AIRCRAFT ACCIDENT SHORT REPORT

CA18/2/3/9713 Piper PA-31-350 Navajo Chieftain: Left gear collapse

Date and time	30 May 2018: 1004Z
Aircraft registration	ZS-LVJ
Aircraft manufacturer and model	Piper Aircraft Corporation – PA-31-350
Last Point of departure	Baragwanath (FASY) Aerodrome
Next point of intended landing	Wonderboom Aerodrome (FAWB)
Location of accident site with reference to easily defined geographical points (GPS readings if possible)	GPS Coordinates S25°39' 9.75" E028°13'.23.84"
Meteorological Information	Wind direction, 290°: Temperature, 22°C: Wind speed, 10 knots: Visibility, 10km
Type of operation	Private (Part 91)
Persons on board	1 + 2
Injuries	None
Damage to aircraft	Substantial

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Purpose of the Investigation:

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (2011), this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or accidents and not to apportion blame or liability.

Disclaimer:

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1. SYNOPSIS

1.1 On Wednesday morning, 30 May 2018, the pilot and two passengers departed Baragwanath Aerodrome (FASY) on a ferry flight to Wonderboom (FAWB) Aerodrome on a PA-31-350 aircraft. The flight segment to FAWB was uneventful and, during approach at about 3 nautical miles (3NM) to FAWB, the pilot selected the landing gear down and the landing gear indication lights were green confirming that gears are down and locked.

1.2 The aircraft touched down normally on Runway 29 and, during the landing roll, the left main landing gear (MLG) collapsed. Damage was sustained to the left propeller and left wing. No one was injured. Post-accident inspection of the MLG showed that the left MLG side brace had fractured.

1.3 The investigation revealed that the left-hand main landing gear collapsed due to fractured MLG side brace.

2 FACTUAL INFORMATION:

2.1 On Wednesday morning, 30 May 2018, the pilot and two passengers departed Baragwanath Aerodrome (FASY) on a ferry flight to Wonderboom (FAWB) Aerodrome on a PA-31-350 aircraft. The aircraft was being ferried for maintenance purposes to repair fuel gauges.

2.2 The pilot reported that before departing FASY, he conducted normal passenger briefing, started the engines and, thereafter, taxied the aircraft to the threshold of Runway 31.

2.3 Visual meteorological conditions (VMC) prevailed and the take-off was normal. The pilot continued to climb to a cruising altitude of 7 500 feet (ft) and 160 knots indicated air speed (KIAS). According to the pilot, on approach to FAWB at approximately 3.8nm, he was cleared by the air traffic control (ATC) to land on Runway 29. The flight was conducted without incident during the initial approach.

2.4 Standard calls were made on the aerodrome frequency 118.35 megahertz (MHz) and the aircraft was on final approach speed of about 90 miles per hour (mph). At approximately 3 NM from touchdown, the flaps were lowered to 25%, followed by the lowering of the landing gear to the down and locked position with three landing gear green indication lights illuminating. The aircraft touched down on the centreline of the runway at a ground speed of about 60 knots. During the landing roll, the left wing started to drop, and the pilot felt the aircraft sinking. The pilot then suspected the left main gear failure and closed the throttles; placed the mixtures in the idle cut off position and feathered the propellers.

2.5 The aircraft continued veering off to the left of the runway onto the grass area facing towards the threshold of Runway 29. The pilot called the ATC who promptly dispatched the aircraft rescue and firefighting team (ARFF) to the scene. The pilot turned off the fuel and the master switch before supervising the evacuation. Neither the pilot nor passengers suffered any injuries during the accident sequence.

2.6 A team of aircraft maintenance engineers (AMEs) from the aircraft maintenance organisation (AMO) where the aircraft was ferried came to the site. They confirmed that the gear lever was in a down position. All the cockpit controls and switch selections were in their aircraft shutdown positions, which included the fuel selectors in the off position. During the recovery of the aircraft, when the left wing was lifted by a fork lift, the left main gear extended and was instantly secured by a heavy-duty ratchet strap (See Figure 2 and 3). This allowed a thorough visual inspection of the left wheel well area, which showed that the hydraulic lines had remained intact. Both oleo struts were normally extended. Further examination revealed that the left main gear leg side brace (P/N 40277) had fractured and is the cause of the left gear collapse.

