the flex temperature as part of that check. In contrast, the corresponding check in the manufacturer's A320 Quick Reference Handbook (QRH) used by the operator requires that the crew check take-off reference speeds and the flex temperature.[12]
- The crew conducted the before take-off procedures out of sequence, in that the checklist was not completed again after the FMGS was reprogrammed (runway was re-set).[13]
- The operator identified that the flight simulator used for flight crew cyclic training had a previous version of the FMGS software installed, leading to differences in MCDU presentation and crew responses. With a different software version, the operator was unable to recreate the scenario in entirety, and was therefore unable to fully evaluate the response of the FMGS (and auto-flight system) under the conditions relevant to this incident.
- The captain's decision to respond to the 'CHECK TAKE OFF DATA' message on the MCDU scratchpad and select 'CONFIRM TO DATA' during the take-off, had the potential to introduce other problems as the take-off continued.

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[12] Although consistency of the operator's checklist with that issued by the aircraft manufacturer is a significant point, it probably had little bearing on this incident. Had the operator's checklist replicated the manufacturer's A320 QRH, the take-off data would have been checked during conduct of the before take-off checklist, but it would still have been inadvertently removed when the captain subsequently and momentarily changed the departure runway.

[13] While this observation appears valid, it should be noted that nothing in the operator's procedures alerted the crew to any requirement to repeat the before take-off checklist following modification of data entered into the FMGS. The manufacturer's Flight Crew Operations Manual requires re-insertion of take-off reference speeds and the flex temperature following a runway change, but that requirement appears in the 'above the line' before take-off checklist, completed before the aircraft enters the runway.

ATSB comment

Although it was not an issue during this incident, flight crew are reminded that the use of a selected lateral mode such as HDG, means that the aircraft auto-flight system will not be tracking a defined lateral path. Under these circumstances, the auto-flight system reverts to a selected vertical auto-flight mode, which in this case was OP CLB. As such, procedural altitude constraints are not recognised by the auto-flight system. The manufacturer's Flight Crew Training Manual states that:

> *The crew should keep in mind that the use of HDG mode … will revert CLB to OP CLB and any altitude constraints in the MCDU F-PLN page*[14] *will not be observed unless they are selected on the FCU.*

Having elected to continue the take-off, the crew focussed their attention foremost on manually flying a safe vertical and lateral flight path, and managing the aircraft configuration. As such, the actions of the crew were consistent with Airbus 'Golden Rules for Pilots' (Figure 6), particularly the first 'golden rule'. Airbus 'Golden Rules for Pilots' are operational guidelines, introduced to help address the causes of many accidents and incidents, and assist with flight efficiency. The 'Golden Rules for Pilots' take into account the principles of flight crew interaction with automated systems, and the principles of crew resource management.

Figure 6: Airbus 'Golden Rules for Pilots'

Source: Airbus

[14] The MCDU F-PLN (flight plan) page is the page where flight plan lateral waypoints are displayed in sequence, along with any applicable speed and/or altitude constraints.

Safety action

The ATSB has been advised by Tiger Airways that, since this occurrence, the following safety actions have been implemented or are being considered by the operator:

- The operator has introduced a phased approach to align its procedures with those of the manufacturer. This transition includes:
  - Alignment of the before take-off checklist with the manufacturer's Flight Crew Operations Manual (FCOM).
  - Implementation of a revised crew briefing format (based upon risk assessment) that will provide additional threat and error management guidance to crews.
- The FCOM runway change procedure has been highlighted in educational material provided to flight crew (associated with update of the operator's procedures).
- The flight simulators used by the operator have been updated to accurately reflect the Flight Management Guidance Computer software status of operational fleet aircraft.
- The operator's training department is considering including the behaviour of the FMGS during this event in future pilot training scenarios.

Safety message

For operators, this incident highlights a number of important safety messages, including:

- The need for robust checklists and checklist management procedures that effectively cater for a wide range of operational scenarios, particularly with regard to safety-critical checklist items such as many of those that form part of before take-off procedures.
- The importance of ensuring that the performance of training equipment accurately reflects the performance of operational equipment. Any variance can undermine training effectiveness, and even lead to negative training.
- Although the operator could not replicate the FMGS database error (incorrect direction of turn) on this occasion, the incident nonetheless highlights the fundamental importance of consistently accurate FMGS aeronautical data.

While database anomalies are uncommon, flight crew should remain vigilant with respect to the possibility of a discrepancy between published data and the associated FMGS data. In this incident, the crew noted the apparent data anomaly and implemented a plan that ensured compliance with the published procedure. In another event involving a database error, an Airbus A320 on approach to Melbourne, Victoria, descended beneath its cleared altitude. A copy of the ATSB report dealing with that occurrence can be found at www.atsb.gov.au/publications/investigation_reports/2011/aair/ao-2011-070.aspx.

For flight crew, the incident also highlights the need for extra caution following an interruption to the normal sequence of events during preparation for departure. In an event with some similarities, an Airbus A380 departed Los Angeles International Airport without take-off reference speeds displayed. The associated ATSB investigation found that:

> *The runway change procedure was not entered in the aircraft's flight management guidance system in accordance with the operator's standard operating procedures, which resulted in the take-off speeds not being displayed during the take-off roll.*

A copy of the ATSB report dealing with that occurrence can be found at www.atsb.gov.au/publications/investigation_reports/2011/aair/ao-2011-151.aspx.

General details

Occurrence details

Date and time:	15 February 2014 – 2142 EST	
Occurrence category:	Incident	
Primary occurrence type:	Flight preparation	
Location:	Hobart Airport, Tasmania	
	Latitude: 42° 50.17’ S	Longitude: 147° 30.62’ E

Aircraft details

Manufacturer and model:	Airbus A320-232	
Registration:	VH-VNQ	
Operator:	Tiger Airways Australia	
Serial number:	5218	
Type of operation:	Air Transport High Capacity	
Persons on board:	Crew – Unknown	Passengers – Unknown
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

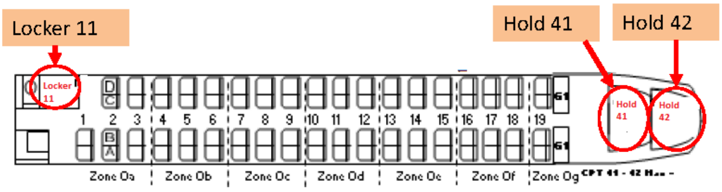
Turboprop aircraft

Loading event involving a Bombardier DHC-8, VH-LQK

What happened

On 25 August 2014, a QantasLink Bombardier DHC-8 aircraft, registered VH-LQK, was being prepared for a scheduled passenger flight to Blackall and then Longreach, from Brisbane Airport, Queensland. Ground handlers loaded bags into the aircraft in accordance with the load instruction report: 12 bags with destination Blackall and 47 bags for Longreach in hold 41; 20 bags for Longreach in hold 42; and nil bags or cargo in locker 11 (Figure 1).

