Australian Government

Australian Transport Safety Bureau

Aviation Short Investigations Bulletin

Issue 55

Investigation

ATSB Transport Safety Report

Aviation Short Investigations

AB-2016-161

Final – 14 December 2016

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

Engine shut down involving Boeing 787, VH-VKK

What happened

On the evening of 6 August 2016, Jetstar Airways flight JQ12, a Boeing 787 aircraft, registered VH-VKK, departed from Tokyo, Japan on a scheduled passenger transport flight to the Gold Coast, Queensland. On board the aircraft were two flight crew, nine cabin crew and 309 passengers.

The aircraft was pushed back from the gate at Narita Airport, Tokyo, at 1133 UTC.[1] About two hours into the flight, the flight crew received an engine indication and crew alerting system (EICAS) message ELEC GEN DRIVE R2, which indicated a fault with the number 2 generator in the right engine. The flight crew performed the checklist actions for that fault, which included disconnecting the number 2 generator drive from the engine driven accessory gearbox (AGB) and starting the auxiliary power unit to supplement the aircraft electrical power with the auxiliary power unit driven generators.

About 30 minutes later, cruising at FL 400,[2] the secondary engine instruments appeared[3] on the flight crews' multi-function displays and the flight crew detected there was a low oil quantity indication for the right engine. While the flight crew investigated the engine indications, another EICAS message annunciated, ENG OIL PRESS R, which indicated low oil pressure in the right engine. The flight crew performed the checklist actions for low oil pressure in the right engine. The right engine auto-throttle was switched off and the right engine thrust lever retarded to idle. The low oil pressure EICAS message momentarily cleared before it returned again, and the flight crew shut down the right engine in accordance with the checklist procedures.

The captain identified Guam Airport as the nearest suitable airport, about 370 km to the south of their position. They made a PAN[4] call to Guam air traffic control, who provided them with a clearance to manoeuvre as required for a landing at Guam Airport. The flight crew sent a message using the aircraft communications addressing and reporting system to their operations control that they were diverting the aircraft to Guam. They descended the aircraft to FL 220 due to single engine performance limitations and diverted around some weather as they tracked towards Guam Airport. The captain reported that they made an uneventful one engine landing on runway 24 at about 1520 UTC.

After the aircraft vacated the runway, the captain held the aircraft on the taxiway to allow the airport emergency services to inspect the engine before they taxied the aircraft to the arrival gate. The aircraft was shut down at the arrival gate without further incident.

Maintenance findings

When the engine cowls were opened for the initial inspection there was a large quantity of oil found throughout the engine and a considerable amount of metallic debris found within the engine oil system. A data download of the engine was performed and the results were sent to GE Aviation, the engine manufacturer, for review. GE Aviation provided options for returning the aircraft to service, of which Jetstar determined an engine change was the most expeditious.

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1 Coordinated Universal Time (abbreviated UTC) is the time zone used for civil aviation. Local time zones around the world can be expressed as positive or negative offsets from UTC.

2 At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 400 equates to 40,000 ft.

3 The secondary engine instruments are only displayed when an abnormal condition is detected.

4 An internationally recognised radio call announcing an urgency condition which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.

Engine manufacturer findings

GE Aviation found there was no history or shift in oil system parameters except for the chip count[5] on this flight. Chips are detected and recorded by the engine debris monitoring system (DMS), within the engine oil system.

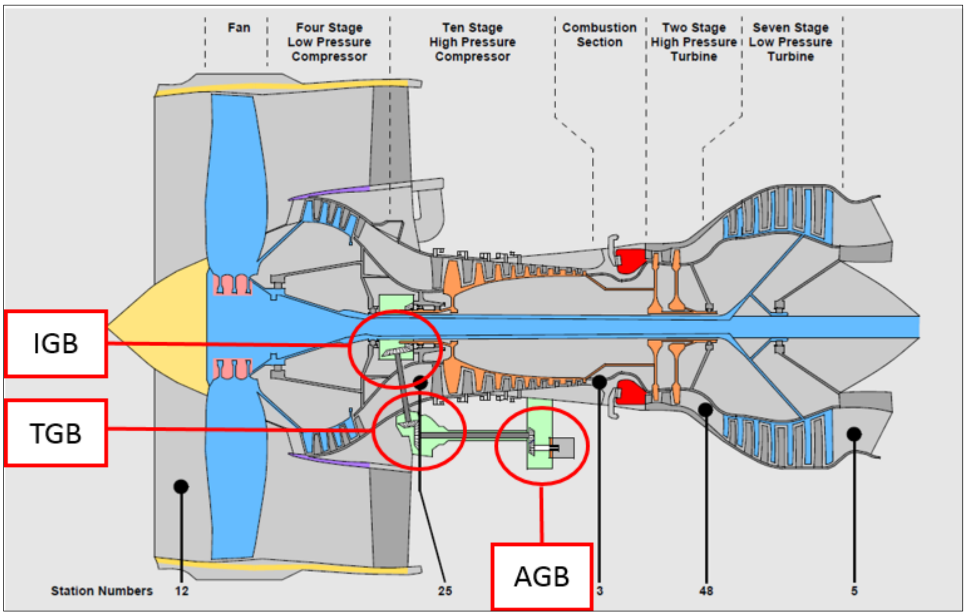
On the incident flight, the right engine oil system started to detect chips from about one hour into the flight. The chip count reached seven when the crew were alerted to disconnect the number 2 generator. At 1415 a status message was generated for ENG OIL DMS R, which indicated the chip count for the right engine had reached eight.

Between 1415 and 1419 the chip count reached 11, there was a rapid loss of engine oil, a momentary spike in vibration from the engine number 1 bearing, and the EICAS message to the flight crew reporting low engine oil pressure. The engine was shut down and the aircraft landed about 52 minutes later.

Engine driven gearboxes

Engine rotation is transmitted to an inlet gearbox (IGB) with a radial driveshaft, which connects to a transfer gearbox (TGB). The TGB transmits the engine speed to the AGB via a horizontal driveshaft (Figure 1). The AGB drives the accessories necessary for engine operation and other aircraft services, such as the generators for the aircraft electrical system. The engine oil system provides lubrication, cooling and removes debris from the gearboxes.

Figure 1: Engine driven gearboxes



Source: Boeing, annotated by ATSB

Transfer gearbox damage

On inspection, the TGB housing was found to be fractured (Figure 2). The TGB oil screen was found with metallic debris and the engine oil DMS sensor was found with metallic debris (Figure 3). The manufacturer’s inspection of the TGB failure indicated it was consistent with a known failure mode of the TGB described in their service bulletin (SB) 72-0298.

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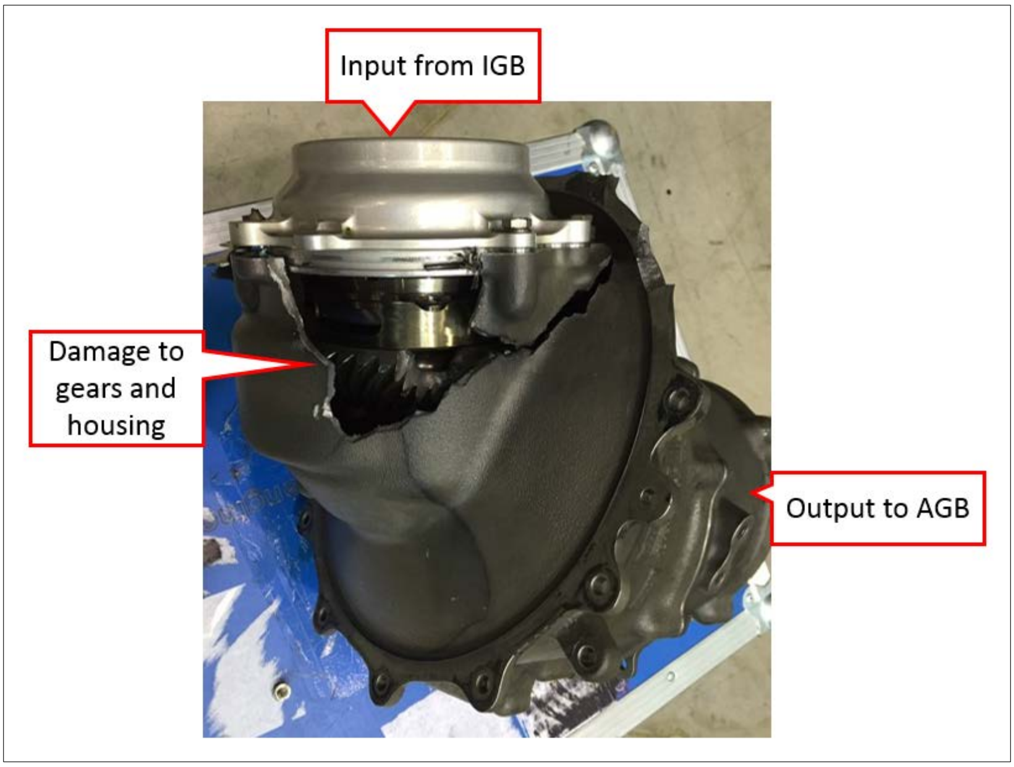
5 Chip count refers to metallic debris detected within the engine oil system, which may be a leading indicator of machinery failure. Chip count indicates the number of metal chips detected by the debris monitoring system.

Figure 2: Transfer gearbox damage



Source: Jetstar Airways

Figure 3: DMS sensor and TGB oil screen metallic debris

Source: Jetstar Airways

GE Aviation service bulletin 72-0298

GE Aviation SB 72-0298 revision 0, dated 31 March 2016, is applicable to all GEnx-1B engines, which were the engines fitted to VH-VKK at the time of the incident. The SB introduces a new transfer gearbox (TGB) configuration. According to the SB:

> Pre-modified TGBs have a radial bevel gear with potential resonance modes (see *Resonance*) in the engine operating range. Excitation of resonance modes may lead to a gear fracture, which can result in engine oil loss and an in-flight shut down. The SB modification introduces a new damper ring groove to the radial bevel gear and a damper ring to mitigate the excitation of the resonance modes.

GE Aviation recommended the compliance periods for the SB in Table 1 below, which are based upon the number of cycles since new (CSN) for the TGB as of 31 March 2016.

Table 1: SB 72-0298 compliance

Cycles Since New (CSN) as of 31 March 2016	Compliance period from 31 March 2016
TGB less than 300 CSN	12 months
TGB between 300 and 1,000 CSN	10 months
TGB greater than 1,000 CSN	8 months

Jetstar management of service bulletin 72-0298

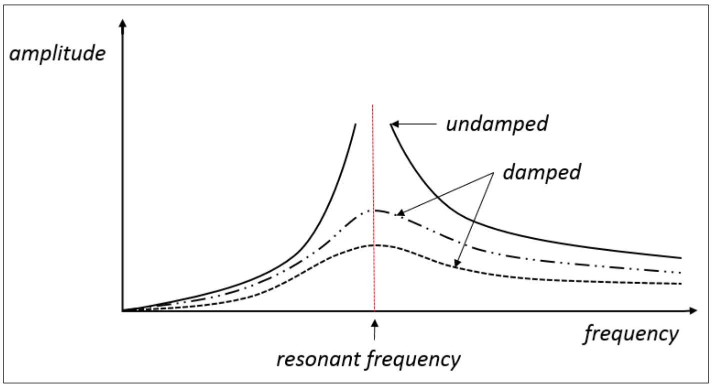
The SB related modifications for the Jetstar 787 fleet was managed with a risk profile developed by GE Aviation. The risk profile had four levels of risk for TGB failures, which depended on a number of engine operating factors in addition to the TGB CSN. Jetstar responded to the SB terminating action by immediately sourcing additional post-modification units from the manufacturer and prioritised the TGB modification in accordance with the order of highest to lowest TGB risk until the incident flight. The incident engine TGB was identified as the lowest risk (based on lowest CSN, limited in-service operational data and GE Aviation recommendations) for the Jetstar fleet at the time of the incident.

The incident engine TGB had 181 CSN at the time of the incident and therefore the compliance date to complete the SB for this engine was 31 March 2017. The engine modification to comply with the SB for the incident engine was scheduled for 31 December 2016.

Resonance

All machinery have a natural frequency of vibration. If a particular abnormality in the machinery generates a forced vibration, which vibrates in-phase and at the same frequency as the natural frequency of vibration, then the energy will magnify. The frequency at which this occurs is known as the resonant frequency (Figure 4). If there is insufficient damping present at the resonant frequency, then the amplitude of the vibrations will increase with each cycle. Excessive movement of components with high energy can cause a catastrophic failure of the machinery.

Figure 4: Resonant frequency for damped and undamped vibration



Source: ATSB

Jetstar Airways extended diversion time operations

Twin engine turbine aeroplanes are normally restricted to operating on routes where if an engine fails or is shut down in-flight, the aircraft is within 60 minutes flight time, at the cruise speed for one engine inoperative, to a suitable airport. Extended diversion time operations (EDTO), which are approved by CASA for individual operators, permit the Boeing 787 to operate on routes which are further than the 60 minutes flight time in the event of an engine in-flight shut down (IFSD). EDTO approval for an operator is subject to the continuous monitoring of the engine IFSD rate.

For the Jetstar Boeing 787 fleet the EDTO approval at the time of the incident was for up to 180 minutes, which required a target IFSD rate of not greater than 0.02 per 1,000 flight hours. Prior to the incident flight, Jetstar were operating at a rolling 12 month IFSD rate of 0 per 1,000 flight hours, which increased to 0.0096 post-incident. Jetstar have performed several unscheduled engine changes on their 787 fleet since introduction into service, but no changes prior to the incident flight related to the fault condition identified in SB 72-0298.

ATSB comment

The ATSB notes that the failure of the TGB and loss of oil is a potential failure mode known to the engine manufacturer and operator. This condition is under risk management through the service bulletin process and the operator was within the compliance period at the time of the incident. Prior to the incident flight, the incident TGB was assessed as being in the lowest risk profile for the operator's fleet.

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.

Jetstar Airways

In light of the incident, Jetstar amended their TGB modification schedule in order to prioritise at least one engine TGB on each aircraft airframe in their fleet at the earliest opportunity (known as depairing or decoupling). The fleet was completely depaired from 26 August 2016. Jetstar completed the modification programme for their fleet in November 2016.

