AIRCRAFT INCIDENT SHORT REPORT

CA18/3/2/1214, Nose gear failed to extend during approach and the aircraft landed with nose gear retracted.

Date and time	:	23 July 2018 at 1257Z
Aircraft registration	:	ZS-MBU
Aircraft manufacturer and model	:	Cessna Aircraft Company; Model T210M
Last point of departure	:	Wonderboom Aerodrome (FAWB)
Next point of intended landing	:	Wonderboom Aerodrome (FAWB)
Location of incident site with reference to easily defined geographical points (GPS readings if possible)	:	Wonderboom Aerodrome (FAWB), Gauteng (GPS:25°39'13.79" E028°13'51.53")
Meteorological information	:	Surface wind: Calm, CAVOK
Type of operation	:	Training (Part 141)
Persons on-board	:	2
Injuries	:	Nil
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 incident and ***not to apportion blame or liability.***

Disclaimer:

This report is produced without prejudice to the rights of the South African Civil Aviation Authority (SACAA), which are reserve.

1. SYNOPSIS

1.1 The aircraft was involved in a fuel starvation incident on 15 August 2017 wherein the nose gear fork and doors were damaged. Both the nose gear fork and doors were replaced by the aircraft maintenance organisation (AMO) number 1148 during a mandatory periodical inspection (MPI) which was completed on 12 December 2017. During the MPI, whilst the AMO was inspecting the nose gear doors before replacing them, it was discovered that the nose gear doors were made of fiberglass. The landing gear fork and damaged doors were removed, and serviceable fork and manufacturer-approved doors fitted to the aircraft.

1.2 On 23 July 2018, an instructor and a student took off from Wonderboom Aerodrome (FAWB) on a training flight for conversion to type. During the downwind checks, the instructor realised that the nose gear was not extended. He then executed three landing approaches for the tower to confirm all landing gears were extended. The tower confirmed that the main landing gear was extended but the nose gear was retracted. The instructor also reported that he had used the emergency landing gear extension to recycle the landing gear without success. He then declared an emergency by broadcasting a “Pan Pan Pan” before landing on Runway 29. The aircraft landed with the main landing gear extended and the nose gear retracted. The aircraft flew 24.2 hours since the last MPI which was carried out on 12 December 2017.

1.3 The investigation revealed that it is likely that there was a blockage in the nose gear door check valve which prevented the flow of the hydraulic fluid into the nose gear door actuator system which prevented system from reaching 400psi and opening the landing gear doors. The failure of the landing gear door system prevented the hydraulic pressure build up which would open the priority valve and lower the nose gear. The emergency system operation failed due to the system dependent on the nose gear door check valve and the priority valve operating and with the check valve inoperative, the system failed to lower the nose gear.

2. FACTUAL INFORMATION

2.1 History of flight

2.1.1 On 15 August 2017, the aircraft had an incident of fuel starvation in which the nose gear folk and doors were damaged. The aircraft was sent to an aircraft maintenance organization (AMO) number 1148 for repairs and scheduled maintenance. The AMO completed this maintenance on 12 December 2017 and, during that maintenance, it was discovered that the damaged nose gear doors were not manufacturer-approved and were made of fiberglass. The landing gear folk and damaged doors were removed, and serviceable folk and manufacturer-approved doors fitted to the aircraft.

2.1.2 On 23 July 2018, an instructor and a student took off from FAWB on a training flight for conversion on type. During the downwind checks, the instructor realised that the nose gear was not extended. He then executed three landing approaches for the tower to confirm all landing gears extended. The tower confirmed that the main landing gear were extended but the nose gear was retracted. The instructor also reported that he had used the emergency gear extension to recycle the landing gear without success. He then declared an emergency by broadcasting a “Pan Pan Pan” and executed a landing on Runway 29. The aircraft landed with the main landing gear extended and the nose gear retracted. The aircraft had flown 24.2 hours since the last MPI which was carried out on 12 December 2017.