2.7 The investigators also examined the right main gear components and no discrepancies were identified. Both main wheel well doors were hydro-mechanically operated and were consistent with the landing gear being down prior to the accident. The left-wing tip had sustained abrasion due to contact with the runway surface. The abrasion/wear affected the whole left-wing tip assembly, in particular, the lower skin assembly. Additionally, the left-wing flap had been violently pushed upwards, which indicated that its driving system had suffered damage, considering that the respective left-wing flaps were found in a landing configuration (second notch); and the left wing, engine and propeller came into contact with the ground surface.

2.8 The left propeller “Hartzell” Model HC-E3TR-2AFT, serial No DJ4347 sustained substantial damage after coming into contact with the ground. The aircraft was towed to a hangar where a thorough visual inspection was conducted. The landing gear rigging examination was conducted and was found to be satisfactory. The bushings had deposits of grease consistent with normal maintenance and the correct grease type MIL-G-7711.

2.9 The calculated take-off weight of the aircraft was 1971kg below the maximum certificated take-off weight of 3,273kg and it was established that the aircraft’s centre of gravity (C of G) was within the prescribed limits of 126.8 inches aft of datum prior to the accident.

2.10 Maintenance records made available to the investigator showed that the undercarriage of ZS-LVJ aircraft had no history of operational problems. Review of the maintenance records for the accident aircraft showed compliance with the Federal Aviation Administration (FAA) Airworthiness Directive (AD) 2000-25-01 on 7 April 2008 at a total of 8064.3 airframe hours. The FAA AD required the landing gear door hinges and attachment angles to be inspected for cracks.

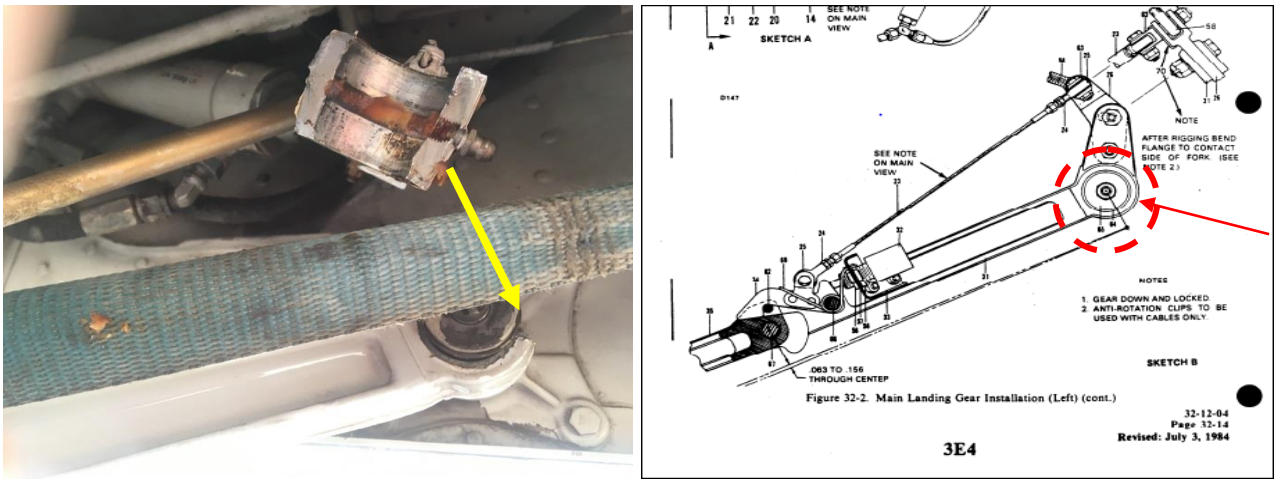
2.11 FAA AD-96-10-14 with an effective date of 27 June 1996 required the repetitive dye penetrant inspections of the right and left main landing gear forward side braces on Piper PA31, PA31P and PA31T series aircrafts at every 100hour scheduled maintenance unless a newer designed side brace is fitted thus complying with the AD. It is recorded on the airframe logbook that AD-96-10-14 was complied with on 29 May 2014 at a total 8056.0 hours, then on 13 October 2017 at 8076.95 airframe hours and finally on 16 August 2018 at 8081.10 airframe hours. The AMO could not provide maintenance records that demonstrate left and right main landing gear were subjected to dye penetrant inspection, only entries were entered in the logbook as complied with.