Figure 1: Cargo hold diagram



Source: Operator

A ground handling agent transcribed the baggage information onto a call back card, but indicated there were 12 bags in hold 41 instead of 59 bags. The agent omitted to verify the card information with the loaded baggage. The call back card was then provided to the flight crew, who entered the baggage information into the iPad loading application to complete the final load sheet. During the cross check of the load sheet, the flight crew did not identify the discrepancy between the load sheet and provisional baggage information.

The aircraft departed Brisbane and arrived in Blackall at 0915 Eastern Standard Time, with no anomalies noted during the flight. A ground handler at Blackall completed the offload reconciliation procedure and identified a discrepancy of 47 bags or 676 kg in hold 41.

Weight and balance review

A subsequent review of the aircraft weight and balance indicated that the aircraft remained within centre of gravity limits and no structural limits were exceeded.

Operator investigation

An investigation conducted by the aircraft operator found the following:

- In June 2014, the company implemented a major change initiative to the company's approved loading system. This included flight crew performing load control functions using an iPad application and changes in loading related paperwork and ground handling procedures.
- The loading documentation procedure used, and the flight crew procedures used when calculating figures using the iPad loading application, had been superseded. A memo was issued to company flight crew reminding them of the correct procedures for using the loading application. The contractor responsible for aircraft loading has increased the supervision levels required when loading aircraft.

Safety message

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is about data input errors, www.atsb.gov.au/safetywatch/data-input-errors.aspx. Data input errors, such as the incorrect loading figures being used, occur for many different reasons. The consequences of these errors can include a range of aircraft handling and performance issues.

Accurate weight and balance information is essential for the safety of every flight. Following standard procedures and checklists minimise the potential for error.

General details

Occurrence details

Date and time:	25 August 2014 – 0715 EST	
Occurrence category:	Incident	
Primary occurrence type:	Loading related event	
Location:	Brisbane Aerodrome, Queensland	
	Latitude: 27° 23.05' S	Longitude: 153° 07.05' E

Aircraft details

Manufacturer and model:	Bombardier DHC-8-402	
Registration:	VH-LQK	
Operator:	Sunstate Airlines	
Serial number:	4415	
Type of operation:	Air Transport High Capacity - Passenger	
Persons on board:	Crew – 4	Passengers – 67
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Piston aircraft

Separation issue involving a Skyfox Aviation CA25N, 24-3265, and a Piper PA-28R, VH-WJO

What happened

At about noon on 03 July 2014, an instructor and student were conducting training in the circuit at Roma Airport, Queensland, in a Skyfox Aviation CA25N (Gazelle), registered 24-3265.[1] At the same time, a PA-28R, registered VH-WJO (WJO), was inbound to Roma Airport for a landing, on a solo pilot navigation exercise. WJO had overflown Taroom, and was tracking towards Roma from the north-east. Runway 36 was in use at Roma with a light breeze from the north, and the conditions were fine and clear.

When about 15 NM from Roma, the pilot of WJO reported inbound to Roma from the north-west (although the aircraft was actually to the north-east) on the Roma Airport Common Traffic Advisory Frequency (CTAF). With that transmission, the pilot indicated that he planned to overfly the airport at 2,500 ft above mean sea level (AMSL),[2] and join the circuit for runway 36. Based upon the inbound broadcast by the pilot of WJO, the Gazelle instructor anticipated that WJO would overfly the airport from the north-west and join the circuit from the non-active (eastern) side (Figure 1). The Gazelle instructor and student subsequently focussed their lookout accordingly, in an attempt to sight WJO.

About 5 minutes later, as he neared the airport, the pilot of WJO enquired about the Gazelle's current position. The Gazelle instructor responded that the Gazelle was about to turn crosswind. The pilot of WJO responded to the effect that he would follow the Gazelle onto the downwind leg of the circuit.

As the pilot of WJO was about to overfly the airport, he transmitted that he was still unable to sight the Gazelle, again indicating that he was overflying the airport from the north-west (although the inbound track was actually from the north-east). The Gazelle instructor responded with the position of the Gazelle, indicating that the Gazelle was approaching circuit altitude (2,000 ft AMSL), and was about to turn downwind. Soon after, the pilot of WJO reported overflying the airport at 2,700 ft AMSL, adding that he was tracking for a wide left base for runway 36 to accommodate the Gazelle.

About a minute after broadcasting that he was overflying the airport, the pilot of WJO reported that he was at 2,200 ft AMSL, adding that he was turning onto a wide downwind for runway 36. The pilot again requested the position of the Gazelle with this transmission.

At about the same time, as the Gazelle continued downwind, the instructor noticed the shadow of a second aircraft on the ground. He looked ahead and sighted WJO, passing from left to right (heading in approximately a south-westerly direction), about 100 metres ahead and about 200 ft above the Gazelle. He then advised the pilot of WJO that he had WJO sighted, and that the Gazelle was in the 7 o'clock position[3] relative to WJO.

The pilot of WJO was then able to sight the Gazelle over his left shoulder. Both aircraft continued for a full stop landing, the Gazelle landing ahead of WJO which flew a wider circuit.

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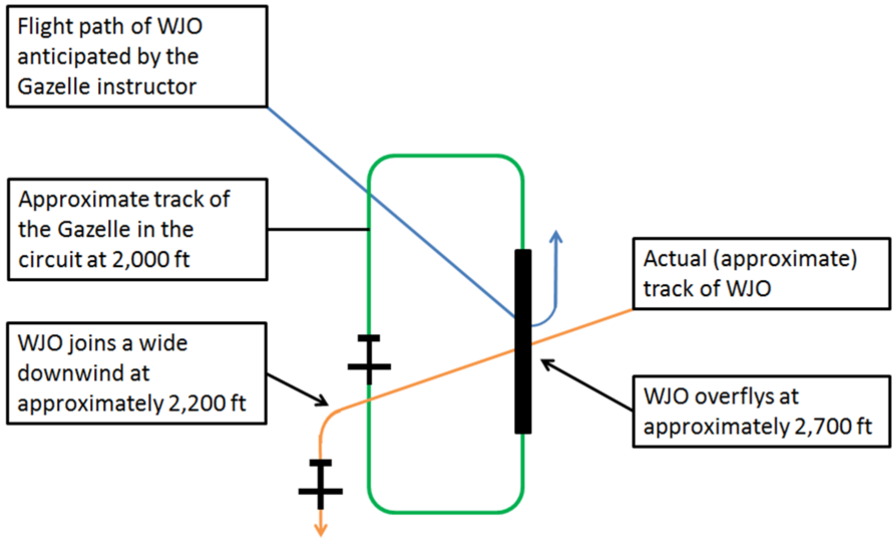
1 The Skyfox Aviation CA25N was registered on the Recreational Aviation Australia aircraft register.