Safety message

This incident highlights the importance of flight crew complying with checklist actions when dealing with a fault condition. Inflight, the crew did not have knowledge of the extent of the damage to the engine TGB. However, by following their training and checklist procedures, they reduced the risk of a potential escalation of the fault.

General details

Occurrence details

Date and time:	6 August 2016 – 1400 UTC	
Occurrence category:	Incident	
Primary occurrence type:	Engine failure or malfunction	
Location:	370 km north of Guam, North Pacific Ocean	
	Latitude: 16° 49.72' N	Longitude: 144° 51.60' E

Aircraft details

Manufacturer and model:	The Boeing Company 787-8	
Registration:	VH-VKK	
Operator:	Jetstar Airways PTY Limited	
Serial number:	36237	
Type of operation:	Air Transport High Capacity - Passenger	
Persons on board:	Crew – 11	Passengers – 309
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Hydraulic leak involving Boeing 787, 9V-OFG

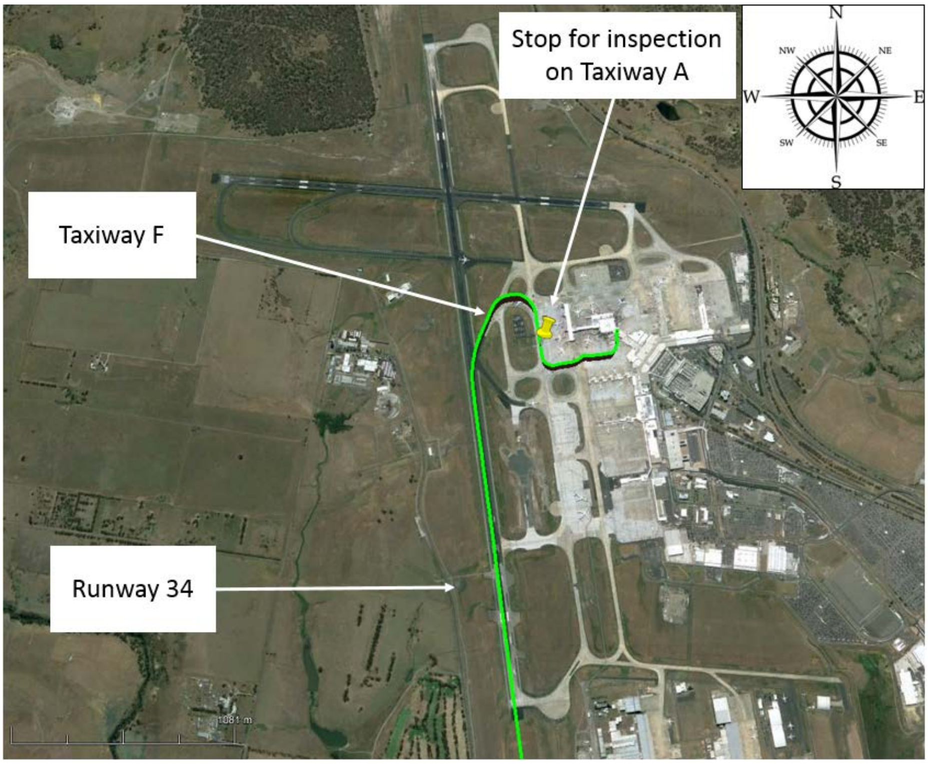
What happened

On 7 September 2016 at 1720 UTC,[1] Scoot Airline flight TZ026, a Boeing 787 aircraft, registered 9V-OFG, departed Singapore on a scheduled passenger transport flight to Melbourne, Victoria.

Flight TZ026 made an approach to Melbourne Airport runway 34 and landed without incident at 0021 UTC on 8 September 2016. During the landing roll, the flight crew used maximum reverse thrust in order to vacate runway 34 at Taxiway F (Figure 1). After the aircraft exited the runway onto Taxiway F, air traffic control (ATC) instructed the flight crew to change radio frequency to the ATC Ground frequency. The surface movement controller (SMC) then provided the flight crew with their taxi instructions.

The flight crew proceeded to taxi the aircraft from Taxiway F, right onto Taxiway T, then another right onto Taxiway A. As they started to taxi down Taxiway A, they heard a comment on the Ground frequency about smoke. The flight crew were unsure if the comment was in reference to their aircraft, so they queried the SMC. The SMC responded that flight TZ026 had smoke coming from their right engine. The captain elected to stop the aircraft on the taxiway and request an inspection from the aviation rescue and fire-fighting (ARFF) services.

Figure 2: Aircraft ground track at Melbourne Airport



Source: Google earth, annotated by ATSB

The ARFF vehicles arrived in front of the aircraft on Taxiway A and an ARFF officer communicated their observations of the right engine to the SMC. The SMC directed the flight crew

[1] Coordinated Universal Time (UTC): the time zone used for aviation. Local time zones around the world can be expressed as positive or negative offsets from UTC. Singapore local time is UTC +8 and Melbourne Eastern Standard Time (EST) is UTC +10.

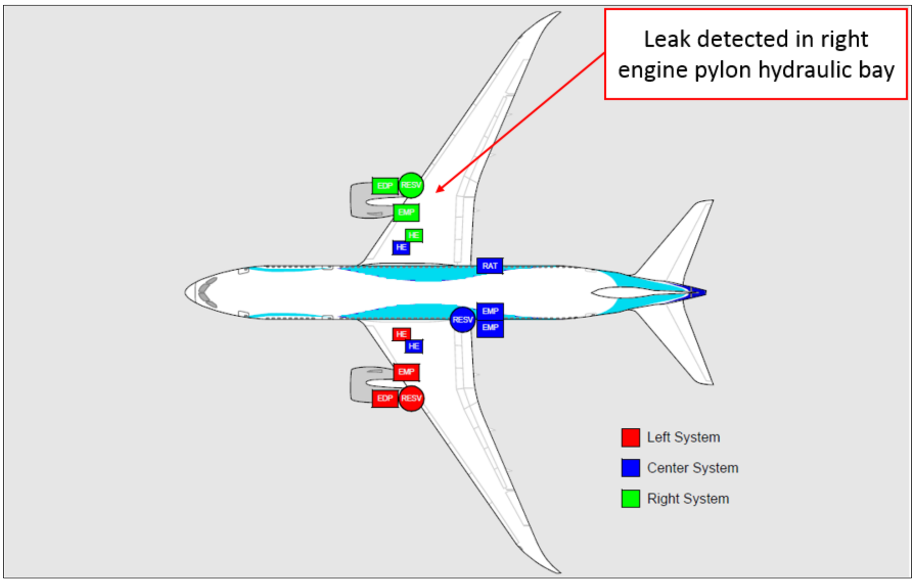
to monitor the frequency in use by the ARFF. Consequently, the flight crew heard the ARFF officer report to the SMC that the smoke they saw 'appeared to be normal'. The aircraft captain was aware that the aircraft engines can emit smoke from the engine oil system and cross-checked their engine indications. There were no abnormal indications present and therefore the captain elected to taxi the aircraft to their allocated parking bay and conduct a normal shut down with ARFF in attendance. The aircraft was shut down without further incident.

Maintenance fault finding

After the passengers had disembarked, the captain informed one of the company maintenance engineers that smoke had been observed coming from the right engine after landing, but all engine indications were normal. The engineer conducted a general visual inspection of the engine and reported to the captain that there was no obvious sign of a fault. The captain documented the incident in the aircraft technical log and signed-off duty.

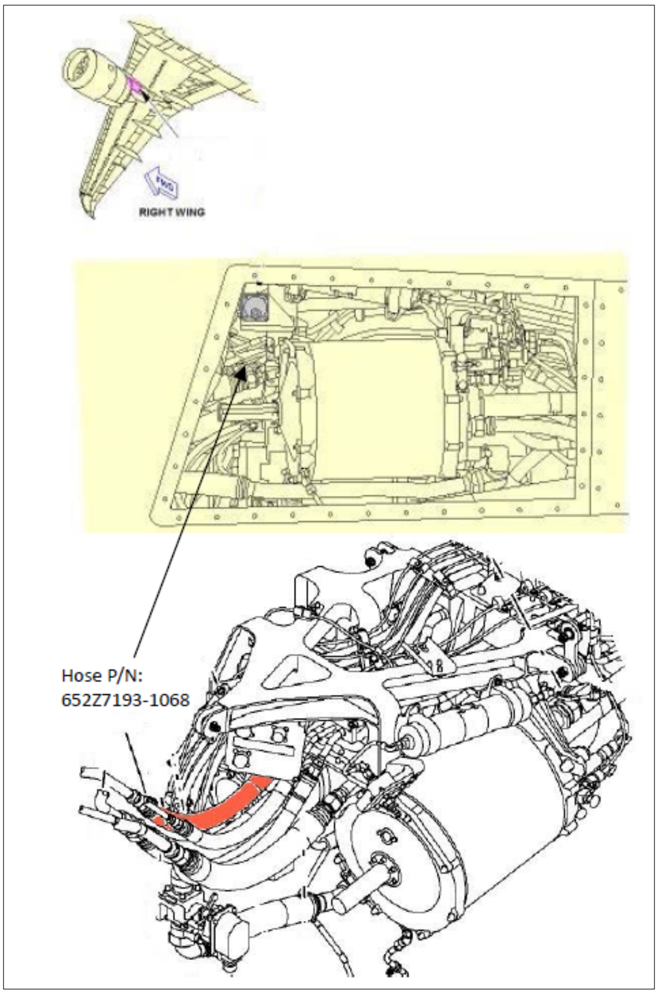
During the turn-around inspection, another company maintenance engineer noted that the right hydraulic system was at the refill level. The engineer conducted leak checks on the right hydraulic system and found a damaged hydraulic hose in the right engine pylon hydraulic bay (Figures 2 and 3). The damaged hose was located downstream of the right engine thrust reverser stow line.

Figure 2: Location of aircraft hydraulic systems and leak



Source: Boeing, annotated by ATSB

Figure 3: Location of hydraulic hose



Source: Boeing

Flight data recorder

The engine thrust reversers are electrically controlled, but hydraulically powered systems. The right hydraulic system powers the right engine thrust reverser and the left system powers the left engine thrust reverser. Flight data recorder information indicated that the three hydraulic systems were at the same quantity when the aircraft landed. When the thrust reversers were applied to assist braking, the left and right hydraulic system quantities reduced, as required, to power the thrust reverser actuators. However, when the thrust reversers were stowed only the left hydraulic system returned to the normal quantity. The right system quantity continued to reduce, which was consistent with a leak in the hydraulic system.

Aircraft manufacturer findings and recommendations

The failed hose was part of the thrust reverser retraction circuit and is otherwise isolated during flight. The thrust reverser circuit is the only location where this part is installed on the aircraft. Boeing note that the leak has previously been observed either as drip from the aft fairing of the engine pylon after flight, or during landing as a mist sprayed from the engine exhaust during thrust reverser retraction. Boeing has advised operators to heighten their awareness of the issue, and in the event of an observed leak at the aft pylon fairing module, to check the incident part number hose for a rupture. Boeing has recorded several in-service failures of this part number hose and investigated the fault with the part manufacturer.

Engine manufacturer findings

During development testing of the engine, the manufacturer, Rolls Royce, identified the potential for a visible white-coloured mist from the engine oil breather to occur at any stage of engine operation. They stressed that this is a normal characteristic of the engine, which is a result of incomplete air/oil separation, and 'does not represent an increase in engine oil consumption.'

Aircraft captain comments

The captain noted that during the inspection from the ARFF services, the flight crew were asked by the SMC to monitor the ARFF frequency, but they were not allocated a discrete frequency for communications with ATC. This resulted in interruptions from other traffic using Ground frequency for routine communications and at times the captain felt they could not immediately relay information to ATC.

Airservices comments

Airservices noted the captain's comment regarding the need for a discrete frequency. This is currently not standard practice and has the potential to create confusion for ATC at times of high workload. The use of a published frequency can aid in situational awareness for other operators and ARFF services throughout the emergency.

Safety analysis

Hydraulic leak

During the turn-around inspection of the aircraft, the right hydraulic system fluid level was found to be low due to a ruptured hydraulic hose. This hydraulic hose is only installed in the engine thrust reverser retraction circuit and is otherwise isolated inflight. The flight data indicated that the reduction of fluid in the right hydraulic system, consistent with a hydraulic fluid leak, coincided with the thrust reverser retraction after landing.

Engine smoke

At the time that the aircraft stopped for a visual inspection by ARFF, what was reported as smoke appears to be mist emanating from the vicinity of the engine oil breather (Figure 4). The presence of mist is consistent with the Boeing investigation into the failures of the affected hydraulic hose that indicates a rupture of this hose. However, the location of the mist suggests the source could have been (by itself or in addition to the hydraulic fluid) due to the engine oil breather. This is because the mist was also consistent with what Rolls Royce had previously noted as a visible white-coloured mist that can be observed emanating from the engine oil breather as a result of incomplete air/oil separation.

Figure 4: Aircraft stopped for inspection

Source: Melbourne Airport

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The hydraulic hose in the right engine thrust reverser retraction circuit ruptured when the right engine thrust reverser was retracted on landing.
- The reported engine smoke was probably mist from the right hydraulic system leaking hydraulic fluid into the engine exhaust, or mist from the engine oil breather as a result of incomplete air/oil separation, or a combination of both conditions.

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 manufacturer

As a result of this occurrence and previous occurrences, Boeing has advised the ATSB they have taken the following safety action:

A 'capture and control in production' process was introduced. This process has identified and screened out defective parts. Their own investigation has identified the likely root causes of the failures and identified the population of hoses affected. They have communicated recommended actions to aircraft operators, which describes how to identify and replace potentially affected hoses.

Aircraft Operator

As a result of this occurrence, Scoot Airlines has advised the ATSB they are taking the following safety action:

As per the aircraft manufacturer's recommendations, a 787 fleet check was conducted, potentially affected hoses identified, and replacement hoses ordered.

Safety message

At each stage during this incident: after the aircraft had landed, when the engineering inspection detected a low hydraulic system fluid level, and subsequently when the manufacturer received the failed part, the exact nature of the problem was unclear. However, at each stage, precautionary action was taken to investigate the problem, which mitigated the risk to the safety of personnel and serviceability of the aircraft.