2.12 A review of maintenance records revealed that the aircraft's recent mandatory periodic inspection (MPI) was completed and signed out on 5 February 2018. At that time, the airframe had accumulated 8081.10 total airframe hours. Following the MPI, a total of 46.5 airframe hours was flown with the aircraft.

2.13 The pilot was qualified for the flight in accordance with the existing Civil Aviation Regulations. According to the pilot's logbook at the time of the accident, he had a total of 4958 total flight hours, of which 100 were on the Piper PA-31-350 aircraft type. The flight was conducted under the provisions of Part 91 of the CAR 2011, as amended.

2.14 The accident occurred during daylight conditions at a geographical position determined to be S25°39'9.75" E028°13'23.84" at an elevation of about 4 095 feet (ft) above ground level. (See Figure 1)

Figure 1: The aircraft as found at the accident site.



Figures 2 and 3: A picture showing a fractured left main gear side brace and an illustration from Piper Maintenance Manual.

2.15 Metallurgical Examination Outcome

2.15.1 A fractured main landing gear forward side brace from the Piper PA-31, registration number ZS-LVJ, was reviewed by a metallurgist. The side brace was painted white and had fractured at the pivot point. The side brace was removed from the aircraft, upon which the paint was stripped from the entire part. (See Figure 4)

Figure 4: The side brace showing a fractured pivot point.

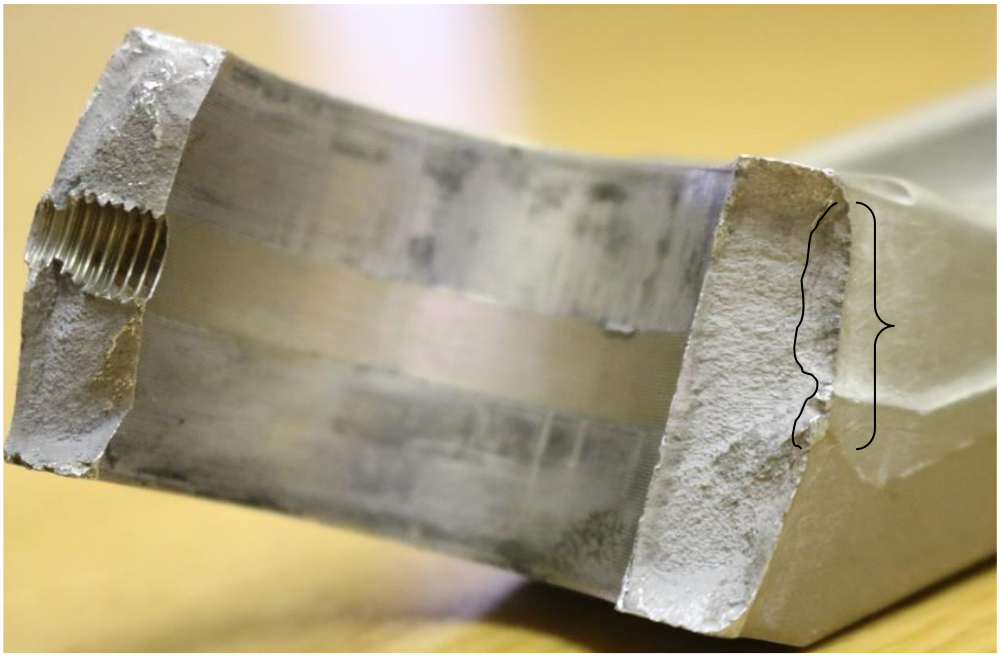


Figure 5: The side brace from a different angle showing a fractured pivot point.

