



FINAL REPORT

AIC 17-1002

FINAL REPORT

Link PNG

P2-ANK

de Havilland Dash 8-202

Burst tyre at 20,000 feet during climb

39 nm west-northwest of Port Moresby

PAPUA NEW GUINEA

4 August 2017



About the AIC

The Accident Investigation Commission (AIC) is an independent statutory agency within Papua New Guinea (PNG). The AIC is governed by a Commission and is entirely separate from the judiciary, transport regulators, policy makers and service providers. The AIC's function is to improve safety and public confidence in the aviation mode of transport through excellence in: independent investigation of aviation accidents and other safety occurrences within the aviation system; safety data recording and analysis; and fostering safety awareness, knowledge and action.

The AIC is responsible for investigating accidents and other transport safety matters involving civil aviation, in PNG, as well as participating in overseas investigations involving PNG registered aircraft. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The AIC performs its functions in accordance with the provisions of the PNG *Civil Aviation Act 2000 (As Amended)*, and the *Commissions of Inquiry Act 1951*, and in accordance with *Annex 13* to the Convention on International Civil Aviation.

The object of a safety investigation is to identify and reduce safety-related risk. AIC investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the AIC 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 AIC endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why it happened, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, were based on many factors, including the level of safety benefit likely to be obtained from the investigation. For this occurrence, a full on-site, fact-gathering investigation was commenced. The aircraft sustained a burst tyre in flight at 20,000 ft, causing substantial damage to the left nacelle main structure with panels aft of the exhaust missing. Under the PNG *Civil Aviation Act 2000 (as amended)*, *Section 247, Advisory Circular AC 12-1 Appendix A, Section 3, Defect Incidents*, and ICAO *Annex 13, Chapter 1*, the occurrence was classified as an accident.

This Final Report has been produced in accordance with the PNG *Civil Aviation Act 2000 (as amended)*, *Annex 13* to the Chicago Convention on International Civil Aviation, and the PNG Accident Investigation Commission's Policy and Procedures.

Burst tire in flight at 20,000 ft

Occurrence details

On 4 August 2017 local date (3 August UTC¹), a de Havilland Dash 8-202 aircraft, registration P2-ANK (ANK), owned by Air Niugini and operated by Link-PNG, completed a scheduled Commercial air transport operation² as flight number PX 713 from Bulolo, Morobe Province to Port Moresby. The aircraft arrived at Port Moresby Jacksons International Airport at 21:31 UTC. It had remained overnight at Bulolo. According to the Technical Log, the aircraft was serviceable when it arrived at Port Moresby.

The aircraft was scheduled for flight PX 864, from Port Moresby to Tari, Hela Province on the same day, with an estimated departure time of 22:45. The pilots carried out a normal pre-flight inspection of the aircraft before it was released to service by the licensed engineer on duty.

After obtaining a clearance from air traffic control (ATC), ANK departed from runway 14L at 23:04 UTC, then made a right turn, and commenced tracking on the 298°R of the Port Moresby VOR³ for Tari, under IFR⁴ procedures. There were 28 passengers, two pilots, and one flight attendant on board. At about 09:20 while 39 nm west-northwest of Port Moresby and passing 20,000 ft during the climb, both pilots heard a bang sound, and felt the aircraft shudder.

The copilot reported that he first thought that it was an engine failure. However, visual checks of the engines and instrument gauges showed that both engines were operating normally. He then did a further quick scan of the instrument panel and said that he saw the “unsafe left hand main landing gear door indication” amber light illuminated⁵. He said that he immediately advised the pilot in command (PIC). The copilot then informed ATC of their intention to return to Port Moresby, and that a normal approach and landing was expected.