2 The elevation of Roma Airport is 1,032 ft. 2,500 ft AMSL is therefore equivalent to about 1,500 ft above ground level.

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

Figure 7: Simplified representation of the incident



Source: ATSB

ATSB comment

Although both pilots were communicating on the CTAF and attempting to establish visual contact, separation seems to have been compromised on this occasion for a number of reasons, related primarily to the effectiveness of the communication and the limitations of each pilot's lookout.

The pilot of WJO inadvertently indicated that he was joining the circuit from the north-west, while the inbound track was actually from the north-east. Although the Gazelle instructor had been unable to sight WJO, he was satisfied that WJO was well behind him as he proceeded downwind. The perception of the Gazelle instructor was based upon CTAF communications from the pilot of WJO referring to the inbound track (from the north-west) and the intent to overfly the airport, and indications that WJO would follow the Gazelle onto downwind. The Gazelle instructor was surprised when he sighted WJO ahead and above.

Based upon his interpretation of the CTAF communications, the pilot of WJO believed that he would be clear of the Gazelle as he joined the circuit. He planned to fly a wide circuit to allow the Gazelle to continue inside his planned track, without interruption. No CTAF communications alerted the pilot of WJO to the fact that the Gazelle crew had not sighted his aircraft as he joined the circuit. The pilot of WJO later indicated that he would have discontinued his arrival and manoeuvred on the non-active side of the circuit if he believed that there was a problem with separation.

Aside from the communication issues discussed above, the ability of each pilot to sight the other aircraft was probably compromised to some degree by a number of factors, including the nature of construction of each aircraft and the geometry of occurrence. The PA-28 was above the Gazelle - the Gazelle has a high wing, while the PA-28 has a low wing, so the ability of each pilot to sight the other aircraft may have been compromised to some extent by wing structures. The pilot of WJO also commented that his ability to sight the Gazelle may have been affected by sun glare, particularly as he leaned forward (into the direct sunlight) to broaden his view of the circuit area. An ATSB research report titled *Limitations of the See-and-Avoid Principle* discusses a wide range of factors that may limit the effectiveness of a pilot's lookout. A copy of the research report is available on the ATSB website at www.atsb.gov.au/publications/2009/see-and-avoid.aspx.

Safety message

This incident highlights the important role of an effective lookout, complemented by accurate and timely communication. An ATSB booklet titled *A pilot's guide to staying safe in the vicinity of non-towered aerodromes* aims to provide pilots with an appreciation of the types of safety events that are associated with operations at non-controlled aerodromes, and provide education to assist pilots in being prepared for the related risks. The booklet includes some discussion regarding the importance of radio-alerted 'see-and-avoid' and an effective lookout. The booklet summary includes the following paragraph:

> *Most of the occurrences involved conflicts between aircraft, or between aircraft and ground vehicles. A large number of these involved separation issues, ineffective communication between pilots operating in close proximity, the incorrect assessment of other aircraft's positions and intentions, relying on the radio as a substitute for an effective visual lookout, or a failure to follow published procedures.*

A copy of the booklet is available on the ATSB website at www.atsb.gov.au/publications/2008/avoidable-1-ar-2008-044(1).aspx.

A range of information is also available on the CASA website regarding operations at non-controlled aerodromes (www.casa.gov.au/nca). The website includes a link to a booklet titled *Operations at non-controlled aerodromes* which discusses the limitations of the 'see-and-avoid' principle, provides a number of examples where communications were ineffective, and discusses circuit procedures and radio rules.

The ATSB SafetyWatch program highlights broad safety concerns that emerge from investigation findings and from the occurrence data reported to the ATSB by industry. One of the safety concerns is safety around non-controlled aerodromes: www.atsb.gov.au/safetywatch/safety-around-aeros.aspx.

General details

Occurrence details

Date and time:	03 July 2014 – 1153 EST	
Occurrence category:	Incident	
Primary occurrence type:	Aircraft separation issue	
Location:	Roma Airport	
	Latitude: 26° 32.70' S	Longitude: 148° 46.48' E

Aircraft details – PA-28R

Manufacturer and model:	Piper Aircraft Corp PA-28R-200	
Registration:	VH-WJO	
Serial number:	28R-7635441	
Type of operation:	Flying training	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Aircraft details – CA25N

Manufacturer and model:	Skyfox Aviation Ltd	
Registration:	24-3265	
Serial number:	Ca25n086	
Type of operation:	Flying Training	
Persons on board:	Crew – 2	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Collision during landing, involving a GA8 Gippsland Airvan, VH-XHV

What happened

Airvan VH-XHV damage

Source: Operator

On 24 August 2014, at about 1515 Western Standard Time, the pilot of a Gippsland Aeronautics Airvan aircraft, registered VH-XHV, had just completed a parachute drop and was on descent to land at the Pinjarra Skydiving Airstrip, Western Australia.

The wind, as measured by the Dropzone Safety Officer prior to the flight, was about 10 kt from the north-west.

At about 1,000 ft above the ground, the aircraft was configured for landing with full flap selected. The pilot reported that the airspeed was about 80 kt on base, and about 75 kt on final. Due to a local noise abatement requirement, the pilot flew a curved, slightly truncated approach onto final and the touchdown was further along the runway than usual. Realising that this would increase the landing roll, the pilot checked the runway ahead, and reported it appeared to be clear.

The pilot applied intermittent gentle pressure on the brakes, but was mindful of the potential for skidding on the gravel surface if too much braking was applied. As the Airvan approached the hangar area (Figure 1) the pilot noticed a Cessna 182 aircraft on its regular hard stand, and when a little closer again, noticed the operator's Classic Aircraft Corporation WACO YMF5 aircraft behind it (Figures 1 and 3). The left wing of the WACO was over the runway. Reluctant to apply any stronger brake pressure, the pilot applied left rudder to manoeuvre the Airvan around the WACO.