2.15.2 The report indicated that a portion of the side brace pivot point was fractured in a plane perpendicular to the surface. This portion of the fracture on a perpendicular plane was located at the upper side of the brace and had curving crack arrest lines and a smooth curving boundary, features consistent with fatigue. Radial step features consistent with ratchet marks were also observed.
Ratchet marks are step features on the fracture surface that form due to fatigue crack initiation on slightly different planes. The ratchet marks and the overall shape of the fatigue boundary were consistent with multiple fatigue origins located at the upper surface. Dashed lines on the images of the fracture surfaces figure 5 above indicate the approximate fatigue boundary, and brackets in the same images indicate the fatigue origin area. The remainder of the fracture surface had rough matte grey fracture features consistent with ductile overstress fracture. The presence of multiple fatigue origins and the relatively small size of the fatigue region relative to the remainder of the fracture area were consistent with relatively high cyclic stresses on the part.

3. Findings:

3.1 The pilot was issued with a commercial licence on 22 April 2017 with an expiry date of 31 May 2018.

3.2 The pilot was issued with a medical certificate on 17 November 2016 and with an expiry date of 31 October 2017.

3.3 The pilot had accumulated a total of 4 958.5 flying hours, of which 100 flying hours were on the aircraft type. He had flown 3.2 hours on type during the past 90 days prior to the accident.

3.4 The aircraft was issued with a valid Certificate of Airworthiness on 23 November 2017 with an expiry date of 30 November 2018.

3.5 Maintenance records revealed that the aircraft's most recent mandatory periodic inspection (MPI) was completed and signed out on 5 February 2018. At that time, the airframe had accumulated 8 079.1 total airframe hours, and the engines had accumulated (left) 4570.15, (right) 4 570.15, and the propellers (left) 4 497.2, (right) 4 497.2 flight hours since major overhaul. According to the maintenance records the airworthiness directive was complied with on 13 October 2017 at total airframe hours of 8 064.

3.6 Following the MPI, a total of 46.5 airframe hours was flown with the aircraft.

3.7 The aircraft sustained substantial damage during the accident sequence.

3.8 The accident was survivable as the cockpit/cabin area remained intact and all occupants were properly restrained; none of them was injured.

3.9 The pilot indicated that he did not obtained weather forecast, however, he reported the following: wind direction of 290 degrees at 10 knots, and visibility as CAVOK.

3.10 The aircraft was on a ferry flight to FAWB for maintenance. Records showed that the aircraft fuel gauges were unserviceable. The flight was conducted under the provisions of Part 91 of the Civil Aviation Regulation (CAR) 2011 as amended.

3.11 There was no evidence observed that the condition of runway could have been a factor in the accident.

3.12 On-site visual inspection of the left wheel well area showed that the hydraulic lines were intact. Both oleo struts were normally extended. Further examination revealed that the left main gear leg side brace (P/N 40277) had fractured and had caused the gear to retract.

3.13 The investigation revealed that the left-hand main landing gear collapsed as a result of the left side brace failure due to fatigue and, in some areas, due to overstress fracture.

3.14 Although the AMO made logbook entry that the FAA AD 96-10-14 was complied with on the 13th of October 2017, the AMO could not provide evidence of maintenance records that support the entry into the logbook, it is probable that the FAA AD 96-10-14 was not complied with.

4 PROBABLE CAUSE:

4.1 The left-hand main landing gear collapsed due to a side brace failure during the landing roll, and the side brace failure was due to fatigue.

4.2 **Contributory factor:**

4.2.1 No compliance with AD 96-10-14 which requires repetitive dye penetrant inspection.

5 SAFETY RECOMMENDATION:

5.1 The AMO should ensure adherence to the manufacturer's documentation and the CAR 2011, Part 43.

5.2 It is recommended to the Director of Civil Aviation that the Director review the maintenance activities of the AMO with the aim to ensure that there are maintenance records supporting entries entered in the aircraft logbooks.