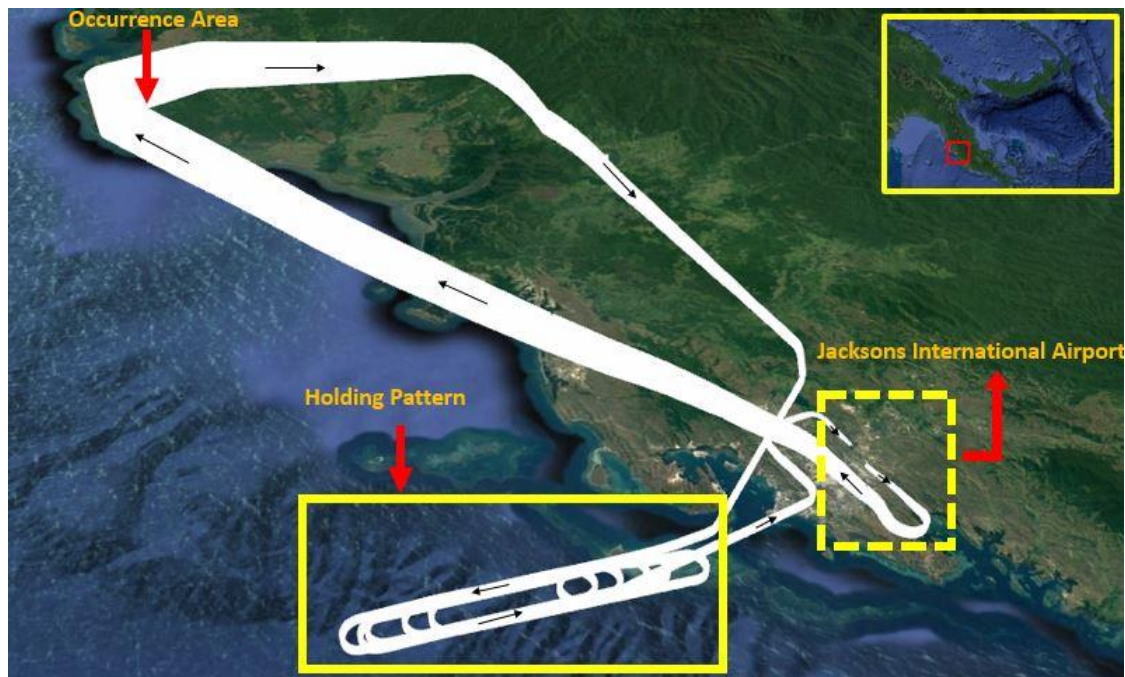


Figure 1. ANK Estimate Flight path
Source: Flight Data Recorder

¹ The 24-hour clock, in Coordinated Universal Time (UTC), is used in this report to describe the local time as specific events occurred. Local time in the area of the accident, Papua New Guinea Time (Pacific/Port Moresby Time) is UTC + 10 hours.

² An aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire.

³ Very High Frequency Omni-Directional Radio Range (VOR).

⁴ IFR; instrument flight rules.

⁵ The report is quoting the copilot. The aircraft manufacturer confirmed that the landing gear indications are Advisory Lights. The doors' indications are illuminated only when the appropriate gear door is not in a CLOSED condition, rather than “unsafe”. The copilot saw the left main landing gear door OPEN Advisory light.

The flight attendant then alerted both pilots that the left main landing gear door was open. That confirmed the reason for the illuminated left main landing gear door OPEN Advisory light. The PIC referred to the Quick Reference Handbook (QRH) as a precaution, and descended to remain below 15,000 ft, and not above 130 knots.

At 10 nm from Port Moresby, the copilot requested clearance from ATC to track west of Port Moresby to the Daugo Island area, to hold for 30-40 minutes and burn-off fuel, due to the maximum allowable landing weight. After burning off the excess fuel to achieve a landing weight of 15,650 kgs, they requested a clearance from ATC to continue descent to Jacksons for a landing.

After obtaining a clearance to land, on the Tower Frequency VHF⁶, the copilot selected the landing gear down. With the landing gear fully extended, the cockpit indication was three green lights illuminated. The copilot conducted a cross-check against the alternate landing gear selection, which showed three green lights illuminated. They proceed to land, assured that the nose- and main- landing gear were safe. At 00:46, the aircraft landed on runway 14L, and was cleared to cross runway 14R to the parking area.