Almost immediately the right wing of the Airvan struck the left wing of the parked WACO and the Airvan spun rapidly. The propeller struck a parked trailer, and the left wing went through the window of an unoccupied 4WD vehicle, before coming to rest. During this sequence, at least two people on the ground had to expedite themselves from the vicinity. The pilot shut down the aircraft and, still in shock, remained in the aircraft while ground personnel moved the Airvan back from the vehicle. The pilot was not injured, however two people nearby sustained minor injuries. The Airvan and the WACO were both substantially damaged.

Figure 1: Apron area

Source: Operator

Pinjarra Skydiving Airstrip

Runway 02 is 1,250 m long, however depending on the operational need of the day, normally 836 metres south of the hangars was kept for take-off and landings. The runway surface was compacted gravel.

There are two hangars located about 374 m from the northern end of 02, set back about 26 m east of the runway centreline. The area between the hangars and the runway is apron area. In front of the hangars is a fenced off spectator area. On the eastern side of the runway, a spoon drain runs south from the hangars for about 170 m.

There is a displaced landing threshold for runway 20 about 60 m south of the apron hangar area.

Figure 2: Runway 02

Source: Google earth

Figure 3: Damaged Classic Aircraft Corporation WACO

Source: Operator

Pilot comments

The pilot had commenced duty at about 0800 WST. This was the last of six sorties flown in the Airvan and there had been two flown in the Cessna 182. On the previous day, the pilot had conducted a scenic flight around the Perth area. Duty time for this day had been about five hours.

The pilot reported that, in their opinion, the wind had picked up during the day, and there was light turbulence during the descent, hence five kt was added to the approach speed to compensate for these conditions.

The pilot advised the WACO had only been in front of the hangar since around midday, and had changed position from where it had been originally parked. The background clutter of personnel, vehicles and aircraft on the apron area, meant the WACO was not clearly visible to the pilot until late in the landing roll. At this point, the pilot judged a go-around was no longer a safe option, and tried to manoeuvre the Airvan to the left around the WACO.

The pilot suggested that better communication from ground based operators to pilots in flight may have assisted in avoiding this accident.

Operator comments

The operator advised that the wind direction at the time of the accident was 330 degrees at 10 kt. A perceived increase in wind velocity resulted in the Dropzone Safety Officer taking a wind reading prior to allowing the flight to be dispatched; however as there was only one recorded gust over a twenty minute period, the flight departed.

The operator reported that the parachute drop was recorded on video, and there was no obvious gusts or turbulence noted or reported by the parachutists. The video also showed the Airvan moving at speed through the apron area just prior to the collision with the WACO.

He also advised that the paddock adjacent to the collision point would have been a suitable option to run off the runway if needed.

He feels a gust of wind may have resulted in the WACO weather-cocking, leaving the left wing closer to the runway centreline. He stated he was surprised that the much larger WACO was not visible from the runway.

Safety message

The differences in the recollection of events between the pilot and the operator on the day could not be reconciled.

There is agreement that the Airvan approached the apron area at a higher speed than any of the other landings that day, but there remains a difference in recollection and opinion on other points.

This accident still serves as an important reminder of the need to initiate a go-around as soon as there is doubt about the suitability of the approach and landing. In this instance, the pilot had assumed that the full length of the runway was available and had left the option of a safe go-around too late.

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.

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:	24 August 2014 – 1600 Western Standard Time	
Occurrence category:	Accident	
Primary occurrence type:	Collision with a parked aircraft	
Location:	Pinjarra Skydiving Airstrip 19 km SSE of Murray Field Airport, Western Australia	
	Latitude: 32° 40.73' S	Longitude: 115° 52.98' E

Aircraft details

Manufacturer and model:	Gippsland Aeronautics Pty Ltd GA8-TC 320

Registration:	VH-XHV	
Serial number:	GA8-TC 320-10-158	
Type of operation:	Private – Parachute operations	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Helicopters

Loss of control involving a Robinson R44, VH-NUZ

What happened

Robinson R44, VH-NUZ

Source: Owner

On 15 September 2013, the pilot of a Robinson R44 helicopter, registered VH-NUZ, was flying passengers on a private scenic flight over the Montgomery Reef and Buccaneer Archipelago area of Western Australia. The pilot had completed several take-offs and landings at that site already on the day.

After a routine landing at the reef, the pilot shut down the engine. The passengers had disembarked and were standing about 20 to 30 m away.

At approximately 1530 Western Standard Time, the pilot, who was the sole occupant, then started the helicopter's engine and completed the pre-flight checks. When the pilot raised the collective[1] to bring the helicopter into a hover, it suddenly rotated three times while airborne. The pilot could not regain control and elected to land immediately, however the helicopter landed heavily. The pilot shutdown the engine and exited the helicopter.

The direction that the helicopter rotated could not be ascertained by the pilot or witnesses. The pilot and bystanders were not injured but the helicopter sustained substantial damage as a result of the hard landing. A subsequent inspection revealed that both tail rotor blades had broken off near the tail rotor hub, the vertical fin lower section and tail rotor guard were damaged, the tail rotor gearbox mounts had detached from the tail boom at two places and the landing gear skids were splayed (Figure 1).

Witnesses reported that the weather conditions on the day were clear skies, a light wind of about 5-8 kt, and a temperature of about 32 °C.

Based on the information provided, the Australian Transport Safety Bureau (ATSB) was unable to determine what led to the loss of control.

Montgomery Reef

The landing area was on an extensive sandbank at the centre of the Montgomery Reef formation, with no obstructions from trees or other large physical features. The sand was compacted and undulating.

Helicopter information

The helicopter, serial number 2272, was built in the United States in 2013 and first registered in Australia on 22 April 2013. At the time of the occurrence, the helicopter's total time in service was about 94 hours.

The ATSB was advised of a previous occurrence with the helicopter, which occurred at about 45 hours total time in service, where a sudden and violent yaw in both directions was experienced. A maintenance inspection of the engine cylinders found one stuck inlet valve, which was rectified.

Due to no further reports of this occurrence with the helicopter, it was deemed unlikely to be a contributing factor to this accident.