General details

Occurrence details

Date and time:	8 September 2016 – 1021 EST	
Occurrence category:	Incident	
Primary occurrence type:	Systems - hydraulic	
Location:	Melbourne Airport, Victoria	
	Latitude: 37° 40.40' S	Longitude: 144° 50.60' E

Aircraft details

Manufacturer and model:	The Boeing Company – 787-8	
Registration:	9V-OFG	
Operator:	Scoot Airline	
Serial number:	37123	
Type of operation:	Air Transport High Capacity - passenger	
Persons on board:	Crew – 10	Passengers – 280
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Loading event involving Airbus A320, VH-VFN

What happened

On 8 September 2016, at about 1900 Eastern Standard Time (EST), an Airbus A320-232 aircraft, registered VH-VFN, was being loaded at Sydney Airport, New South Wales, to operate Jetstar flight JQ820 from Sydney to Brisbane, Queensland.

The leading hand assigned to loading the aircraft had received the deadload weight statement[1] (DWS) for the cargo from the cargo terminal operator (CTO), and printed out a copy to refer to while loading the aircraft. The DWS listed three containers of freight, which the leading hand reported was usually loaded onto the aircraft before the passenger bags. The CTO had previously delivered the three containers to the loading bay from their facility. The leading hand checked the containers with those listed on the DWS – crosschecking the container numbers and the flight details, and confirming that the sum of the weight of the three containers corresponded to the total gross weight on the DWS. Two of the three listed containers were correct, however, the third was listed on the DWS with number 4183 and a gross weight of 240 kg, while the container on the bay was number 1483 (Figure 1), which was subsequently found to have had a gross weight of 900 kg.

Figure 1: Container AKH 1483 JQ

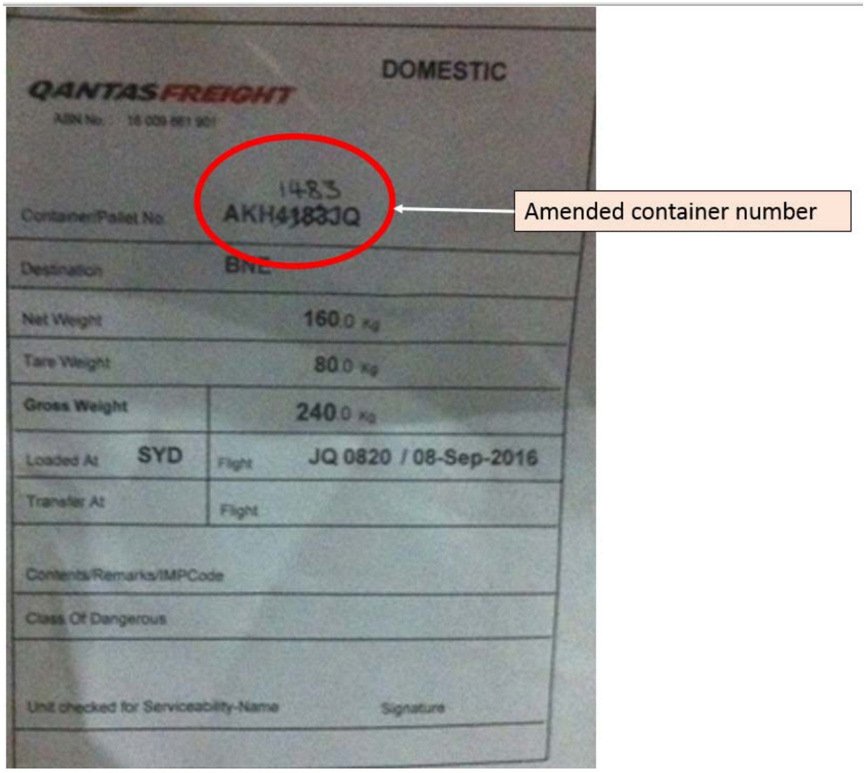
Source: Jetstar

The container card associated with, and attached to the container also had number 4183 on it (Figure 2). The leading hand assumed that the freight handler had inadvertently transposed the first two digits of the container number from 14 to 41, entered that onto the card and transferred the error onto the DWS. The leading hand therefore amended the card and the DWS with the actual number of the container (1483), and entered that container number onto the underfloor load advice (ULA) as it was loaded onto the aircraft (Figure 3).

1 Deadload weight statement: Document produced by the cargo terminal operator that listed the details of freight booked on a specific flight.

The leading hand supervised the loading of the three containers and the passengers' bags onto the aircraft and completed filling out the ULA. Container 1483 was loaded into position 32 (see *Underfloor load advice*), which was close to the aircraft's centre of gravity.

Figure 2: Container card


QANTAS FREIGHT

ABN No. 16 009 661 901

DOMESTIC

Container/Pallet No: AKH41883JQ (amended: 1483)

Destination: BNE

Net Weight: 160.0 Kg

Tare Weight: 80.0 Kg

Gross Weight: 240.0 Kg

Loaded At: SYD | Flight: JQ 0820 / 08-Sep-2016

Transfer At | Flight

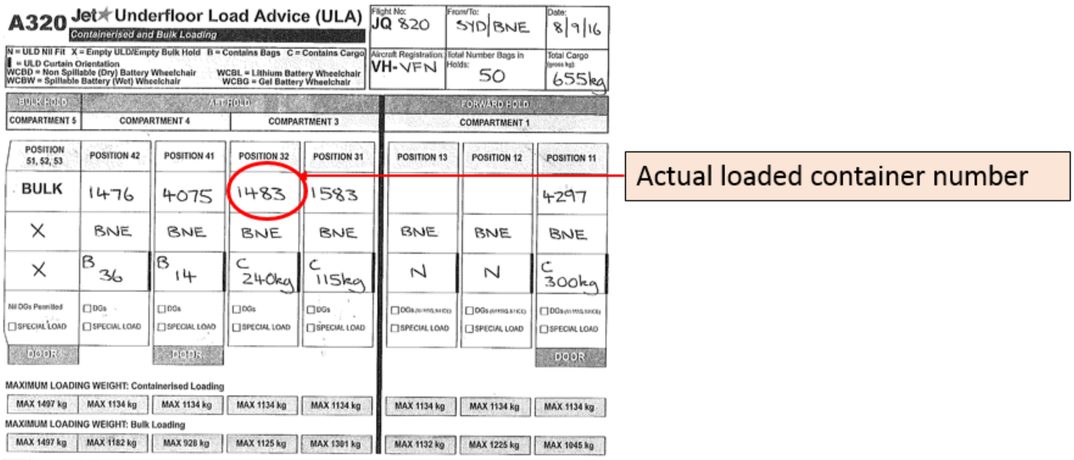
Contents/Remarks/IMPCode

Class Of Dangerous

Unit checked for Serviceability-Name | Signature

Source: Jetstar

Figure 3: Extract of the underfloor load advice


A320 Jet★ Underfloor Load Advice (ULA)

Containerised and Bulk Loading

N = ULD Nil Fit X = Empty ULD/Empty Bulk Hold B = Contains Bags C = Contains Cargo

▌ = ULD Curtain Orientation

WCBD = Non Spillable (Dry) Battery Wheelchair WCBL = Lithium Battery Wheelchair

WCBW = Spillable Battery (Wet) Wheelchair WCBG = Gel Battery Wheelchair

Flight No:	From/To:	Date:
JQ 820	SYD/BNE	8/9/16
Aircraft Registration: VH-VFN	Total Number Bags in Holds: 50	Total Cargo (gross kg): 655kg

BULK HOLD	AFT HOLD				FORWARD HOLD		
COMPARTMENT 5	COMPARTMENT 4		COMPARTMENT 3		COMPARTMENT 1		
POSITION 51, 52, 53	POSITION 42	POSITION 41	POSITION 32	POSITION 31	POSITION 13	POSITION 12	POSITION 11
BULK	1476	4075	1483	1583			4297
X	BNE	BNE	BNE	BNE	BNE	BNE	BNE
X	B 36	B 14	C 240kg	C 115kg	N	N	C 300kg
Nil DGs Permitted ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD	☐ DGs ☐ SPECIAL LOAD
DOOR		DOOR					DOOR
MAXIMUM LOADING WEIGHT: Containerised Loading							
MAX 1497 kg	MAX 1134 kg	MAX 1134 kg	MAX 1134 kg	MAX 1134 kg	MAX 1134 kg	MAX 1134 kg	MAX 1134 kg
MAXIMUM LOADING WEIGHT: Bulk Loading							
MAX 1497 kg	MAX 1182 kg	MAX 928 kg	MAX 1125 kg	MAX 1301 kg	MAX 1132 kg	MAX 1225 kg	MAX 1045 kg

Source: Jetstar

At about 1915, the leading hand completed loading the aircraft and took the paperwork, including the DWS and ULA, to the flight deck. The captain sighted the amendments and the leading hand explained that they had amended the container number because the digits had been mixed up. The captain said they would accept the paperwork if the leading hand was sure the contents of the container was the same as the container listed on the DWS. The leading hand affirmed, as they believed at the time, that the weight was correct and the container number was now correct on the DWS and ULA.

The flight crew then entered the data into the loading program and crosschecked it. The data was then used to generate the take-off data including reference speeds and trim settings based on the weights provided on the DWS. The crew then entered the performance data into the aircraft's flight management and guidance system.

The aircraft departed on time at about 1925. The flight crew were not aware of the discrepancy during the flight and did not encounter any handling or control issues on take-off or receive any abnormal indications.

Subsequent investigation revealed that the incorrect container was delivered for loading; the CTO had delivered container 1483 (which weighed 900 kg) instead of 4183 (which weighed 240 kg).

Freight management procedures

The aircraft operator's procedures included that if the DWS was incorrect, then the leading hand was to 'offload' the freight – that is, not load it onto the aircraft and remove it from the DWS, irrespective of how the incorrect container arrived at the bay.

Leading hand's comments

Generally, if there is a discrepancy between the freight and the DWS, the leading hand commented that they would cease loading, go to the office and give the CTO a call. They would then ask the team to email a new DWS and bring a new container card to the loading bay. In this event, time did not permit the normal process to be followed, due to the short turnaround time for the aircraft. In addition, as it was the last Brisbane flight of the day, they were trying to ensure the cargo would be loaded if possible. The leading hand also commented that in their experience, it was not uncommon to have discrepancies on the DWS, including errors in the weights. The leading hand assessed that this had just been a simple transcription error, and changed the numbers.

The leading hand had not been to the CTO facility and was not certain as to how the container card and DWS were compiled. However, the leading hand was experienced in operations in the bag room, where the bags were loaded into containers. The loader would then fill out the container card including the container number and the number of bags loaded into the container. The leading hand commented that transcription errors sometimes occurred in that process, resulting in the incorrect number on the container card. The leading hand would then amend the card to reflect the actual (and correct) container number.

The leading hand subsequently found that the CTO did not operate in a similar way to the bag room. On this occasion, container 4183 with 240 kg of freight was scheduled to be loaded onto JQ820, but the incorrect container was delivered to the bay. The leading hand was advised during a post-incident discussion, that the container numbers and corresponding cargo are entered into a database at the CTO and the container numbers on the DWS would therefore be correct.

The leading hand stated that they would only open up the containers to check the contents if there were dangerous goods manifested in the contents, to check for spills or leakages, or if some contents were insecure. Otherwise, once the container is delivered to the bay from the freight shed, there is no confirmation of its contents and no ability to check the weight of the container.

Captain's comments

The captain commented that it is necessary for the leading hand to be able to amend the ULA, which is a Jetstar document. However, the DWS is not a Jetstar-generated document. If there was a Jetstar procedure that did not allow amendments to the DWS (and a new one was required from the CTO whenever a change was deemed to be necessary), that may prompt the CTO to review the DWS details. Such a review may identify any discrepancies such as an incorrect container. This would provide an additional defence against an incident of this nature.

The aircraft operator responded to the comment, advising that the operations manual stated that 'all changes to the DWS must be completed by the cargo terminal operator (CTO)'.

The captain was not required to sign the ULA, unlike the Notification to the Captain (NOTOC) – which contains information about dangerous goods. The captain commented that ULAs were frequently amended, and if the leading hand amends them on the flight deck, they then initial the change.

The leading hand is a trusted member of the team; the captain delegates responsibility for the loading of the aircraft to them. If there are any issues with the loadsheets, the flight crew clarify them with the leading hand. The flight crew can also contact the ground operations controller (GOC) if there are any issues, but the GOC will refer the crew to the leading hand for questions regarding the underfloor load.

The captain accepted the amendment to the DWS based on the leading hand's confirmation that the correct container weighing 240 kg had been loaded onto the aircraft. The captain then entered that weight into the loading program, an iPad application 'Jetload', which was used to generate the aircraft's performance data.

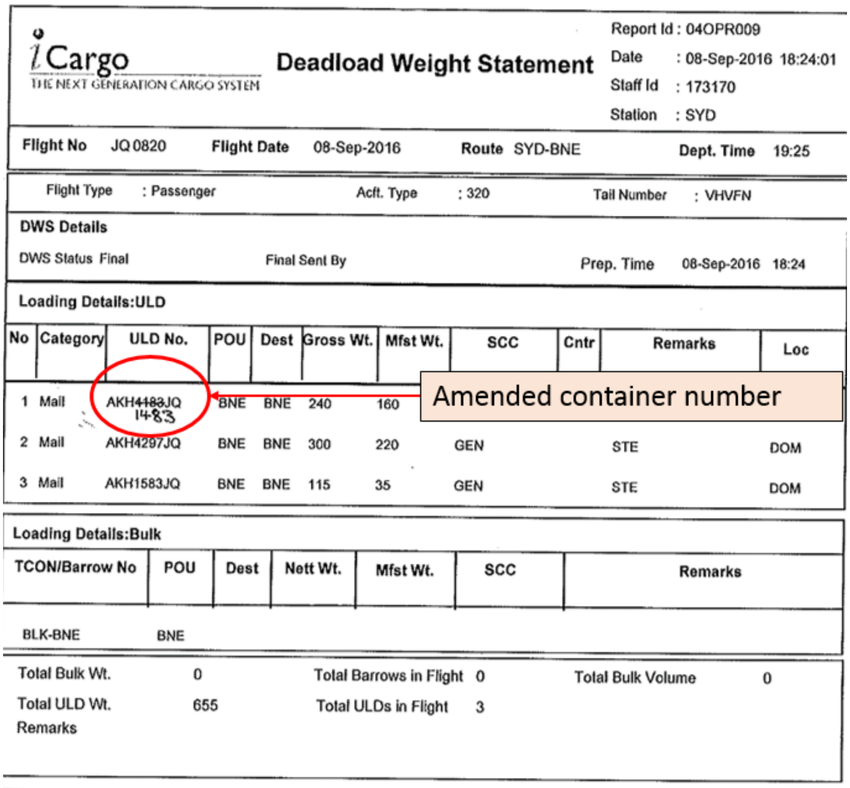
The captain commented that the Jetload program is very robust and is designed around ease of use. It prevents crew making a basic input error because there is a crosscheck. If there is a mismatch, it will not proceed to the next screen. The data then goes into the Airbus fly smart program along with the environmental and aircraft data, and generates the V speeds[2] and flex temperature for take-off. While the system is robust, it depends on the correct data being provided on the DWS and ULA. Offloading freight or bags is easy to do with the program and only takes 5–8 minutes for the leading hand to action and the crew to amend the data.