The PIC reported that it was at that moment they realized that everyone on the tarmac was looking at the aircraft, particularly the left side. It wasn't until the passengers and the crew disembarked, that the crew were advised by the engineers that panels were missing aft of the left exhaust nacelle.

Further inspection found that the left main landing gear number-two tyre was deflated and damaged. It was apparent that when the tyre blew out in the wheel well, it caused substantial damage to the main structure on the inside of the nacelle. It was then the crew realised that the bang sound they heard was the tyre exploding in flight at 20,000 ft.

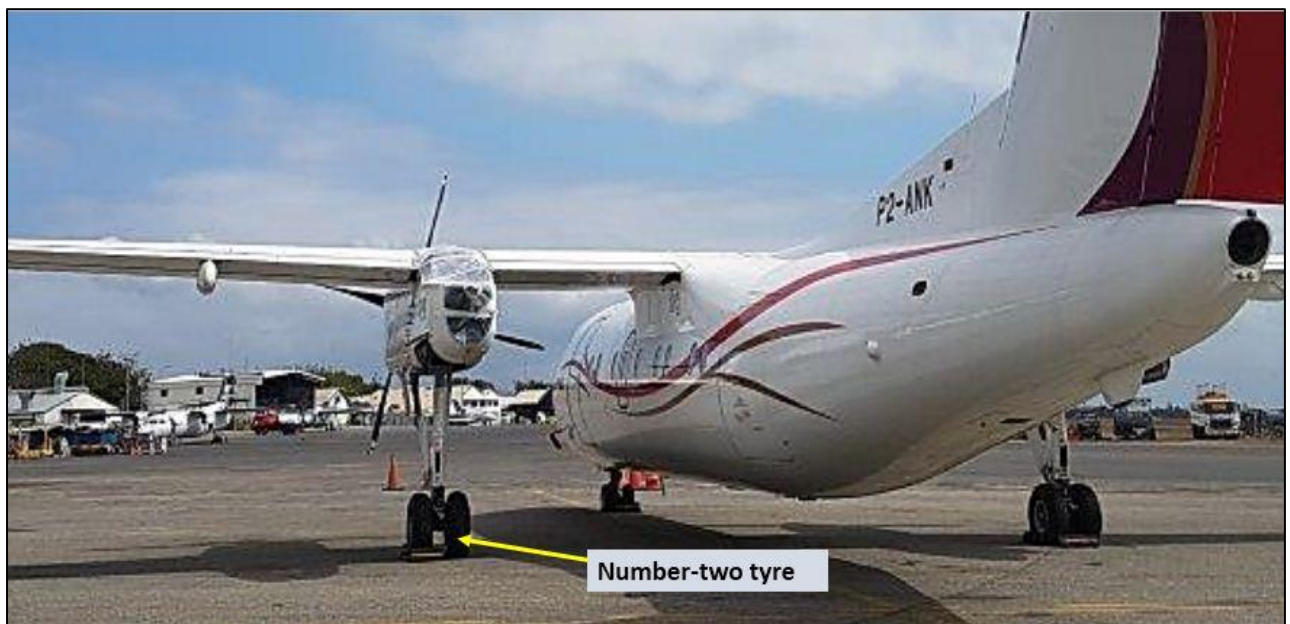


Figure 2. View showing location of the number-two tyre

⁶ VHF; very high frequency radio



Figure 3: Damage area left nacelle



Figure 4. Damaged left nacelle (Wrapped in plastic for protection)



Figure 5: Right nacelle fully intact



Figure 6: Damage number-two left main wheel tyre



Figure 7: Wheel Assembly during dis-assembly under AIC supervision.

Pilot Information.

The pilot was an Australian Citizen and held a valid PNG ATPL (A)⁷ issued by CASA, and a valid Class 1 Medical Certificate. He had 25,000 hrs total flying time, with 5,000 hrs on the aircraft type. He was multi-engine rated and held a command Instrument Rating. Not injured.