2.1.3 The owner of the aircraft could not recall who recovered the aircraft and who removed the landing gear doors after the incident of 23 July 2018.

2.1.4 The AMO number 85, who repaired the aircraft post this incident of 23 July 2018, reported that the nose gear doors were removed from the aircraft prior to the aircraft being received by them for repairs. They tested the landing gear without the doors attached and no anomalies were detected.

2.1.5 The aircraft had a certificate of registration (CoR) which had been issued on 19 August 2014. The aircraft also had a certificate of airworthiness (CoA) which had been issued on 31 January 2018, with an expiry date of 31 January 2019. The last mandatory periodic inspection (MPI) was carried out on 6 December 2017 at 4106.1 hours. The certificate of release to service (CRS) was issued on 6 December 2017 at 4106.1 hours, with an expiry date of 5 December 2018 or at 4206.1 hours, whichever occurs first. The aircraft had flown a total of 24.2 hours since its last MPI. There were no recorded defects prior to the incident of 23 July 2019.

2.1.6 Fine weather conditions prevailed at the time leading to the incident.

2.1.7 The incident occurred during daylight at FAWB with Global Positioning System (GPS) co-ordinates determined to be S25°39’13.79” E028°13’51.53” and at an elevation of 4095 feet.

2.1.8 The following information was obtained from the service manual Model 210 & T210:

System operation

When the aircraft master switch is closed the hydraulic power pack is ready to operate. When the gear up position is selected with the selector handle the selector valve connects the gear up line to the system pressure and the gear down line to return. At the same time the electric motor that powers the hydraulic pump is turned on. The hydraulic pressure is passed through a filter and is then divided between the selector valve and door valve.

The hydraulic pressure is passed through a filter and is then divided between the selector valve and door valve. Before hydraulic pressure can reach the selector valve a priority valve a priority valve must open. The priority valve can open only under two conditions:

There can be no pressure in the door close line because door close pressure is applied to a piston to hold priority valve closed. System pressure must build up to 750 psi before the valve can open. Pressure therefore must go to the door open line. Pressure in the door-close line is prevented from returning by the door close lock check valve and the valve is opened by a piston that senses door-open pressure.

When the pressure reaches 400 psi the door close lock check valve opens and the doors on the aircraft open. At 750 psi the priority valves open and the landing gear begins to retract. As soon as the landing gear is locked in the UP position the landing gear up limit switches sequence the door solenoid valve to the door close position. When pressure in the door close line reaches 1500psi the pressure switch shuts off the motor and the GEAR-DOWN cycle is similar to the GEAR-UP cycle.

The system has been designed so that at any time during system operation the direction of system of operation may be reversed. Under these conditions the first operation of the system after the selector handle is moved is to completely open the doors and then move the gear into the newly selection position after which the doors will close again. There is no danger of interference between the gear and doors of the aircraft since the gear does not receive hydraulic pressure unless the doors are in the fully opened position.

When extending the landing gear with an emergency hand pump, fluid flows directly to the landing gear check valve and the priority valve, where it first opens the doors then extends the landing gear through the same passages and lines used by the normal/regular system. The check valve will prevent fluid from entering the inlet passage from the engine driven pump.