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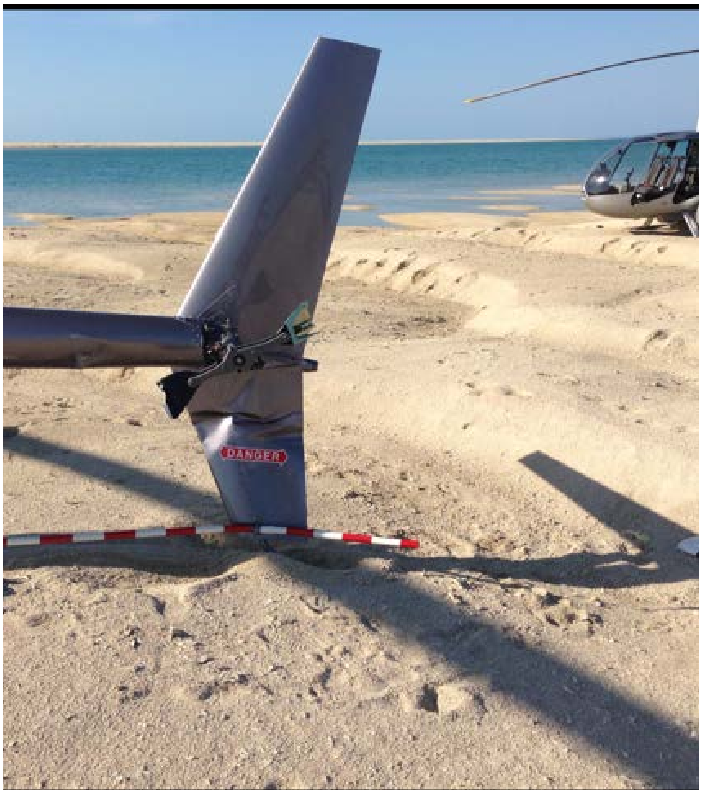
1 The collective pitch control, or collective, is a primary flight control used to make changes to the pitch angle of the main rotor blades. Collective input is the main control for vertical velocity.

Figure 1: Damage to the tail assembly



Source: Owner

ATSB comment

During the investigation, the ATSB was advised that instances of sudden and violent yawing in forward flight of up to 30° to the left and right may have occurred on other, low-time, R44 helicopters. These occurrences were attributed to a ‘sticky [engine] inlet valve’, with no recurrence after maintenance rectification. One similar occurrence was identified in the ATSB notification database, however, a review of Service Difficulty Reports (SDR) provided to the Civil Aviation Safety Authority (CASA) did not identify any specific occurrences involving sticking inlet valves.

Information sought by the ATSB from 12 Australian helicopter and engine maintenance organisations identified three additional events attributed to sticking inlet valves.[2] These occurrences involved R44 Raven I and Raven II helicopters with less than 300 hours total time in service, and occurred between 2009 and April 2013.

A representative from the R44 engine manufacturer, Lycoming Engines, advised that they were aware of instances of sticking inlet valves, however the number of worldwide occurrences were very low and considered to be a problem that was unlikely to occur if the correct engine ‘break-in’ and operating procedures were followed.

The engine manufacturer advised the ATSB that possible warning signs can include high oil consumption with elevated cylinder head temperature, high magneto drop after engine start and engine hesitation. Cylinder compression checks can also assist with troubleshooting and identifying engine valve anomalies. If an intake valve is suspected or found to be stuck, borescope inspection by removing the induction pipes is an easy way to gain inspection access. The valve sealing face should also be inspected during the rectification process for burning or any other damage.

2 A fourth event may also have been attributable to sticking engine inlet valves but that could not be confirmed.

The engine manufacturer has several publications available that provide guidance to prevent, identify and rectify sticking valves. These publications, which are available from the Lycoming Engines website[3], include:

Service bulletin SB 388C – Procedures to determine exhaust valve and guide condition

Service Instruction SI 1080C – Maintenance items for special attention

SI 1425A – Suggested maintenance procedures to reduce the possibility of valve sticking

SI 1427 – Lycoming reciprocating engine break-in and oil consumption

Service Letter SL L197 – Recommendations to avoid valve sticking

The helicopter manufacturer advised that, while they were aware of instances of sticking exhaust valves, they were not aware of any reports of inlet valves being similarly affected. In order to prevent instances of sticking exhaust valves, Robinson Helicopters has implemented the requirement to conduct Lycoming Engines Service Bulletin SB 388C at the first 100 hour inspection, and every 300 hours thereafter. Additionally, participants in the manufacturer's pilot safety course are advised that, where possible and subject to other operating limitations, engines should be operated at their Maximum Continuous Power (MCP –about 77% of rated power), for the first 50 hours of engine 'break-in' time.

Based on the information provided to the ATSB, engine valve sticking appears to be a known, but rare, phenomena that can be largely prevented by compliance with the engine and aircraft manufacturer's recommendations. The ATSB also encourages the reporting of occurrences, and defects via the CASA SDR process, as this helps to identify emerging trends in aviation safety.

Safety message

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is under-reporting of occurrences. More information can be found on the ATSB website here:

www.atsb.gov.au/safetywatch/under-reporting-of-occurrences.aspx

The Civil Aviation Safety Authority (CASA) has Service Difficulty Reports to detect trends and permit timely safety oversight of the Australian aircraft fleet, CAAP 51-1 and Part 4B of CAR 1988 refers. More information can be found on the CASA and ComLaw websites here:

CAAP 51-1 http://www.casa.gov.au/wcmswr/_assets/main/download/caaps/airworth/51_1.pdf

CAR 1988 http://www.comlaw.gov.au/Details/F2013C00371/Html/Volume_1#_Toc360093931

General details

Occurrence details

Date and time:	15 September 2013 – 1530 WST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	170 km N of Derby (Montgomery Reef), Western Australia	
	Latitude: 15° 56.87' S	Longitude: 124° 16.32' E

3 Lycoming website www.lycoming.com/Lycoming/SUPPORT/TechnicalPublications.aspx

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R44	
Registration:	VH-NUZ	
Serial number:	2272	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – Nil
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Collision with terrain involving a Robinson R44, VH-HLB

What happened

On 23 September 2014, at about 1500 Central Standard Time, a Robinson R44 helicopter, registered VH-HLB, departed Bulman camp, Northern Territory, to conduct gravity survey operations.[1] On board were a pilot and a geophysical field technician. The operation involved flying to specified locations 2 km apart and selecting a suitable landing site within 400 m of the location.

At about 1630, after completing landings at about 30 sites, the helicopter arrived overhead a specified location. The pilot identified a potential landing site, overflew it for a closer inspection, and then entered an out of ground effect hover[2] just above treetop height to determine whether the selected site was suitable for landing. The pilot decided the site was unsuitable as trees prevented sufficient clearance for the main and tail rotors.