Co-Pilot Information.

The co-pilot was a PNG Citizen and held a valid PNG CPL (A)⁸ issued by CASA, and a valid Class 1 Medical Certificate. He had 1,257 hrs total flying time, with more than 1,000 hrs on the aircraft type. He held a copilot multi-engine rating and instrument rating. Not injured.

Cabin crew.

There was one flight attendant; a PNG citizen. Not injured.

Passengers

There were 28 passengers on board; all were PNG citizens. Nil injuries.

Weather

According to the Area Forecast, the weather at the time of the flight on 3 August was: wind variable at 3kts, with clear skies and visibility more than 10 km, with few clouds at 1,800 ft, and scattered clouds at 4,000 ft.

⁷ ATPL (A): Air Transport Pilot Licence for aeroplanes

⁸ CPL (A): Commercial Pilot Licence for aeroplanes

Occurrence notification

The Air Niugini Corporate Quality & Safety Department management did not reveal the full extent the aircraft damage when notifying the AIC on 4 August. Further enquiries into the occurrence by AIC on 6 August revealed that the aircraft was significantly damaged, and panels had been lost at sea. The AIC notified Air Niugini of the decision to immediately commence an investigation.

The AIC notified the State of Manufacturer, and a non-travelling Accredited Representative was appointed by that State, the Accredited Representative did not nominate an adviser from the aircraft Manufacturer, nor was one appointed.

The AIC investigators visited the Air Niugini Engineering department, late afternoon on the evening of 6 August, and examined the aircraft, and downloaded the recorded data from the Flight Data Recorder and the Cockpit Voice Recorder. They took photos and inspected the nacelle area that was extensively damaged as a result of the tyre exploding up through the top of the nacelle. The investigators arranged for the wheel and tyre to be quarantined in the Air Niugini quarantine store.

The AIC's investigation team re-visited the Air Niugini Engineering hangar on 7 August, and had the wheel assembly disassembled under AIC supervision. The tyre was then taken into AIC custody and was brought to the AIC facility where it was further examined before being sent to the tyre manufacturer's facility for analysis to determine the cause of the failure.

The Investigation team requested *Non Destructive Testing* of the hub assembly, serial number 2634 to establish if it had been damaged. *Eddy Current and Fluorescent Dye Penetrant* inspections were carried out in accordance with the Non Destructive Testing Manual (NDTM), AP763 Part 3 and 5, chapter 32-42-05 and 32-42-07. No cracks were found during the inspection, and the hub assembly was certified as serviceable, by the engineer technician.

Air Niugini Engineering Management invited the manufacturer's Senior Structures Engineer based in Sydney to carry out a damage assessment survey report. The AIC was given a copy of the engineers report.

Aircraft pre-flight inspections

The PIC is required to carry out a pre-flight check, which includes checking the condition and serviceability of the main- and nose- landing gear assemblies including wheels and tyres, all flight control surfaces, engines and nacelles, propellers, fuselage and empennage for any irregularity or Foreign Object Damage (FOD). The PIC subsequently accepts the aircraft as serviceable after a licensed engineer confirms that the aircraft is serviceable, by certifying in the Aircraft Technical Log (ATL) book.

The engineer on duty is required to ensure that the aircraft is serviceable before and after each flight. Air Niugini *Form MC-D8-001* is a DASH-8-200/300 *Maintenance Instructions Checklist*, which is used to carry out a post or pre- flight inspection, and must be certified by the licensed engineer. This is in accordance with Civil Aviation Rules, Part 43. The form is sent to the Air Niugini Maintenance Section and filed for record purposes. The engineer certifies and releases the aircraft as serviceable on the Aircraft Technical Log book. These inspections were reportedly carried out in accordance with Air Niugini procedures and Civil Aviation Rules, Part 43.