Deadload weight statement

The deadload weight statement (Figure 4) was generated by the freight shed at 1824 and the loading details specified three unit load device (ULD, or container) items: AKH4183JQ gross weight 240 kg, AKH4297JQ 300 kg and AKH1583JQ 115 kg, all destined for Brisbane with a total ULD weight of 655 kg.

2 V speeds: take-off reference speeds or V speeds are provided by the manufacturer to assist pilots in determining when a rejected take off should be initiated, and when the aircraft can rotate, lift off and climb.

Figure 4: Extract of the deadload weight statement



iCargo
THE NEXT GENERATION CARGO SYSTEM

Deadload Weight Statement

Report Id : 04OPR009
Date : 08-Sep-2016 18:24:01
Staff Id : 173170
Station : SYD

Flight No JQ 0820 **Flight Date** 08-Sep-2016 **Route** SYD-BNE **Dept. Time** 19:25

Flight Type : Passenger Acft. Type : 320 Tail Number : VHVFN

DWS Details

DWS Status Final Final Sent By Prep. Time 08-Sep-2016 18:24

Loading Details:ULD

No	Category	ULD No.	POU	Dest	Gross Wt.	Mfst Wt.	SCC	Cntr	Remarks	Loc
1	Mail	AKH~~4183~~JQ 1483	BNE	BNE	240	160				
2	Mail	AKH4297JQ	BNE	BNE	300	220	GEN		STE	DOM
3	Mail	AKH1583JQ	BNE	BNE	115	35	GEN		STE	DOM

Loading Details:Bulk

TCON/Barrow No	POU	Dest	Nett Wt.	Mfst Wt.	SCC	Remarks
BLK-BNE	BNE					

Total Bulk Wt. 0 Total Barrows in Flight 0 Total Bulk Volume 0
Total ULD Wt. 655 Total ULDs in Flight 3
Remarks

Source: Jetstar

Effect on the aircraft

The actual container loaded onto the aircraft weighed 660 kg more than the 240 kg entered into the loading program, and was loaded close to the aircraft's centre of gravity. The trim setting used for the take-off was the same as would have been used if the actual container weight and position had been entered and the derived V speeds were within 1 kt and the flex temperature within 1 °C of those generated based on the actual aircraft take-off weight. There was no effect on the aircraft performance or handling and no issues or abnormal indications were identified by the flight crew.

Based on the weights listed on the DWS, the leading hand commented that they could have loaded any of the three containers into the forward compartment of the aircraft, but elected to load container 4297 with a gross weight of 300 kg for position 11 (Figure 3) and fortuitously elected to load 1483 close to the centre of gravity.

Safety analysis

The aircraft operator advised that a member of the freight company misread the digits on the container (confusing 1483 for 4183) and transported it to the incorrect bay while delivering the correct DWS and container card.

The leading hand (incorrectly) assumed the freight container (1483) was the correct container to be loaded, but that the container number on the container card and DWS (4183) had been entered incorrectly (due to a transcription error). Although the leading hand could have requested a new printed DWS and container card, due to the combination of the limited turnaround time available and the concern to ensure the freight made it to the destination that night, the leading hand instead 'corrected' the numbers with a pen so they matched the number on the container. This resulted in a lost opportunity for the leading hand's incorrect assumption to be identified. Similarly, although the captain could see there was a discrepancy, they accepted the hand-written amendment to the DWS based on the leading hand's assurance that the correct container been loaded onto the aircraft.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- An incorrect container was delivered to the ramp by the cargo terminal operator, probably because the cargo terminal operator crew misread the similar container numbers.
- The short turnaround time combined with this being the last flight to Brisbane that night, along with the assumption there was a transcription error, resulted in the leading hand not requesting a new deadload weight statement and container card, and loading the incorrect container on the aircraft.
- Due to the leading hand's assurance, the captain accepted the hand-written amendment to the deadload weight statement.
- Although the actual take-off weight was about 660 kg more than the calculated take-off weight, as the container was loaded close to the aircraft's centre of gravity, there was no effect on the aircraft performance or handling.

Safety action

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

Aircraft operator

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

Reminder to ground staff

Ground crew have been reminded to offload any freight where there is a discrepancy in the paperwork.

Safety message

The procedure published by the aircraft operator was to offload freight if a discrepancy existed. The leading hand thought it was a simple typographical error and amended the associated paperwork. Their intention was to facilitate loading the freight if at all possible, rather than offload it and leave it overnight for the next shift to deal with. This incident highlights how being service oriented to increase efficiency can inadvertently bypass safety-related risk controls.

General details

Occurrence details

Date and time:	8 September 2016 – 1900 EST	
Occurrence category:	Incident	
Primary occurrence type:	Loading related	
Location:	Sydney Airport, New South Wales	
	Latitude: 33° 56.77' S	Longitude: 151° 10.63' E

Aircraft details

Manufacturer and model:	Airbus A320	
Registration:	VH-VFN	
Operator:	Jetstar Airways	
Serial number:	5566	
Type of operation:	Air transport high capacity – Passenger	
Persons on board:	Crew – 6	Passengers – 173
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Turboprop aircraft

Loading event involving Avions de Transport Régional ATR42, VH-TOX

What happened

On 27 September 2016, at about 0030 Eastern Standard Time (EST), an Avions de Transport Regional ATR42-300 aircraft, registered VH-TOX (Figure 1), was being loaded at Sydney Airport, New South Wales, for a freight charter flight to Brisbane, Queensland.

The freight had arrived from a freight facility where it had been weighed and a load plan completed, with a total freight weight of 2,281 kg.

Prior to loading the freight, a representative from the aircraft operator was unsure of the accuracy of the provided weights and requested ground staff reweigh the freight using calibrated scales at the airport. The measured total weight was 3,215 kg, which was 934 kg more than stated on the load plan.

The flight crew, consisting of a captain and first officer, completed the trim sheet using the actual weights, and the aircraft was within its weight limitations and the allowable centre of gravity envelope. The aircraft operated to Brisbane without incident.

Figure 1: VH-TOX

Source: Daniel Vorbach edited by ATSB

Freight weighing

The freight was weighed at the freight facility using a forklift fitted with scales. Each item of freight was then allocated to a loading position on the aircraft using a spreadsheet from which the aircraft load plan was derived.

The aircraft operator commented that they had previously advised the freight company that forklifts should not be used for the weighing of freight when intended for carriage by air, as they were not sufficiently accurate. The loading supervisor, who was employed by the freight company and responsible for loading the aircraft in accordance with the load plan, was not aware that the weights recorded on the load plan were inaccurate.

The ground handling agreement between the aircraft operator and freight company did not include Sydney as a port of service at the time of the incident. Until recently, the operator's Sydney operations were based at Bankstown Airport, where calibrated floor scales were used to weigh the freight.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The freight company weighed the freight using inaccurate (forklift) scales, resulting in a discrepancy of 934 kg from the actual freight weight. The aircraft load plan was derived from the inaccurate freight weights.
- The aircraft operator discovered the inaccuracy before loading and the aircraft was subsequently loaded within its weight and balance limitations.

Safety action

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

Aircraft operator

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

Change of port

The operator ceased operations into and out of Sydney Airport and reverted to Bankstown Airport, where calibrated floor scales are used to determine the freight weight for the load plan.

Safety message

Accurate aircraft weight and balance information is vital for the safety of flight, particularly during take-off. Inaccurate weight of freight items can lead to incorrect flight management selections such as power and trim settings. Discrepancies in these can result in reduced take-off performance and incidents such as tail strikes and runway overruns.

General details

Occurrence details

Date and time:	27 September 2016 – 0330 EST	
Occurrence category:	Incident	
Primary occurrence type:	Loading related	
Location:	Sydney Airport, New South Wales	
	Latitude: 33° 56.77' S	Longitude: 151° 10.63' E

Aircraft details

Manufacturer and model:	ATR - Gie Avions De Transport Regional ATR42	
Registration:	VH-TOX	
Serial number:	024	
Type of operation:	Charter – Freight	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

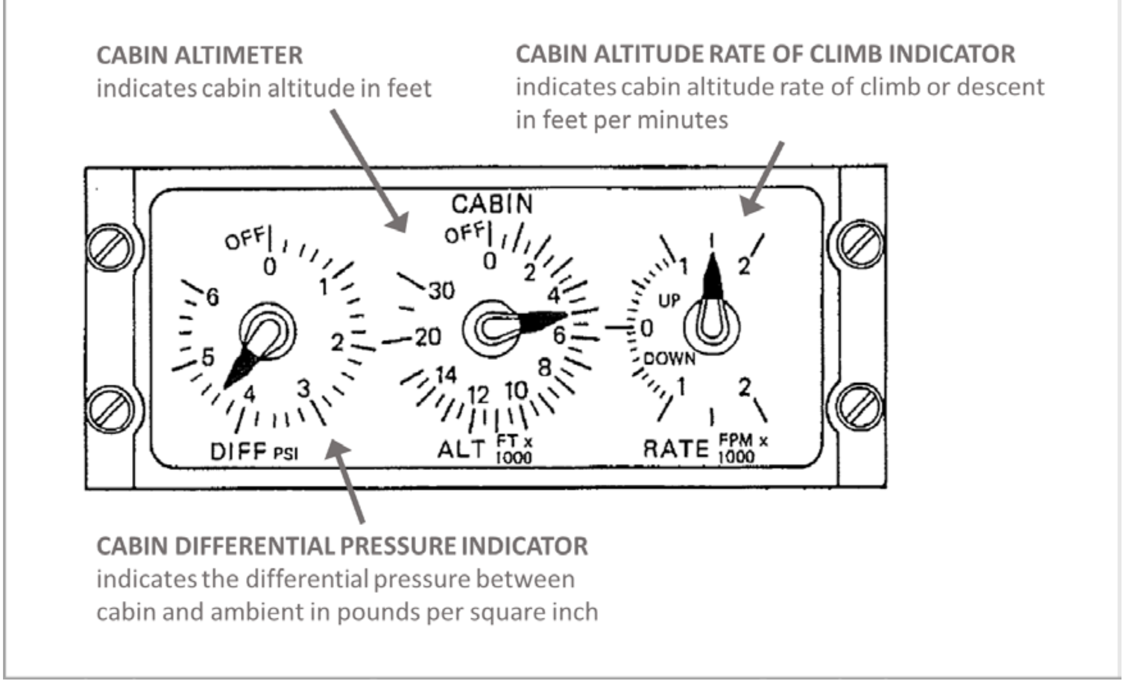
Depressurisation event involving de Havilland DHC-8, VH-XFP

What happened

At about 1330 Western Standard Time (WST) on the 7 August 2016, a Skippers Aviation de Havilland DHC-8-106 aircraft, registered VH-XFP (XFP), departed Perth Airport for Shark Bay Western Australia. Two flight crew, one cabin crew and 30 passengers were on board the regular public transport flight.

At about 10,000 ft, the flight crew conducted the transition checklist items that included checking the cabin pressurisation system and noted that everything was operating normally. The captain observed that the cabin altitude[1] was about 4,000 ft, the rate of climb was between 250 ft and 500 ft, and the maximum differential pressure between the outside air pressure and the cabin air pressure was about 2.5 to 3 psi (Figure 1).

Figure 1: Cabin pressure indicator panel showing the cabin differential pressure, cabin altimeter and cabin altitude rate of climb indicators



Source: Aircraft Maintenance Manual, modified by the ATSB

At about flight level (FL) 176[2] the flight crew engaged the autopilot. As the aircraft approached the cruising altitude FL 180, the master warning activated and the cabin pressure warning light[3] illuminated. The crew observed that the cabin altitude indicated about 12,600 ft with an excessive rate of climb, where the rate of climb indicator had gone to its maximum indicated reading. They conducted their phase one memory checklist items for a rapid depressurisation and an emergency descent. Both crewmembers fitted their oxygen masks and the captain, who was not the flying

[1] Pressurisation of the cabin is displayed as cabin altitude and is the equivalent to outside pressure at different altitudes. A cabin altitude of 4,000 ft corresponds to an atmospheric pressure of 4,000 ft.

[2] Flight level: at altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 176 equates to 17,600 ft.

[3] If the cabin altitude exceeds 10,000 ft, this automatically illuminates the 'CABIN PRESS' warning light on the warning light panel. The light will remain illuminated until the cabin altitude decreases below 10,000 ft.

pilot, took control of the aircraft. The captain made an announcement through the aircraft's public announcement (PA) system. However, the announcement was muffled and distorted and the cabin crewmember did not understand what was being said. The cabin crewmember tried contacting the flight crew but did not get a response. The flight crew selected the passenger seat belt sign on and commenced an emergency descent. The cabin crewmember realised that the aircraft was in a descent, fastened their seatbelt and using the PA system instructed the passengers to do the same. The cabin crewmember did not use supplemental oxygen (available at the flight attendant seat), as they were not aware of the nature of the emergency. Oxygen was not made available for passengers (see *Passenger oxygen requirements* below). The first officer declared an emergency (PAN PAN)[4] to air traffic control and advised that they were on descent through FL 175.

The captain levelled the aircraft at about 10,000 ft, re-engaged the autopilot and the crew conducted the cabin pressurisation failure checklist. The crew were not able to regain control of the cabin pressurisation. The maximum cabin altitude observed by the crew was just over 14,000 ft and this had returned to 10,000 ft when the aircraft was at an altitude of about 10,000 ft. The cabin pressure warning light remained on. The captain called the cabin crewmember and informed them that they were returning to Perth. The cabin crewmember then carried out a cabin check to ensure that the passengers were not injured and the cabin was secured.