The pilot commenced moving the helicopter forwards to depart the landing site, but it started to sink and the pilot observed the rotor revolutions per minute (RRPM) decaying. He lowered the collective[3] and rolled on throttle in an attempt to increase the RRPM. The outside air temperature gauge indicated about 40 °C and the pilot reported that increasing the throttle did not provide any detectable increase in power. There was a light breeze, which the pilot assessed may have been from a northerly direction at that time, and the helicopter was heading south, resulting in a slight tailwind.

The pilot then eased forward on the cyclic[4] to increase translational lift[5] and at about the same time, the low RRPM horn sounded. The helicopter continued to descend and the main rotor blades collided with multiple tree branches. The pilot turned the helicopter towards a small creek bed. When at about 6 ft above ground level, the helicopter rotated about 180° and landed hard with the left skid touching the ground first. The helicopter sustained substantial damage (Figure 1) and the pilot and passenger were uninjured.

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1 Gravity surveying measures small differences in gravity due to the variation in density of rocks across the earth's surface. The data is used for many purposes including minerals exploration, mapping and to underpin the Global Positioning System.

2 Helicopters require more power to hover out of ground effect due to the absence of a cushioning effect created by the main rotor downwash striking the ground. The distance is usually defined as more than one main rotor diameter above the surface.

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

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

5 The helicopter gains translational lift from horizontal movement or headwind.

Figure 1: Accident site

Source: Operator

Pilot comments

The pilot provided the following comments:

- The combination of the air temperature and the lack of wind reduced the performance of the helicopter.
- The helicopter had departed with full fuel and at the time of the incident the tanks were about half full.

Safety message

To maintain a steady hover, an increase in the weight of the helicopter requires more engine power. Increases in altitude and temperature reduce air density, and consequently the engine's ability to produce power and also reduce the power required.

The helicopter had been fitted with bladder fuel tanks. Despite the hard landing and substantial damage to the helicopter, there was no post-impact fire and the pilot and passenger were able to exit the helicopter uninjured.

This incident highlights the effect of air temperature on helicopter performance. Understanding the controllability issues at the limits of the normal operating envelope can assist pilots in recognising the symptoms of reduced aircraft performance. Further information is available in the following ATSB reports:

www.atsb.gov.au/publications/investigation_reports/2006/aair/aair200600979.aspx

www.atsb.gov.au/publications/investigation_reports/2013/aair/ao-2013-203.aspx

General details

Occurrence details

Date and time:	23 September 2014 – 1632 CST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	126 km ESE Tindal Aerodrome, Northern Territory	
	Latitude: 15° 01.28' S	Longitude: 133° 25.72' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R44	
Registration:	VH-HLB	
Serial number:	1466	
Type of operation:	Aerial work - survey	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

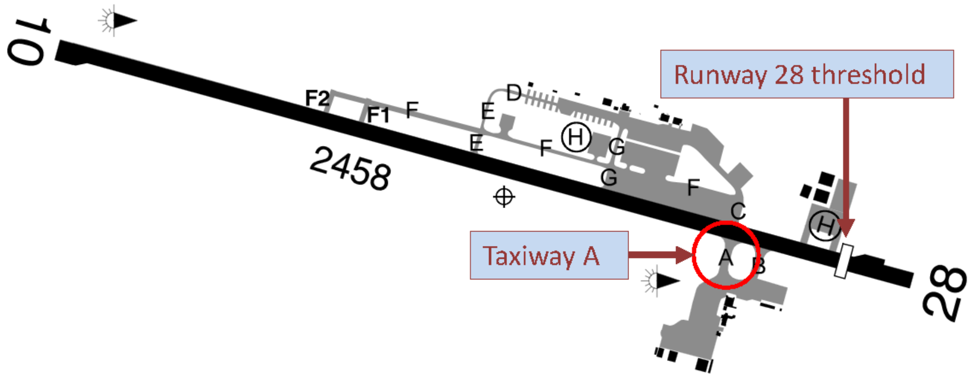
Recreational aircraft

Loss of control involving a Jabiru J230, 24-7491

What happened

On 3 October 2014, at about 0900 Western Standard Time, a Jabiru J230 aircraft, registered 24-7491, departed Cape Leveque for Broome, Western Australia, with a pilot and one passenger on board. When passing abeam Cape Boileau, about 15 NM from Broome Airport, the pilot contacted Broome Tower air traffic control advising that he was inbound to the airport. When at about 5 NM from the airport, the controller cleared the aircraft to join a right circuit for runway 28. The pilot reported that the approach and landing were normal and, at about 1022, the aircraft touched down on runway 28 just beyond the threshold, at a speed of about 70 kt.

Figure 1: Broome Airport extract from En Route Supplement Australia



Source: Airservices Australia

During the landing roll, the pilot was focused on looking for the correct taxiway to exit the runway for the itinerant parking bay. The aircraft was decelerating normally and the pilot did not apply brakes due to the length of runway remaining. The pilot detected the right wing rising slightly, possibly due to a crosswind. He then looked straight ahead and realised that the aircraft had veered off the runway centreline to the left. He applied right rudder in an attempt to return to the centre of the runway, but the aircraft continued towards the edge of the runway and taxiway A. He sighted a grass area and a drainage ditch ahead just off the runway which he wanted to avoid, along with a Fokker 100 aircraft that was stationary on taxiway A at the holding point for runway 28. The pilot elected to apply full left rudder to turn the aircraft around and remain on the sealed area.

The Jabiru aircraft's propeller and right wingtip struck the ground (Figure 2) and the aircraft came to rest upright and facing in the opposite direction to the landing and about 20 metres from the Fokker 100. The pilot and passenger were uninjured.

Pilot comments

The pilot provided the following comments:

- He became disoriented while looking for a taxiway to vacate the runway. He had not previously flown into Broome Airport and he felt that there were less visual cues to maintain direction, than at smaller, more confined aerodromes.
- He had to choose between veering off the runway and potentially colliding with a ditch; and ground-looping the aircraft and remaining on the runway.

Figure 2: Damage to 24-7491

Source: Airport operator

Safety message

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is the large number of incidents involving general aviation pilots www.atsb.gov.au/safetywatch/ga-pilots.aspx. There are procedures and methods that enable pilots to manage the hazards associated with some of the common avoidable accident types.