Bulolo airstrip

The Bulolo airstrip had a gravel surface and was approximately 1,460 m long. A strip surface inspection report was carried out on 10 August by the LinkPNG, Ground Operations and Security Manager. The AIC was given a copy of the report.

The report was comprehensive, describing the airstrip surface. The airstrip has a slope 0.8° down to the northwest. The report stated that in September 2016, three quarters of the runway was compacted with coarse gravel. Subsequent continuous exposure to the weather elements had eroded the gravel surface, exposing large embedded stones at several locations along the runway. Depressions in several areas along the runway were also evident during the inspection.



The Bulolo Airport Licence Agreement, between *PNG Forest Products* (Licensor) and *Hidden Valley Services* (Licensee), signed on 2 June 2013, was binding for a period of 5 years, or such other period as the Licensor and the Licensee agree, and may be extended under this clause more than once.

The Licensor Obligations are an Administration and Support role to the Licensee, but the Licensor must still maintain and comply with all relevant Civil Aviation Rules, Part 139.

The Licensee Obligation is collectively the maintenance works of the aerodrome at its own effort and cost, and to carry out and complete specified airport works.

Figure 8: Jagged edge rocks found at the Bulolo strip.

Source: LinkPNG *Bulolo Airport Facility Inspection Report*

The works included: removal of vegetation identified by the Licensee or CASA as hazardous or potentially hazardous to aircraft arriving, departing or manoeuvring within the airport; grading and compacting of the runway surface; repair and maintenance of fencing; provision of airport security; airport lighting; the terminal building; and collectively the maintenance works as per the agreement. The runway surface was to be maintained to a standard in accordance with CASA requirements and the Civil Aviation Rules.