The flight crew contacted the operator's maintenance personnel and were not able to isolate the reason for the fault. As the aircraft was above the maximum landing weight, they tracked to Rottnest Island to conduct a holding pattern to burn enough fuel to reduce the weight for a landing at Perth. The cabin pressure warning light extinguished on the way to Rottnest Island. The aircraft returned for a landing at Perth without further incident. The two flight crew, one cabin crew and 30 passengers were not injured and the aircraft was not damaged.

Passenger Oxygen requirements

Due to the lower altitudes that this aircraft model operates at, drop down oxygen masks for passengers and cabin crew were not installed nor required. Instead, the aircraft was supplied with portable oxygen bottles that can be handed out throughout the cabin to 10 per cent of the occupants, providing oxygen for half an hour. This is in accordance with Civil Aviation Order 20.4 (7) *Supplemental oxygen requirements for pressurised aircraft engaged in flights not above flight level 250:*

> *7.5 Supplemental oxygen for passengers*
>
> *(a) where the aircraft can safely descend to Flight Level 140 or a lower level within 4 minutes at all points along the planned route and maintain Flight Level 140 or a lower level for the remainder of the flight — to provide 10% of the passengers with supplemental oxygen for 30 minutes or 20% of the passengers with supplemental oxygen for 15 minutes;*

Captains comment

The captain reported practicing emergency descents and pressurisation faults about two weeks prior to the occurrence when conducting simulator training. They commented how valuable that training was to be prepared for this type of occurrence where they could identify that it was not a gradual or subtle depressurisation.

The captain reported that there was no warning or anything that would have indicated that there was a cabin pressurisation failure apart from the activation of the cabin pressure warning system.

The captain was not aware that the PA to the cabin was muffled. The captain also reported that the cabin crewmember had not heard the instruction for cabin crewmembers to use supplemental oxygen until after the flight had landed.

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4 PAN PAN: an internationally recognised radio call announcing an urgency condition which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.

Operator comments

The operator conducted an investigation into the occurrence, and after testing of the forward safety outflow valve, found that it was outside the aircraft maintenance manual specifications, and believed that it was the reason for the cabin pressurisation failure.

The operator reported that during the occurrence, the captain made a public announcement, which the passengers and cabin attendant did not understand as the announcement was muffled and distorted. The pilot's oxygen mask audio system was tested and found to be serviceable. The most likely reason that the announcement was not heard clearly was that the oxygen masks might have distorted the communication.

Safety analysis

The forward outflow valve was not operating as required which led to a rapid depressurisation of the aircraft as it approached its cruising altitude.

The PA announcement from the captain was muffled, resulting in the cabin crewmember not initialling realising that the flight crew were conducting an emergency descent and that they should use supplemental oxygen.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The aircraft's cabin pressurisation system failed resulting in the aircraft depressurising.
- The PA to the cabin was muffled as the crew were using oxygen masks and potentially critical information was not communicated to the flight attendant and the passengers.
- The flight crew fitted their oxygen masks immediately, when they noticed, at about 12,600 ft cabin altitude that the cabin pressure warning system had activated.

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.

Skippers Aviation

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

Raise pilot awareness on the difficulty of communication when they fit an oxygen mask and its effect on their clarity of speech. In such cases, they may be required to be more deliberate and punctuate their instructions.

The continuing airworthiness management system will continue to monitor XFP for any associated defects. The faulty valve will be overhauled to determine why it failed.

Safety message

The reaction time for pilots to fit oxygen masks is of critical importance when there is a cabin pressurisation failure. For the crew in this occurrence, it was the first action taken when they detected that the cabin pressure warning light was on. A misconception is that it is easy to recognise the symptoms of hypoxia and take corrective action before becoming seriously impaired. The signs and symptoms vary depending on the individual, the altitude and the extent of the exposure. While other significant effects of hypoxia usually do not occur in a healthy person in an unpressurised aircraft below 12,000 ft above mean sea level (AMSL), there is no assurance that this will always be the case. Furthermore, the altitude range of impairment due to hypoxia is best described as a continuum; there is no definitive altitude at which the effects of hypoxia begin or end. To mitigate the risk associated with these variations, if hypoxia is suspected, a descent to altitudes below 10,000 ft AMSL is suggested.

Additional information is provided in the following publications:

The ATSB research report, *Depressurisation Accidents and Incidents Involving Australian Civil Aircraft* (B2006/0142), is available from the ATSB website.

The ATSB investigation *report* *Pilot and Passenger Incapacitation Beech Super King Air 200, VH-SKC, Wernadinga Station, Qld, 4 September 2000* (200003771), is available from the ATSB website.

US Federal Aviation Administration (FAA) Advisory Circular AC 61-107B *Aircraft Operations at Altitudes Above 25,000 Feet Mean Sea Level or Mach Numbers Greater Than .75/ with Change 1*, is available from the FAA website.

General details

Occurrence details

Date and time:	7 August 2016 – 1345 WST	
Occurrence category:	Serious incident	
Primary occurrence type:	Depressurisation event	
Location:	67 km N Perth Airport, Western Australia	
	Latitude: 31° 20.35' S	Longitude: 115° 56.85' E

Aircraft details – VH-XFP

Manufacturer and model:	de Havilland DHC-8-106	
Registration:	VH-XFP	
Operator:	Skippers Aviation	
Serial number:	346	
Type of operation:	Air Transport Low Capacity - Passenger	
Persons on board:	Crew – 3	Passengers – 30
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Wirestrike involving Cessna 441, VH-NAX

What happened

On 5 September 2016, at about 0737 Central Standard Time (CST), a Cessna 441 aircraft, registered VH-NAX (NAX), departed from Adelaide Airport on a charter flight to Coorabie aircraft landing area (ALA), South Australia. On board were the pilot and nine passengers.

At about 30 NM from Coorabie, the pilot of NAX broadcast on the common traffic advisory frequency advising that they were inbound to the aerodrome. The pilot of another aircraft operated by the same company, that had landed some minutes earlier on runway 14 at Coorabie ALA, responded to the broadcast, advising the pilot of NAX to use runway 32 due to the downwards slope on runway 14 (Figure 1). The pilot of NAX had not previously operated into Coorabie ALA, but had studied prior to the flight the information provided by the operator (see *Pilot hazard awareness* below) with respect to any hazards associated with their landing. In addition, as the other company aircraft had landed safely, they elected to conduct a straight-in approach to runway 32. The pilot then positioned the aircraft on about a 10 NM final to runway 32.

Figure 1: Coorabie ALA facing south

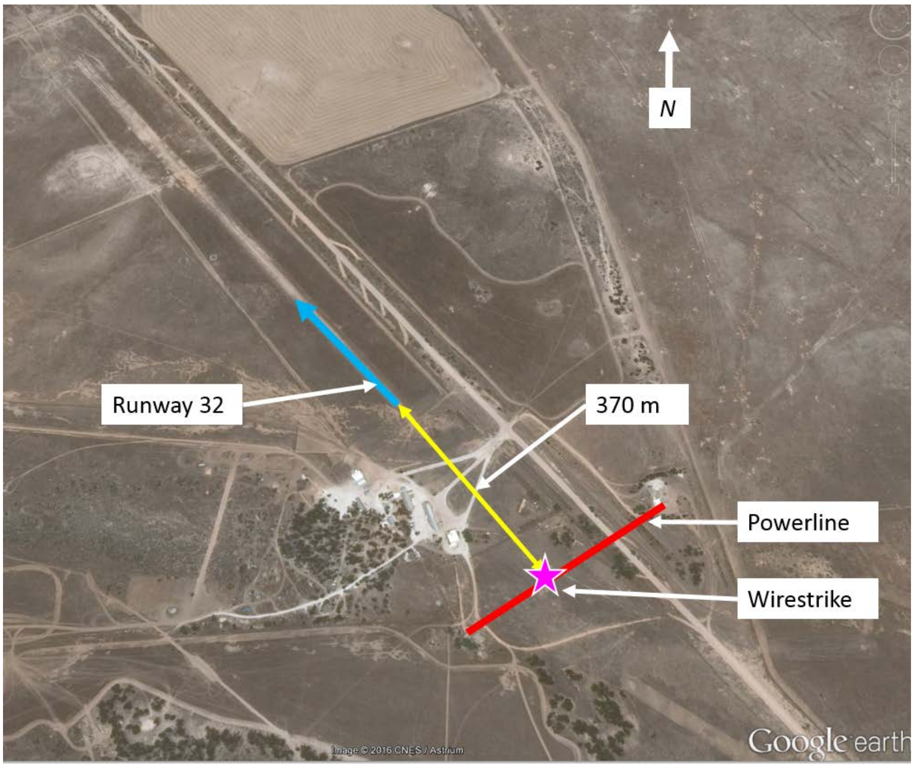
Source: ALA operator

At about 0900, when the aircraft was on final approach to runway 32, the pilot reported that the aircraft decelerated suddenly (from about 120 to 110 kt). At the same time, there was a slight shudder of the right engine and a change in the sound of the propeller pitch. The pilot immediately increased the power to both engines and levelled the aircraft off. The pilot checked the engine instruments and the annunciator panel, and there were no abnormal indications.

The pilot then conducted a go-around and a left circuit at about 1,100 ft above ground level. The aircraft subsequently landed on runway 32. While back-tracking, the pilot sighted a power pole on a hill beyond the runway 32 threshold (in the direction from which the aircraft had just approached). After shutting the aircraft down, the pilot noticed damage to the right propeller blades and suspected that the aircraft had struck a powerline (Figure 2). Witnesses on the ground confirmed that they had seen and heard the aircraft strike the powerline.

The pilot and passengers were not injured. The aircraft sustained minor damage.

Figure 2: Coorabie ALA showing the powerline 370 m from the threshold



Source: ALA operator

Pilot comments

The pilot of NAX had planned to overfly the runway, inspect the landing area and then join the circuit on the downwind leg for runway 14. The pilot commented that if they had overflown the airstrip prior to commencing the approach, they may still not have identified the powerline as the poles and wire were difficult to see. There was one pole near a house and the next pole was some distance away on terrain rising from the runway threshold. The company pilot who had landed before NAX did not sight the powerline during their strip inspection (overflying the runway).

The pilot further commented that if they had conducted a steeper approach they may not have struck the powerline.

Pilot hazard awareness

The pilot reported that they had not been alerted to the presence of the wire before operating at the aerodrome. The pilot had reviewed the company strip guide information for Coorabie ALA and photos of the runway provided by the aerodrome operator.

The information provided included a sketch of the runway and its direction (14/32), the latitude and longitude, length (900 m), width (25 m), elevation (75 ft) and under Special procedures: 'Slight rise to NW end Small hill'.

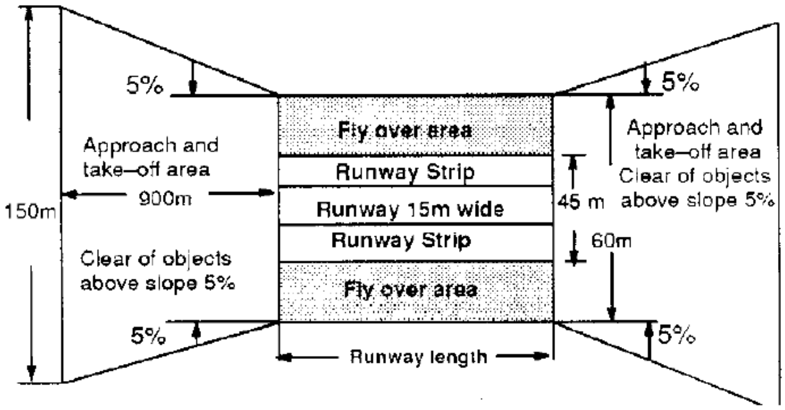
Wire marking standards

The requirements for mapping and marking powerlines and their supporting structures were published in *Australian Standard AS 3891.1, Part 1, Permanent marking of overhead cables and their supporting structures* and *AS 3891.2, Part 2, Marking of overhead cables for low level flying*. The ALA was not used as described in Clause 3.2 of AS 3891.1 nor were the powerlines in an area involved in planned low-flying operations as described in AS 3891.2. The powerlines did not require marking in accordance with either Australian Standard.

Advisory material

The Civil Aviation Advisory Publication (CAAP) 92-1(1) *Guidelines for aeroplane landing areas*, provided guidance on how pilots may determine the suitability of an aeroplane landing area (ALA) such as the recommended obstacle clearance standards and suggested landing area markings. The CAAP defined an obstacle free area to mean 'there should be no wires or any other form of obstacles above the approach and take-off areas, runway, runway strips, fly-over areas or water channels'. The minimum landing area physical characteristics recommended in the CAAP for aircraft (other than single-engine and centre-line thrust aeroplanes not exceeding 2,000 kg maximum take-off weight) for day operations is depicted in Figure 3. This shows the approach and take-off area should be clear of wires within 900 m of the runway ends above a 5 per cent (3°) slope.

Figure 3: Recommended landing area characteristics



Source: Civil Aviation Safety Authority

Powerline

The powerline was located about 370 m from the runway threshold and about 7.5 m above ground level. The powerline was below the recommended slope gradient of 5 per cent (Figure 3).

The operator of the ALA reported that they had spoken to a representative from the aircraft operator and advised them of the existence of the powerline prior to the flight. The ALA operator had identified the powerline as a hazard and reported that they had requested the infrastructure provider to fit markers to the powerline about 12 months prior to the incident.

The power infrastructure provider advised the ATSB that the ALA operator had enquired with the then distribution licensees about the fitting of markers to the powerline in 2012 and 2015. In 2012, the distribution licensee investigated and determined that the span of the powerline was too long to take the additional load of the markers. In 2015, the request for the markers was raised again by the ALA operator in conjunction with a request for a quote on a transformer upgrade. There was no follow-up with the provider about these requests.