General details

Occurrence details

Date and time:	3 October 2014 – 1022 WST	
Occurrence category:	Accident	
Primary occurrence type:	Loss of control	
Location:	Broome Aerodrome, Western Australia	
	Latitude: 17° 56.98' S	Longitude: 122° 13.67' E

Aircraft details

Manufacturer and model:	Jabiru Aircraft J230-D	
Registration:	24-7491	
Serial number:	J750	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Substantial	

Hot air balloons

Landing accident involving a Kavanagh Balloons D-84, VH-YPI

What happened

VH-YPI

Source: George Garcia

On 19 May 2014 at about 0705 Eastern Standard Time, a Kavanagh Balloons D-84, registered VH-YPI, departed 1.5 km west of Canowindra Aeroplane Landing Area (ALA), New South Wales, on a training flight with the instructor and student pilot on board. The flight was conducted in visual meteorological conditions.

During the flight, the student conducted a number of approaches to land, but levelled off with intentional overshoot just above ground level. About 50 minutes into the flight, a number of possible landing areas were selected. The balloon flew low and level and a landing area that favoured the surface wind conditions was selected. A normal approach was made in a 10 kt wind using windy landing procedures. The balloon flew over a line of trees on the eastern side of the landing area and then descended. At about 30 ft above the ground, the student indicated to the instructor that they would be landing and turned off the burner pilot lights. At about 6 ft above the ground, the student pulled the smart vent[1] to land. The basket contacted the ground and the instructor was thrown forward and out of the basket while the student remained in the basket. The basket hit the instructor who was lying on the ground and the basket was dragged over him. The student continued to vent the balloon and it stopped a further 20 m downwind at about 0805 and 10 km south-south-west of Canowindra ALA (Figure 1).

The instructor was seriously injured and transported to hospital, the student pilot was uninjured and the balloon was not damaged.

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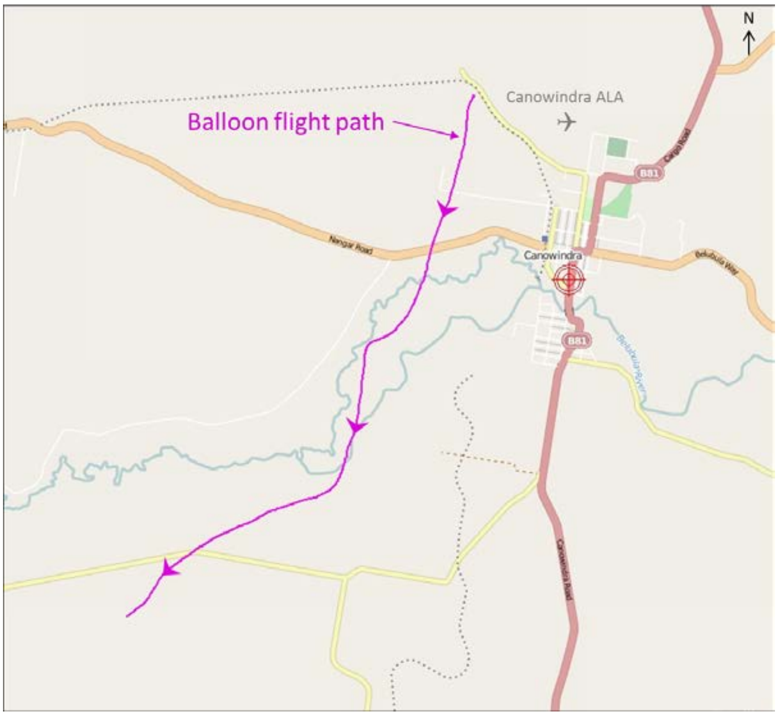
1 The smart vent is a fast deflation system that is located at the top of the envelope of the hot air balloon. It allows rapid venting of gas, which may be needed on landing, and may be reset to maintain the last selected position

Figure 1: VH-YPI flight path



Source: ATSB

Instructor comment

The instructor reported that, during the flight, he had instructed the student on a windy landing procedure that was a requirement of the student's training.

The instructor indicted that the weather at the departure point was calm on the ground, with about 3 kt wind speed from the north, from about 300 ft above the ground. At the landing area, the wind was from the north-east and there were no significant geographic features that would change the wind direction.

The instructor reported that he could remember providing venting instructions during the landing and after he was ejected from the basket but that the rest of the landing was a bit hazy.

Student pilot comment

The student pilot reported that the training flight was planned to be an hour, with the aim of reviewing approach and landing techniques. During the flight, there was discussion on the windy landing procedure and the use of the smart vent.

The student indicated that there was nothing unusual about the landing that may have resulted in the accident and that when a balloon lands in windy conditions the basket momentarily stops and tips over. If the people on board are not in the correct landing position or do not have a firm hold of the internal hold points, their momentum continues to carry them forward.

Safety message

The accident highlights that it is important for everyone in the balloon basket to assume and maintain the landing position and to hold on tight until the balloon fully stops.

The Australian Balloon Federation Pilot Training Manual Part 5 *Aerostatics and Airmanship* contains the following relevant information in regards to balloon landings:

- If the wind speed is moderate at landing, the deflating envelope may pull the basket onto its side and drag it along until friction with the ground stops further movement.

- Landings can vary widely according to the weather conditions and space available. It is good practice to 'set up' your landing well ahead, On board preparations should be completed in advance so the pilot can concentrate fully on the landing knowing passengers and gear are secure.
- Prior to Landing ensure passengers have located hand grips and have a firm grip.
- Landing positioning for a normal landing. Hold on and stand with knees together and slightly flexed, brace to anticipate sudden body movement forward as basket touches the ground in all landings.
- Landing positioning for drag landing. Hold on and resist temptation to put hands out as basket lays over. Stand with knees together and slightly flexed, brace to anticipate sudden body movement forward as basket touches the ground in all landings. Adopt a slightly lower position in basket.
- Landing positioning for hard landing. As for normal landing but warn of hard contact and vital importance to "keep holding on". Stand with knees together and slightly flexed, brace to anticipate sudden body movement forward as basket touches the ground in all landings.

The Australian Balloon Federation Pilot Training Manual Part 5 *Aerostatics and Airmanship* is available at www.abf.net.au/.

The Federal Aviation Administration *Balloon Flying Handbook FAA-H-8083-11A* also contains information for pilots about balloon landings and is available at www.faa.gov/regulations_policies/handbooks_manuals/aircraft/.