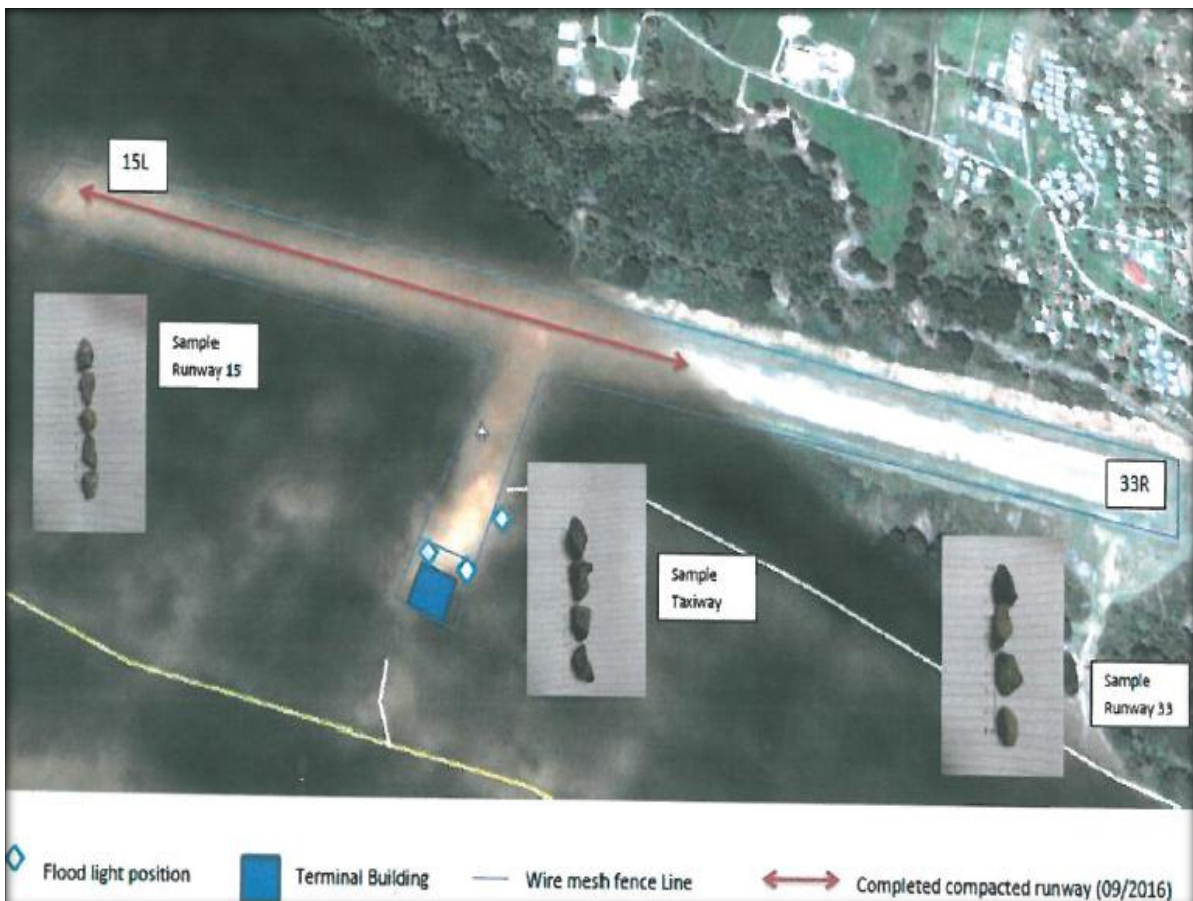


Figure 9: Aerial view of Bulolo Airstrip

Source: LinkPNG *Facility Inspection Report*



Figure 10: Bulolo Airstrip Surface
Source: LinkPNG- Facility Inspection Report

Jacksons International Airport

Jacksons International Airport comes under the jurisdiction of the National Airports Corporation (NAC), which has the 24/7 responsibility to ensure that the runway surface is safe and free of damage or foreign objects. That responsibility rests with the Operations, Safety Assurance and Regulatory Compliance Division. Their report of the runway surface inspection carried out on 4 August, is recorded and documented in the Airport Safety Officer (ASO) Log Book.

Because ANK sustained a burst tyre in flight after departure from Jacksons, the NAC Safety Assurance and Regulatory Compliance Division generated a report *RAOOR: 019:2017* on 18 September. The report detailed the inspections carried out on the Jacksons International Airport runway surface on 3 and 4 August. The first inspection commenced at 02:50 hrs, on runway 14L-32R and runway 14R-32L, and included runway lighting and navigational aids, and other support equipment, which were all recorded as serviceable. These inspections continued throughout the day at regular intervals, and are recorded in the Log Book until the last flight of the day. The Log Book entries for 4 August showed that between 02:50 hours and 10:00 hours, every inspection carried out was recorded as the runways being serviceable.

Tyre manufacturer's report

The tyre assembly was sent to the tyre manufacturer in Thailand for detailed examination and analysis of the failure mode. All relevant processing and history records of the tyre were reviewed and found to comply with all specifications. The tyre manufacturer's report AS171001 concluded that there was no sign of a manufacturing anomaly on the tyre.

The manufacturer found evidence of hard-impact damage on the tyre wall and that the casing fracture was caused by FOD⁹. The analysis revealed that the side wall of the tyre had been impacted by a hard object at serial side sidewall¹⁰ locations. After the casing plies at the impacted serial sidewall area severed, the fractured casing plies propagated along the cord direction to the tread area, and the non-serial¹¹ side sidewall.

- The casing fractured along the casing-ply cord direction, across the tread area. The fractured area was between the serial side sidewall and the non-serial side sidewall.
- There was an impacted sign at serial side sidewall, see Figure 3
- The cord endings at impact area were sharp. That indicated that the casing plies suddenly broke due to hard impact, see Figure 4.

⁹ FOD: Foreign Object Damage.

¹⁰ Serial side sidewall is the side of the tyre facing the outer side of the wheel rim.

¹¹ Non-serial side sidewall is the side of the tyre facing the inner side of the wheel rim.