Runway illusions

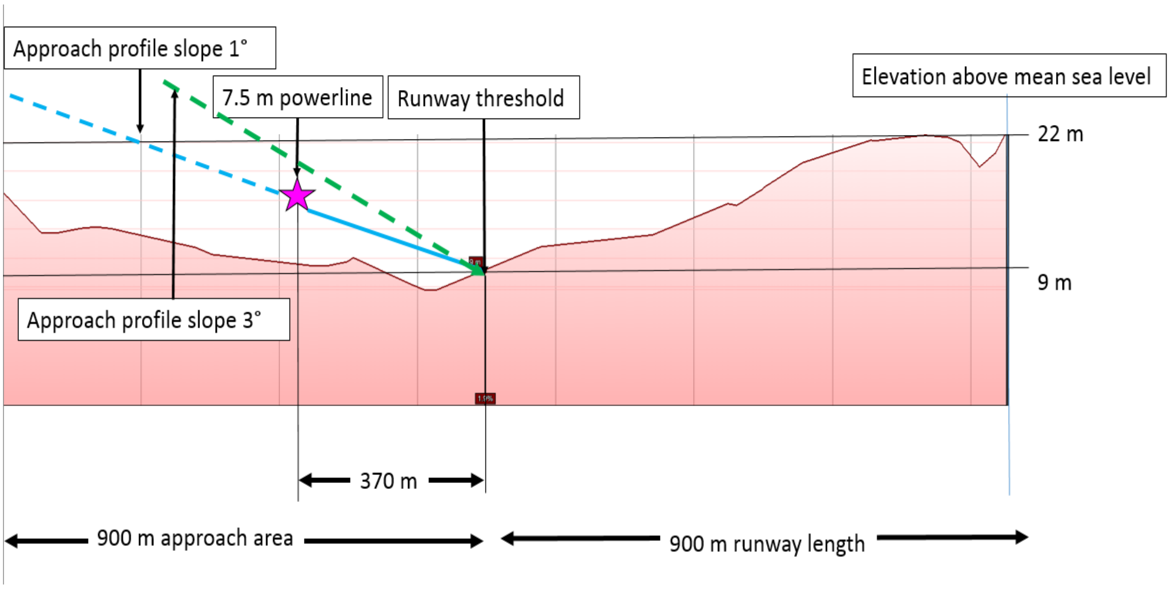
The profile of Coorabie ALA runway 32 and the approach area of 900 m (based on the recommended dimensions specified in Figure 3), obtained from Google earth, is depicted in Figure 4. The cleared area commencing from the runway threshold was about 1,170 m in length. Along that length, the profile rose from 9 m (30 ft) to 22 m (72 ft) elevation at the nominated runway length of 900 m, with higher ground rising to about 29 m (90 ft) beyond 900 m. The information provided to the operator by the ALA operator was that the runway length was 900 m, suggesting that the rising terrain beyond that point was not part of the runway. The stated runway elevation was 75 ft (23 m).

As can be seen in Figure 4, the terrain at the powerline was about the same height as the runway 32 threshold, with a dip in between. The glide path from a powerline 7.5 m above the terrain to the runway threshold was about 1°. A normal approach path is about 3°.

Runway slope is one environmental condition that can affect a pilot's perception of the aircraft's position relative to a normal approach profile. Flight Safety Foundation *Approach and landing accident reduction tool kit briefing note 5.3 – Visual illusions* stated that an uphill slope creates the illusion of being too high. That illusion may induce the pilot to 'correct' the approach resulting in a lower flight path, or may prevent the pilot from detecting when the aircraft is too low during the approach.

The briefing note advises that to reduce the effects of visual illusions, flight crews should assess approach hazards and be trained to recognise and understand the factors and conditions that cause visual illusions.

Figure 4: Coorabie ALA runway 32 and 900 m approach area profile



Source: Google earth annotated by ATSB

ATSB comment

It is essential for pilots to be aware of hazards prior to operating into an aerodrome. The location of known hazards and obstacles such as powerlines should be included in aerodrome information that is provided to pilots and aircraft operators who are permitted to operate at the airfield. As runway slope can result in visual illusions that may affect a pilot's judgement of the approach profile, runway slope information should also be included in operational information.

CAAP 166-1(3): *Operations in the vicinity of non-controlled aerodromes* stated that straight-in visual approaches are not a recommended standard procedure. They can be conducted provided certain conditions are met, including that pilots must be able to assure themselves of the aerodrome's serviceability and that hazards have been identified.

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 safety action in response to this occurrence.

Powerline owner

Following the incident (at the time of repairing the wire), the infrastructure provider marked the wire with three round orange markers (Figure 5).

Figure 5: Powerline with orange markers

Source: ALA operator

Aircraft operator

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

Notice to operational crew

The company issued the following directives in a notice to operational crew:

- Operations to new ALAs require specific chief pilot approval.
- ALAs that have not been used by company aircraft for more than 12 months are treated as new.
- All operations to ALAs require an overhead join to check the runway.
- Straight-in approaches to ALAs are not permitted.

Safety message

Research conducted by the ATSB found that 166 aircraft wirestrikes were reported to the ATSB between July 2003 and mid-June 2011 and another 101 occurred and were unreported but identified by electricity distribution and transmission companies. The majority of wirestrike occurrences were associated with aerial agriculture operations, however, 22 occurrences (8 per cent) involved private operations. Further information is in the research report, *Under reporting of aviation wirestrikes*.

The ability of pilots to detect powerlines depends on the physical characteristics of the powerline such as the spacing of power poles, the orientation of the wire, and the effect of weather conditions, especially visibility.

Depending on the environmental conditions, powerlines may not be contrasted against the surrounding environment. Often the wires will blend into the background vegetation and cannot be recognised. In addition, the wire itself can be beyond the resolving power of the eye: that is, the size of the wire and limitations of the eye can mean that it is actually impossible to see the wire. As such, pilots are taught to use additional cues to identify powerlines, such as the associated clearings or easements in trees or fields that can underlie the powerline, or the power poles and buildings to which the powerlines may connect.

Risks associated with operations to private airstrips can be mitigated by ALA owners assessing their airstrips against the guidance in CAAP 92-1(1) *Guidelines for aeroplane landing areas.* Such risk assessments would benefit from giving consideration to first time users of the ALA.

ATSB research report *An overview of spatial disorientation as a factor in aviation accidents and incidents* stated that 'runway illusions can be mitigated against by pilots being aware of the characteristics of their destination airfield in advance, and by being aware of the potential for such illusions to occur'.

General details

Occurrence details

Date and time:	5 September 2016 – 1037 CST	
Occurrence category:	Serious incident	
Primary occurrence type:	Wirestrike	
Location:	Coorabie ALA, South Australia	
	Latitude: 31° 54.00' S	Longitude: 132° 17.00" E

Aircraft details

Manufacturer and model:	Cessna Aircraft Company 441	
Registration:	VH-NAX	
Serial number:	4410106	
Type of operation:	Charter – Passenger	
Persons on board:	Crew – 1	Passengers – 9
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Minor	

Piston aircraft

Wheels up landing involving Piper PA31, VH-ETW

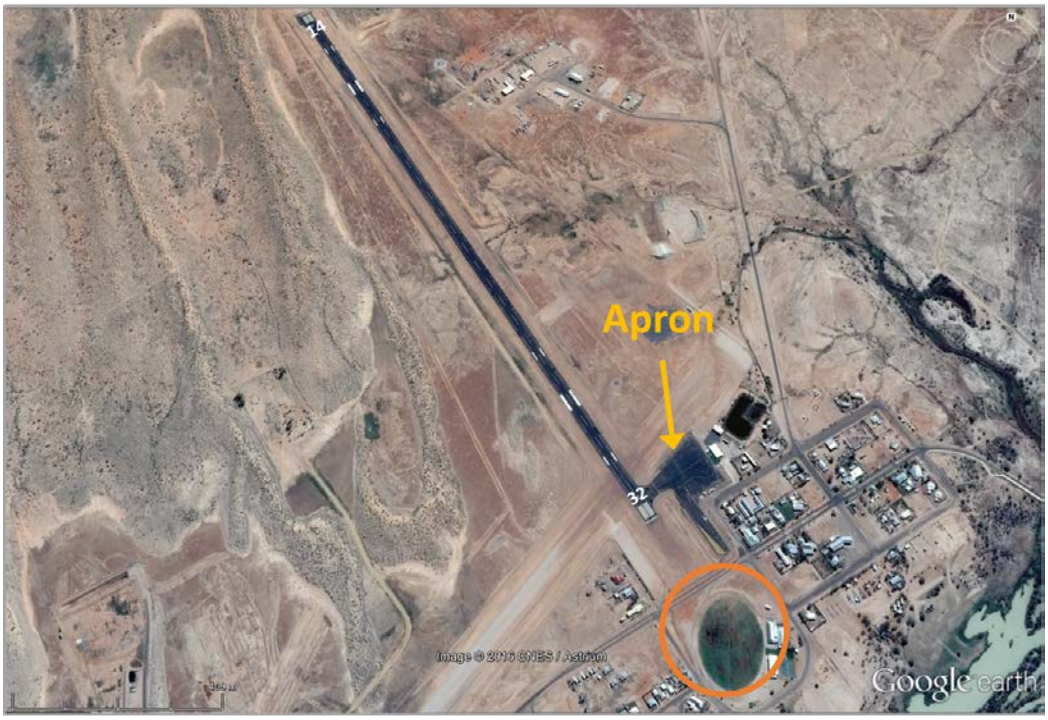
What happened

On 4 July 2016, at about 0940 Eastern Standard Time (EST), a Piper PA31-325 aircraft, registered VH-ETW (ETW), departed from Birdsville Airport, Queensland for a scenic flight to Lake Eyre, South Australia and refuelling at Marree. The pilot and four passengers were on board the charter flight.

On the return flight to Birdsville, at about 1410, the pilot broadcast on the common traffic advisory frequency (CTAF) indicating that they were about 30 NM south-west of Birdsville for a landing on runway 32. Later a pilot of a SAAB 340 aircraft also broadcast on the CTAF that they were about 15 NM east of Birdsville for a straight in approach, landing on runway 32, with a similar arrival time to ETW.

The pilot of ETW overflew the airport at about 2,500 ft on the upwind end of runway 32 to reduce the possibility of a conflict with the arriving SAAB (Figure 1). ETW joined for a wide downwind leg of the circuit and the pilot lowered the landing gear. The pilot observed that the SAAB that had now landed had not vacated the runway, so the pilot retracted the landing gear and extended the downwind leg to allow further time for the SAAB to vacate the runway.

Figure 1: Birdsville airport showing the location of runway 32, the parking apron and where the birds (hawks) were generally located off the end of runway 32 (orange circle).



Source: Google earth, modified by the ATSB

The pilot conducted the downwind checklist that included checking that the landing gear was down and locked, however, as the landing gear was in the up position, this part of the checklist was not conducted. When the aircraft was towards the end of the downwind leg, the pilot selected the landing gear handle down. The pilot noticed that the landing gear selector moved out more easily than normal, but the pilot identified that three landing gear down green lights were illuminated, indicating that the landing gear was down and locked.

While the pilot was scanning out the window, they noticed a flicker of the instrument lights. When they looked back inside the cockpit, they observed that the GPS had gone back into initialising mode, which indicated that it may have lost power. During the turn onto the base leg of the circuit, the pilot gave a broadcast on the CTAF and conducted the base leg checklist items (they did not include checking the landing gear). The pilot noticed that the SAAB had not vacated the runway, but was getting close to exiting onto the apron. As the aircraft completed the turn onto the base leg, the pilot felt something against their right knee. The pilot reached down and found that it was the landing gear selector handle, which had become partially detached from the selector lever (Figure 2). The pilot took hold of the handle to ensure it was not lost and confirmed that there were three green landing gear down lights illuminated.

Figure 2: ETW landing gear selector handle partially detached, against the pilot's knee.

ETW landing gear selector handle removed.

PA31 landing gear selector handle installed.

Source: Pilot, modified by the ATSB

The pilot inserted the handle back into the landing gear selector lever and retracted and extended the landing gear to ensure that everything was operating correctly. The pilot removed the handle and kept hold of it and then gave a final leg broadcast, turned onto the final leg and conducted the finals checklist items. This checklist included a landing gear check, but the pilot could not remember clearly if there were three green lights.

At about 200 ft on final approach, the pilot observed a significant number of birds (hawks) (see orange circle in Figure 1). Due to a 15kt crosswind, as the pilot flared the aircraft for landing, the aircraft moved to the right side of the runway and the pilot then noticed that the aircraft had a slightly higher nose attitude than normal. As the attitude kept increasing, the pilot slowly advanced the throttles, then the rear footstep touched the runway and made a scraping noise. The pilot decided not to close the throttles as the aircraft was not on the runway centreline and they continued to advance the throttles. As the speed increased, the aircraft attitude adjusted and the propellers struck the runway. The aircraft speed had increased to take off speed and the pilot assessed that the safest option was to continue with a take-off. The pilot did not notice any abnormalities with the engines.

The pilot conducted a circuit, selected and held the landing gear handle in the down position and the aircraft landed without further incident. The pilot and passengers were uninjured and the aircraft had minor damage to the propellers (Figure 3).

Figure 3: Damage to ETW propellers

Source: Pilot, modified by the ATSB

Pilot comment

The pilot reported that when the landing gear was selected down when on the final approach, the landing gear selector was easier than usual to pull out and move past the neutral stop to the gear down position.

The pilot reported hearing a continuous horn sounding while in the landing flare just as the throttle was advanced and believed that it was the stall warning horn. The pilot believed that the landing gear horn would not have sounded as the throttles were not decreased past the location of the limit switches, which is where the throttles are almost closed (see *Landing gear system* below).

The pilot indicated that after parking the aircraft on the apron, when the avionic switch was moved to the off position, the avionics remained on and it was not until the switch had been cycled several times between the on and off position did the avionics turn off.

The pilot returned to the aircraft a few days later and noted that when the electrical master switch was turned on there were no green landing gear indicator lights despite the wheels being down, indicating the aircraft still had an avionics defect.

The pilot indicated that a maintenance release inspection (the periodic (100 hourly or 12-month) maintenance inspection) had been completed on 13 May 2016 and about 15 hours prior to the occurrence. The pilot had been the only pilot to fly the aircraft since the 100 hourly inspection and had flown a flight earlier that day and not noticed any issues with the aircraft.