General details

Occurrence details

Date and time:	19 May 2014 – 0805 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	10 km south-south-west of Canowindra Aeroplane Landing Area (ALA), New South Wales	
	Latitude: 33° 36.80' S	Longitude: 148° 35.22' E

Balloon details

Manufacturer and model:	Kavanagh Balloons	
Registration:	VH-YPI	
Serial number:	D84-460	
Type of operation:	Flight training	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 1	Passengers – 0
Damage:	None	

Hard landing involving a Kavanagh Balloon, VH-CNX

What happened

On 26 September 2014 at about 0450 Eastern Standard Time, the pilot of a Kavanagh Balloon, registered VH-CNX, conducted pre-flight preparations for a charter flight with 22 Chinese passengers. The pilot obtained the weather forecast and, due to forecast winds, elected to depart from Beaudesert, with a planned landing site in Cedar Grove, Queensland. At Beaudesert, the pilot performed a wind test using a helium balloon and observed the wind to be from the west up to about 1,000 ft above ground level (AGL) and southerly above that.

The pilot then briefed the passengers using a briefing card in Chinese. The pilot noted that none of the passengers spoke English and, although they had attended the briefing, he was concerned that they did not understand the instructions or were unwilling to comply. During the inflation process, many passengers had to be reminded to stay clear of the fans.

The pilot started the burners and the passengers embarked. The pilot then conducted a safety briefing including demonstration of the landing position. The passengers then assumed their landing positions and the pilot was satisfied they understood the correct position to adopt when he stated ‘landing positions’. After completing the pre-flight checks, the balloon lifted off at about 0550. The 20 minute flight was conducted at about 3,000 ft above mean sea level, with a groundspeed of about 22-23 kt. The pilot then commenced the descent to the landing site and confirmed with the pilot of a company balloon that had landed 5 minutes earlier, that the wind at treetop height was from about 080° at about 8-9 kt and the surface wind 040° at about 6 kt.

During the approach, the pilot observed a light ground fog (Figure 1) and was heading directly into the sun, making the landing site difficult to see. The pilot attempted to obtain an accurate rate of descent from the altimeter, but it was reading erratically. When approaching treetop height, the balloon had a forward speed of about 14.5 kt. The pilot instructed the passengers to put cameras away and adopt the landing position, but not all of them complied. He repeated his instructions to the passengers, the altimeter continued to read erratically and, facing directly into the sun, made visual assessment of the approach difficult.

Figure 1: Landing site showing ground fog

Source: Pilot

On final approach, the balloon had a forward speed of about 9 kt and the pilot repeated the landing instructions to the passengers. The pilot pulled the vent line to descend the balloon and observed a rapid rate of descent. He then put all four burners on full power for about 5 seconds to arrest the rate of descent and repeated his instructions to the passengers. Just prior to touchdown, the pilot operated the rapid deflation system. The balloon landed hard and bounced once before landing about 3 m further along the ground.

The pilot then reset the vent line to close the top of the balloon and reapplied heat to ensure it did not deflate fully. He observed one passenger sitting on the floor of the basket and another indicating a sore back. The pilot immediately spoke to the ground crew via UHF radio and an ambulance was called. Two passengers were taken to hospital by ambulance and another 8 were taken to hospital for assessment. Two were found to have serious injuries, and 7 had minor injuries. One of the passengers sustained injury when two fellow passengers fell onto them having not adopted the correct landing position. The balloon was undamaged. The altimeter reading erratically was found to have been an indication that the battery was going flat.

Pilot comments

The pilot provided the following comments:

- The next suitable landing site was about 20 minutes flying time away by which time the wind was forecast to be significantly stronger therefore aborting the landing was not an option.
- With the sun in his eyes and the fog under the trees, he was relying on the altimeter to determine the rate of descent, however it was malfunctioning.
- A 14 knot forward speed just above treetop height was faster than a normal approach. About 16 kt of forward speed could result in the balloon being dragged about 100 m on landing.
- The rapid deflation system was used for landings above 6 kt.
- If the wind on the ground prior to departure was above 7-8 kt, the flight would be cancelled. On that day the wind on the ground was calm prior to departure.
- He had a spare altimeter in his flight bag but he did not have time to access it prior to landing.

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.

Balloon operator

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

- Pictorial safety cards with instructions in Chinese and Japanese will be taken on board the balloon for passengers to review prior to landing.
- A tour leader who speaks fluent English will be requested to accompany groups.
- A backup altimeter will be kept readily accessible in the balloon.

Safety message

In this incident, the combination of moderate wind speed, the position of the sun, equipment issues and non-compliance to instructions by passengers, contributed to increase the pilot workload at a critical phase of flight. The Civil Aviation Advisory Publication (CAAP) 5.59-1(0), *Teaching and Assessing Single-Pilot Human Factors and Threat and Error Management*, describes threat and error management (TEM) as 'the concept applied to managing and maintaining the safety of a particular flight', while risk management is the process of go or no-go decision making. The CAAP is available from the CASA website at:

www.casa.gov.au/scripts/nc.dll?WCMS:OLDASSET::svPath=/download/CAAPs/ops/,svFileName=5_59_1.pdf

Assessing the risk prior to a flight includes obtaining the appropriate weather forecast and deciding whether to conduct the proposed flight. Threats are situations or events that increase the operational complexity, and have the potential to influence the safety of a flight. Threat and error management requires pilots to identify threats and plan and execute countermeasures. The CAAP advises pilots that when confronted by threats (or errors), the priority is to ensure the aircraft is in an appropriate configuration to optimise their ability to maintain control of the aircraft and flight path.

General details

Occurrence details

Date and time:	26 September 2014 – 0620 EST	
Occurrence category:	Accident	
Primary occurrence type:	Hard landing	
Location:	60 km NW of Gold Coast Aerodrome, Queensland	
	Latitude: 27° 48.38' S	Longitude: 153° 02.83' E

Balloon details

Manufacturer and model:	Kavanagh Balloons B-400	
Registration:	VH-CNX	
Serial number:	B400-438	
Type of operation:	Charter	
Persons on board:	Crew – 1	Passengers – 22
Injuries:	Crew – Nil	Passengers – 2 (Serious) 7 (Minor) 13 (Nil)
Damage:	Nil	

Australian Transport Safety Bureau

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

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

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

Purpose of safety investigations

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

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

About this Bulletin

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

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

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

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

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

Conducting these Short investigations has a number of benefits:

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

Australian Transport Safety Bureau

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Investigation

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Aviation Short Investigations
Aviation Short Investigations Bulletin Issue 37
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