Figure 11: Impact area
Source: Tyre manufacturer's report



Figure 12: Fractured tyre showing sharp cord endings
Source: Tyre manufacturer's report

AIC comment

Under the *Bulolo Airport Lease Agreement* signed on the 2 June 2013 between *PNG Forest Products (Licensor)* and *Hidden Valley Services (Licensee)*, both companies were required to abide by specific obligations.

Under chapter 3 of the agreement, the *Licensor's* responsibility was mostly administrative. They were to ensure they maintained the aerodrome licence for the term of this licence, and comply with all relevant PNG Civil Aviation Rules.

Under chapter 5 of the agreement the *Licensee* must, during the term of the agreement at its own effort and cost, carry out and complete specified airport works to maintain the strip to CASA requirements.

The investigation determined that *Licensee* had neglected its primary responsibility of properly maintaining the airstrip, to allow for safe landings and take-offs of aircraft, in particular LinkPNG aircraft. It is likely that this neglect contributed to the cause of the tyre blow out.

Pre-flight inspections were carried out by the PIC at Bulolo and at Jacksons. The duty engineer at Jacksons carried out the mandatory pre-flight inspection prior to ANK's departure from Jacksons, and the aircraft was certified as being airworthy.

Due to weather erosion over time, and the lack of maintenance by the *Licensee*, large jagged rocks had become exposed on the surface of the Bulolo strip.

The tyre manufacturer's inspection and observations were that the damage to the tyre was caused by FOD.

It is likely that the FOD damage occurred when a jagged rock impacted the non-serial sidewall of the number-two tyre during the landing at Bulolo on 3 August 2017. The aircraft returned to Jacksons safely, but the damage was not found during post-and pre-flight inspections. During the subsequent flight after departure from Jacksons on 4 August, the casing plies in the impacted area fractured, propagating from the serial side sidewall along the cord direction to tread area and the non-serial side sidewall. It is likely that the significantly damaged and weakened casing of the tyre, and the differential of the atmospheric pressure compared with the pressure within the tyre, caused the tyre to blow out, resulting in substantial damage to the left nacelle.

Safety action

On 25 October 2017, the Civil Aviation Safety Authority of PNG informed the AIC that the Bulolo Aerodrome, *Civil Aviation Rule Part 139, Aerodrome Operating Certificate (ADOC)* had lapsed and Bulolo Aerodrome was not certificated. However, moves were underway for its certification. At the time of finalising this investigation report 4 January 2018, the Bulolo ADOC had not been renewed by CASA PNG.

General Details

Date and Time	3 August 2017 23:22 UTC	
Occurrence category	Accident	
Occurrence type	Left main landing gear number-2 tyre burst in flight	
Location	39 nm west-north west of Port Moresby	
	Latitude: 09° 05'S	Longitude: 146°40'E

Crew details pilot in command

Nationality	Australian
Licence type	ATPL (A)
Licence number	P20087
Total hours	24,381 hours
Total hours on type	5,217 hours
Total hours last 30 days	71.8 hours

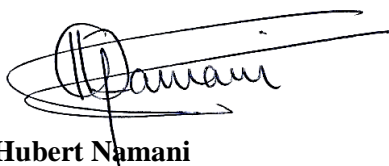
Crew details copilot

Nationality	PNG
Licence type	CPL (A)
Licence number	P22246
Total hours	1,257.8 hours
Total hours on type	1,015.2 hours
Total hours last 30 days	26.6 hours

Aircraft Details

Aircraft manufacturer and model	Bombardier (de-Havilland Canada) Dash 8-202	
Registration	P2-ANK	
Serial number	461	
TTIS	36,000.43 hours	
C of A	Number 011- Non Terminating	
C of R	Number 011- Date of Issue 01 st March 2012	
Type of operation	Scheduled Commercial air transport operation	
Main Tyre P/N	3-14354	
Main Hub assembly S/N	2634	
Persons on board	Crew: 3	Passengers: 28
Injuries	Crew: Nil	Passengers: Nil
Damage	Left nacelle	

Approved



Hubert Namani

Chief Commissioner

4 January 2018