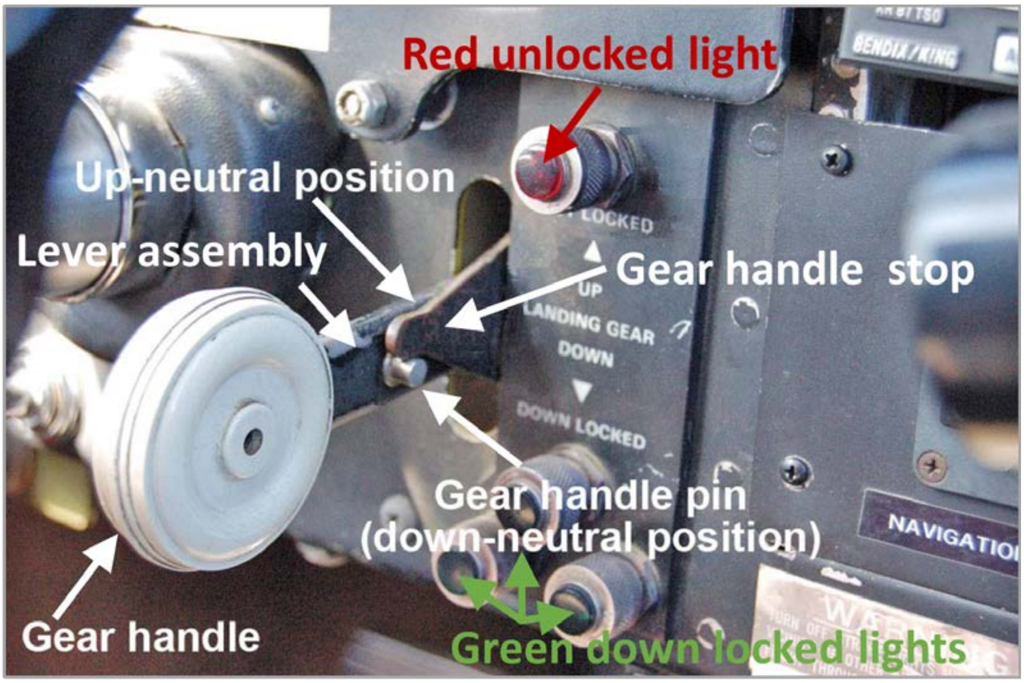
Landing gear system

The landing gear handle is attached to the landing gear lever by a sleeve that fits over the end of the lever and is held in place by a pin, which is retained by a split pin. In this incident, the pin and split pin had fallen out of the landing gear handle and lever. In addition to connecting the handle to the lever, the pin also interacts with a gear handle stop (Figure 4). The landing gear handle is designed so the handle is spring-loaded to a forward position (towards the instrument panel). The pin on the inboard side of the handle rests against the gear handle stop for the neutral up and neutral down position. This ensures that the landing gear handle cannot unintentionally be moved beyond the neutral stop.

To select the landing gear down, the gear handle is pulled away from the instrument panel, down and over the gear handle stop to the full down position. When the landing gear is fully extended and locked, the landing gear handle will then return automatically to the down-neutral position where it is held by the pin against the gear handle stop.

Located on the instrument panel, above and to the right of the landing gear handle are one red and three green indicator lights (Figure 4). The red light will illuminate when the gear is not locked and the gear handle is either in the up or down position. When each of the individual gear is down and locked the respective green light will illuminate. There is no indication light when the gear is up and locked. When power from either engine is reduced below 10 to 12 inches of manifold pressure, a horn in the cockpit should sound if the gear is not down and locked.

Figure 4: Landing gear selector handle showing the gear handle, lever assembly, gear handle pin and the up and down neutral positions. In addition, the red unlocked light and the green down locked lights.



Source: Canada Transport Safety Board, modified by the ATSB

Operator report

The operator conducted an investigation into the occurrence and determined that the aircraft's avionics were found to start up with the battery master switch, even though the avionics master switch was selected off. In addition, although the landing gear was down and locked, there were no green lights to indicate that this was the case. There was no indication of what the mechanical fault was in this system.

An inspection of the aircraft determined that when the gear handle was moved to the landing gear down position, it would normally return to the down neutral position. However, on the occurrence flight, the gear handle pin fell out. Without the gear handle pin to stop the landing gear lever at the gear handle stop, the lever continued to the gear up position (past the down neutral position to the up position) The landing gear retracted without the pilot being aware. However, the gear down and locked lights should have still illuminated prior to landing if the landing gear was down and locked.

Distractions for the pilot included the landing gear handle becoming detached, an issue with the avionics on downwind, numerous birds (kite hawks) that were flying around on final and the 15 kt crosswind.

Safety analysis

When the pilot had discovered that the landing gear selector handle had become detached, they used the detached handle to move the lever to retract and extend the landing gear to determine that there were no issues with the landing gear prior to the landing. The pilot then removed the handle to ensure that it did not fall and become inaccessible in flight, just in case the landing gear needed to be retracted and extended again. They believed that there were three green landing gear down indicator lights but was unaware that with the stop pin missing, the landing gear would self-retract after the landing gear handle was released. As a result, the pilot was not aware that the landing gear had retracted prior to landing.

There were a number of interruptions and distractions during the approach and landing phase of the flight. These included waiting for another aircraft to vacate the runway and subsequent alteration of the circuit to accommodate separation, issues with the GPS, the landing gear handle becoming free, large birds under the final approach and the crosswind during the landing. The combination of these interruptions, distractions and abnormal conditions likely contributed to the pilot flaring the aircraft for landing without realising the landing gear was in the retracted position.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The landing gear selector handle became detached and the landing gear retracting without the pilot's knowledge.
- Numerous distractions existed during the approach and landing that may have contributed to distract the pilot resulting in the aircraft landing with the landing gear in the retracted position.

Safety action

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

Aircraft operator

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

The pilot has undertaken comprehensive successful flight checks.

Aircraft defect rectification to ensure the aircraft is serviceable before further flight.

The aircraft operations manual will be amended to include actions to be taken when experiencing any abnormality with the aircraft's landing gear. This will refer to the emergency procedures checklist and the aircraft flight manual. The procedure will require the pilot to:

- abort the landing
- climb to 1,500 ft
- redo the pre-landing landing checklist to confirm green lights are on/or use the emergency landing gear hand pump to lower the landing gear.
- conduct a visual inspection of landing gear to ensure it is down and locked.

All pilots will be informed of the incident via email or a safety alert to inform them:

- of the importance of the gear control handle locking mechanism
- to inspect the gear control handle on a regular basis for faults or damage
- to look at additional options for confirming that the landing gear is down with the use of active control towers or having contact details of ground crew readily available to inspect the landing gear during a fly over.

Safety message

In the flying environment, interruptions and distractions can be subtle and brief and can interrupt the normal flow in the cockpit resulting in a preoccupation and distraction with one task to the detriment of another task.

The ATSB research report *Dangerous distraction: An examination of accidents and incidents involving pilot distraction in Australia between 1997 and 2004* (B2004/0324), is available from the ATSB website. The report found that it was likely that pilots have a general awareness of the inherent risks associated with distractions in the flying environment. Like all humans, however, pilots are susceptible to becoming preoccupied and distracted with one task to the detriment of another task.

The Flight Safety Foundation *Approach and Landing Accident Reduction (ALAR)* briefing note *2.4 - interruptions/distractions* discuss that interruptions/ distractions may be subtle or brief where even a minor equipment malfunction can turn a routine flight into a challenging event. The primary effects of interruptions/distractions is to break the flow pattern of ongoing cockpit activities such as normal checklists and problem-solving activities. The briefing contains guidance that may assist in managing interruptions/ distractions.

General details

Occurrence details

Date and time:	4 July 2016 – 1423 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Wheels up landing	
Location:	Birdsville Airport, Queensland	
	Latitude: 25° 53.85' S	Longitude: 139° 20.85' E

Aircraft details – VH-ETW

Manufacturer and model:	Piper PA31-325	
Registration:	VH-ETW	
Serial number:	31-8112012	
Type of operation:	Charter - Passenger	
Persons on board:	Crew – 1	Passengers – 4
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Minor	

Engine failure and forced landing involving Jabiru SP500, 19-5503

What happened

On 11 September 2016, at about 1000 Eastern Standard Time (EST), a Jabiru SP500 aircraft registered 19-5503 (5503), departed Caboolture Airfield, Queensland (Qld), for a flight to Boonah Airfield, Qld. The pilot was the only person on board.

As the aircraft approached Boonah Airfield, the pilot observed large white crosses on the runway indicating the airfield was closed. The pilot elected to return to Caboolture and applied engine power to climb to cruise altitude.

At about 1055, the aircraft climbed to the north of Boonah. At a height of about 1,000 ft above ground level, the pilot noticed the engine RPM reducing and applied full throttle. At the same time, the pilot observed a low and fluctuating engine oil pressure indication. Within seconds, the engine failed and the propeller stopped rotating. The pilot broadcast a MAYDAY[1] call on the Amberley common traffic advisory frequency. Air traffic control staff at RAAF Base Amberley received the MAYDAY broadcast and initiated an emergency response.

The pilot identified a paddock to the north of their position as suitable for a forced landing. They manoeuvred the aircraft to conduct a forced landing into the paddock (Figure 1). The pilot ensured that turns made during the forced landing were not tight and of low bank angle to avoid an aerodynamic stall. Late in the ground roll, the nose wheel dug into the soft surface (Figure 2), the aircraft tipped onto its nose and the right wingtip struck the ground. The aircraft then stopped and settled onto its wheels. The pilot was not injured and the aircraft sustained minor damage.

Figure 3: 19-5503 after the forced landing

Source: Pilot

[1] MAYDAY: an internationally recognised radio call announcing a distress condition where an aircraft or its occupants are being threatened by serious and/or imminent danger and the flight crew require immediate assistance.

Figure 2: 19-5503 after the forced landing

Source: Pilot

Engineering details and examination

5503 is an owner built and maintained aircraft. The engine fitted to 5503 was manufactured in 2001.

A post incident examination of the engine found the engine oil pump drive had failed.

Due to the limited scope of this investigation a post incident engineering examination was not conducted. The cause of the oil pump drive failure was not determined.

Previous occurrences

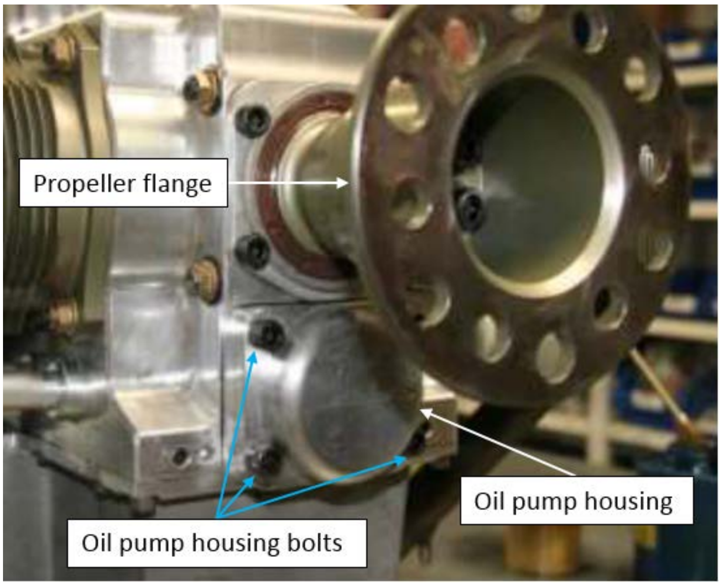
Jabiru advised that they are aware of one previous oil pump drive failure. In the previous occurrence the manufacturer found the engine maintainer had tightened the oil pump housing bolts (Figure 3) unevenly.

The Jabiru *engine overhaul manual* part 7.8.17 contains the following guidance on this part of the engine assembly:

> *Fit the outer pump housing over the gears and insert & hand tighten the retaining cap screws. Use Loctite 243 on the threads and ensure the Jabiru bird is oriented correctly.*
>
> *While the housing is still loosely held to the engine, rotate the crankshaft through at least 2 full revolutions. This turns the cam and allows the oil pump to find its preferred position. The housing can now be tightened to the value given in Table 9.*[2] *Failure to turn the engine can result in the oil pump being offset from the cam axis – this applies side loads to the cam and can eventually crack it or break the tip off altogether.*

[2] Table 9 of the Jabiru engine overhaul manual.

Figure 3: Oil Pump Housing (not incident engine)



Source: Jabiru

ATSB comment

In December 2014, the Civil Aviation Safety Authority (CASA) introduced instrument *294/14* imposing operation limitations on aircraft fitted with Jabiru engines. In July 2015, this instrument expired and was replaced by instrument *102/15.*

In July 2016, instrument 102/15 expired. CASA then introduced instrument 65/16 – *Conditions and direction concerning certain aircraft fitted with engine manufactured by Jabiru Aircraft Pty Ltd.* removing restrictions on Jabiru engines which met criteria detailed within the instrument.

The engine fitted to the aircraft was a Generation 1[3] engine. The pilot reported that the engine was maintained in accordance with Jabiru directions and complied with all Service Bulletins and Service Letters.

The ATSB determined that the operational restrictions imposed by instrument 65/16 did not apply to this aircraft.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The oil pump drive failed leading to engine failure and forced landing.
- The soft surface of the paddock used for the forced landing resulted in damage to the landing gear.

Safety message

This incident is a good example of the effect an in-flight engine failure at a low altitude has on the time available to manage that failure and identify a suitable forced landing area.

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

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[3] A Jabiru 3300 engine in the manufacturer serial number range 33A0001 – 33A0960.

The booklet shows that you can prevent or significantly minimise the risk of damage following a partial or complete engine power loss by using the strategies below:

- Pre-flight decision making and planning for emergencies and abnormal situations for the particular aerodrome
- conducting a thorough pre-flight and engine ground run to reduce the risk of a partial power loss occurring
- taking positive action and maintaining aircraft control either when turning back to the aerodrome or conducting a forced landing until on the ground, while being aware of flare energy and aircraft stall speeds.

General details

Occurrence details

Date and time:	11 September 2016 – 1055 EST	
Occurrence category:	Serious incident	
Primary occurrence type:	Engine failure of malfunction	
Location:	14 km N of Boonah (ALA), Queensland	
	Latitude: 27° 53.930’ S	Longitude: 152° 42.100’ E

Aircraft details

Manufacturer and model:	Jabiru Aircraft SP500	
Registration:	19-5503	
Serial number:	504	
Type of operation:	Private – Pleasure/Travel	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Minor	

Helicopter

Collision with terrain during mustering involving Robinson R22, VH-PFX

What happened

On 18 September 2016, at about 1355 Eastern Standard Time (EST), the pilot of a Robinson R22 helicopter, registered VH-PFX, commenced aerial mustering on a property about 15 km south of Coen, Queensland.

After successfully mustering one mob of cattle into a yard, the pilot started moving a second mob towards the north. The cattle started to move west instead of north, so the pilot descended closer to the cattle to encourage them to turn.

At about 1415, the helicopter was about 10 ft above the ground, at an airspeed of 40 to 50 kt, when a cow with long horns charged and reared up at the helicopter. The cow's horn went over the right skid of the helicopter, trapping the skid underneath it. The pilot applied full left cyclic[1] and raised the collective[2], but the helicopter rolled to the right. The main rotor blade struck the ground and the helicopter collided with the ground and slid about 10 m along a dirt road.

As the helicopter slid along the ground, it caught fire. The pilot exited with minor injuries and the helicopter was destroyed (Figure 1).

Figure 4: Accident site showing VH-PFX destroyed by post-impact fire

Source: Queensland Police

Pilot comments

Normally, the helicopter can remain at a higher altitude and mustering will still be effective as the noise moves the cattle in the intended direction. Very occasionally, when the area is clear, the only way to move the cattle is to get down low.

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1 Cyclic: 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.

2 Collective: 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.

Bladder-type fuel tanks

In July 2014, the Civil Aviation Safety Authority's (CASA) monthly update, *the CASA Briefing* included the section 'R22 operators urged to fit new fuel tanks'. CASA strongly recommended operators of R22 helicopters to install modified fuel tanks as early as possible. This was in response to Robinson Helicopter Company *R22 Service bulletin SB-109*, which required R22 helicopters with aluminium fuel tanks to be retrofitted with bladder-type tanks to improve the fuel system's resistance to a post-accident fuel leak. The retrofit was to be completed as soon as practical, but no later than the next 2,200-hour overhaul or 12-year inspection.

VH-PFX was not fitted with bladder fuel tanks. Although the bladder tanks could have been fitted at any time, as the aircraft had not yet reached the 2,200-hour overhaul or 12-year inspection period, it was not yet required to be fitted with bladder fuel tanks.

ATSB comment

Aerial mustering, as with other low-flying operations, carries an inherent level of risk. Elevated awareness and vigilance is necessary to fly an aircraft safely, monitor for the effects of environmental conditions such as wind direction and strength, and to scan for and avoid obstacles and other hazards. Operating at the height of the animals while mustering introduces additional risk as animals can act unpredictably, and should only be done as a last resort. At low level there is limited opportunity to react and respond to an abnormal situation.

General details

Occurrence details

Date and time:	18 September 2016 – 1415 EST	
Occurrence category:	Accident	
Primary occurrence type:	Animal strike	
Location:	15 km S of Coen, Queensland	
	Latitude: 14° 06.08' S	Longitude: 143° 10.13' E

Helicopter details

Manufacturer and model:	Robinson Helicopter Company R22 BETA	
Registration:	VH-PFX	
Serial number:	3464	
Type of operation:	Aerial mustering	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (Minor)	Passengers – 0
Aircraft damage:	Destroyed	

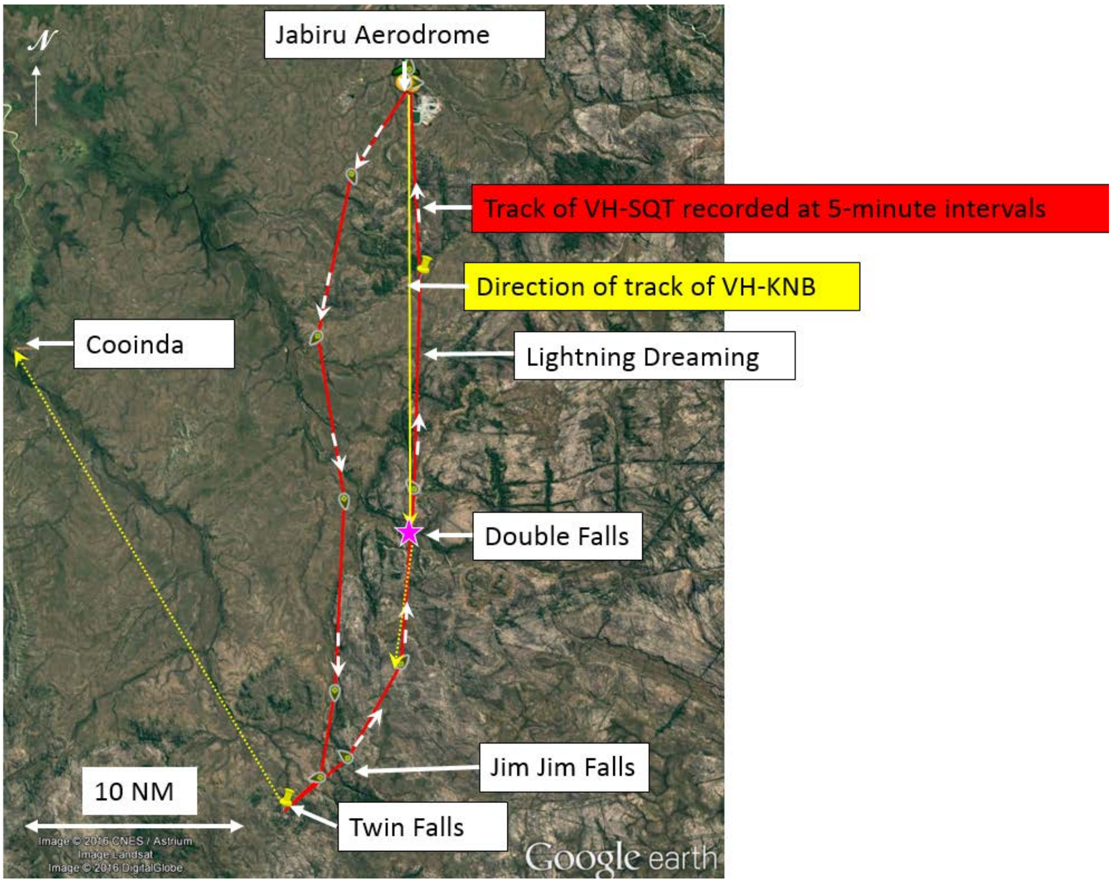
Near Collision

Near collision involving Cessna 210, VH-SQT, and Gippsland Aeronautics GA8, VH-KNB

What happened

On 22 September 2016, at about 1000 Central Standard Time (CST), a Cessna 210M aircraft, registered VH-SQT (SQT), departed Jabiru Airport, Northern Territory (NT), for a scenic charter flight with the pilot and four passengers on board. The aircraft followed the scenic route 'Charlie' in the fly neighbourly agreement (FNA) promulgated by Parks Australia (red line in Figure 1).

Figure 5: Recorded track of VH-SQT and relevant locations



Source: Operator of VH-SQT

About twenty-five minutes after SQT had departed from Jabiru, a Gippsland Aeronautics GA8 aircraft, registered VH-KNB (KNB), departed Jabiru Airport for a scenic charter flight to Cooinda Airport, NT, with the pilot and three passengers on board. Another aircraft from the same company departed immediately behind KNB on the same route. Both aircraft were following route 'Delta' in the FNA (yellow line Figure 1). The pilot of KNB broadcast on the common traffic advisory frequency (CTAF) when departing Jabiru. The pilot of SQT heard this call but did not respond. KNB then tracked south via Lightning Dreaming.

After overflying Jim Jim Falls, the pilot of SQT broadcast on the CTAF that they were departing Jim Jim and tracking for Double Falls (about 10 NM north-east) at 1,500 ft, and did not receive a response. The pilots of KNB and the company aircraft did not hear that call.

At about that time, KNB was also at 1,500 ft. The pilot of KNB selected the second radio in the aircraft which was on their company frequency to talk to the pilot of the company aircraft. During that time, the pilot was able to hear broadcasts on both the CTAF and the company frequency except while transmitting. The pilot then spoke to the passengers to provide commentary as they overflew a waterfall, and switched back to the primary radio to be able to transmit on the CTAF. As KNB was then at Double Falls which is about 10 NM from Jim Jim Falls, the pilot subsequently reported that they were then about to make a 10-mile inbound call for Jim Jim Falls.

After orbiting Double Falls in a left turn, the pilot of SQT rolled the wings level. Just as they did so, the pilot of SQT sighted a GA8 (KNB) pass within about 20 m horizontally to their left, and about 30 ft above SQT.

The pilot of SQT broadcast on the CTAF asking whether the pilot of the GA8 in the vicinity of Double Falls had heard their departure call from Jim Jim Falls. The pilot of KNB replied that they had not. The pilot of KNB then looked for SQT but did not see the aircraft at any time. When the pilot of SQT heard the callsign and response from the pilot of KNB, they realised that this company often had multiple aircraft operating in company and immediately looked for and sighted the other company aircraft at the same altitude about 300 m away.

Operator comments

The operator of SQT commented that they believe there is a need for a separate radio frequency for the Jabiru area. On the existing CTAF, pilots can hear broadcasts from Batchelor to the west and Numbulwar to the east. Most of those broadcasts are not relevant to pilots operating in the Jabiru area, but increase radio congestion and can potentially lead to over-transmissions.

Fly neighbourly agreement scenic routes

Following consultation with local operators through the Northern Territory Regional Airspace and Procedures Advisory Committees, the FNA routes were agreed on and published by Parks Australia in 2010 and published in the En Route Supplement Australia (ERSA). The FNA was due to be reviewed by Parks Australia in 2015 and the review is expected to be conducted later this year (2016).

The FNA routes were designed to avoid sensitive areas and for ‘park amenity, tourism experience and nature conservation’. The routes were not intended to provide aircraft separation, but they are mandatory routes for aircraft operating below 2,500 ft (unless operating in accordance with a special permit).

SQT and KNB were following different routes published in the FNA with both aircraft at 1,500 ft on reciprocal tracks. SQT was following route Charlie and KNB was following route Delta from Jabiru to Cooinda.

This was the first of the flights on the wet season routes this year. There had been significant rain in the previous fortnight that closed the roads to the falls. Pilots from the two aircraft operators had identified the possible conflict of opposite-direction aircraft the previous year and had agreed that they would broadcast departing via Lightning Dreaming when tracking south to alert pilots of aircraft tracking north on the reciprocal track. However, when the pilot of KNB broadcast on the CTAF that they were departing Jabiru, the broadcast did not include that they were tracking via Lightning Dreaming.

The pilot of KNB commented that they could have a similar procedure as they use for flights to Oenpelli: they track to Oenpelli at 1,500 ft and back to Jabiru at 2,000 ft to ensure separation between aircraft travelling in opposite directions. The pilot of SQT commented that having a plan and agreed routes and specified altitudes would help to prevent similar occurrences.

Safety analysis

The pilot of the north tracking SQT broadcast when departing Jim Jim Falls for Double Falls but the pilot of the south tracking KNB did not hear that transmission, possibly due to communicating with the other company pilot on the other radio. Therefore, they were not aware of SQT until the pilot of SQT broadcast after the near collision. The pilot of KNB also commented that the CTAF was busy as it covered a large area, and this may have contributed to the missed communication.

The pilot of KNB did not include 'via Lightning Dreaming' in their departure broadcast when departing Jabiru Aerodrome. While the broadcast 'via Lightning Dreaming' was not mandatory, it may have alerted the pilot of SQT to the two aircraft tracking in the opposite direction on reciprocal routes at the same altitude.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The aircraft were at the same altitude on reciprocal tracks on published FNA scenic routes and came into close proximity because the pilots were not aware of each other due to ineffective communication.

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 safety action in response to this occurrence.

Operator of VH-KNB

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

- A notice to pilots was distributed reminding them of the importance of effective radio usage as an aid to situational awareness in high traffic areas. Pilots were instructed to review and acknowledge Civil Aviation Advisory Publication (CAAP) 166-2(1) as it contains relevant information on alerted see and avoid radio techniques.
- Pilots of aircraft tracking towards Double Falls from the north are required to make an additional radio broadcast.
- All other scenic routes will be examined for potential conflict points and effectiveness of standard radio calls.
- They will discuss the incident with the operator of SQT and determine ways to reduce the risk of a similar incident occurring.
- Investigate alteration of flight routes and altitudes flown in conjunction with other operators.
- Investigate and review potential implementation of a dedicated radio frequency in scenic flight locations in Kakadu National Park.

Safety message

This incident highlights the importance of effective risk analysis by operators. An effective risk analysis of the FNA routes would probably have highlighted the potential for opposite-direction traffic. This may have led to risk management strategies such as implementation of vertical separation planning, radio broadcasts, and consideration of having a dedicated frequency.

A search for other traffic is eight times more effective when a radio is used in combination with a visual lookout than when no radio is used. In areas outside controlled airspace, it is the pilot's responsibility to maintain separation with other aircraft. For this, it is important that pilots use both alerted and un-alerted see-and-avoid principles.

Pilots are encouraged to 'err on the side of caution' when considering when to make broadcasts and whether specific frequencies should be monitored, particularly noting the fundamental importance of communication in the effective application of the principles of see-and-avoid. The ATSB report *Limitations of the See-and-Avoid Principle* outlines the major factors that limit the effectiveness of un-alerted see-and-avoid.

General details

Occurrence details

Date and time:	22 September 2016 – 1045 CST	
Occurrence category:	Serious incident	
Primary occurrence type:	Near collision	
Location:	49 km S of Jabiru Airport, Northern Territory	
	Latitude: 13° 06.00' S	Longitude: 132° 55.67' E

Aircraft details: VH-KNB

Manufacturer and model:	Gippsland Aeronautics GA8	
Registration:	VH-KNB	
Serial number:	GA8-07-109	
Type of operation:	Charter – passenger	
Persons on board:	Crew – 1	Passengers – 3
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Aircraft details: VH-SQT

Manufacturer and model:	Cessna Aircraft Company 210	
Registration:	VH-SQT	
Serial number:	21062874	
Type of operation:	Charter – passenger	
Persons on board:	Crew – 1	Passengers – 4
Injuries:	Crew – 0	Passengers – 0
Aircraft 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

ATSB Transport Safety Report
Aviation Short Investigations
Aviation Short Investigations Bulletin Issue 55
AB-2016-161
Final – 14 December 2016