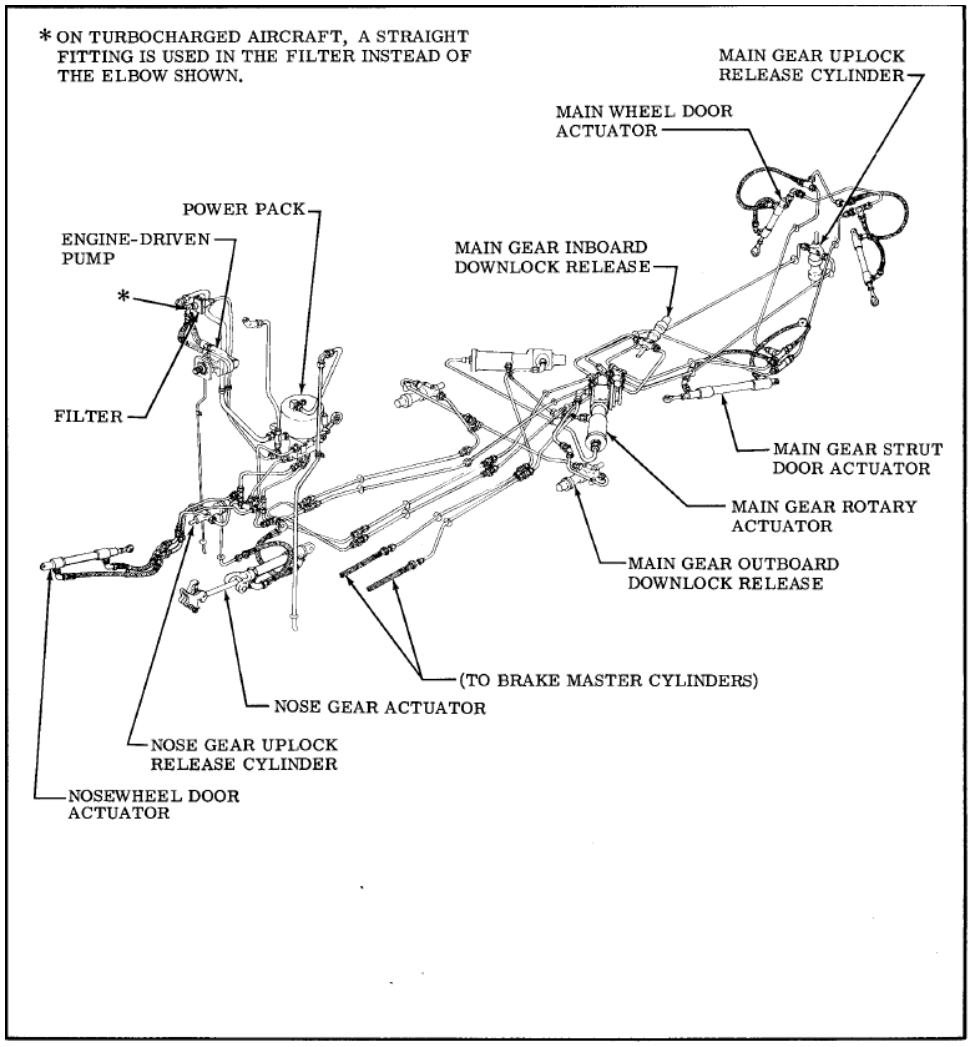

Figure 1: Hydraulic system components

2.1.9 The following are the possible causes of a nose gear system failure to extend:

1. Incorrectly rigged system – the aircraft operated for 24.2 hours prior to this incident and no anomalies were found with the landing gear system after test, however, these tests were done without the doors being installed.

2. Lack or insufficient hydraulic fluid – the hydraulic fluid in the reservoir was sufficient to operate both the normal and emergency system.

3. Mechanical failure – there was no observation of mechanical failure in the system.

4. Hydraulic pump failure – the hydraulic pump was operational as the main gears did extend during extension of all gears, however the nose gear could not be extended. It is not known why the nose gear system failed to extend even after using the emergency system.

2.1.10 The nose gear system failed to extend when the landing gears were selected down and only the main gears did extend. The check valve opens the doors when the pressure in the system reaches 400 pounds per square inch (psi) and if that pressure is not reached, the system will not operate which resulted in the nose gear failing to extend.

2.1.11 When the emergency hand pump was used, it had no effect as the hydraulic fluid flows through the same nose gear door check valve and increases the pressure to 400psi. If the pressure fails to get to 400 psi, then the rest of the system will not operate. As a result the nose gear will not extend.

2.1.12 The investigation revealed that it is likely that there was a blockage in the nose gear door check valve which prevented the flow of the hydraulic fluid into the nose gear door actuator system as a result there was not enough pressure (400psi) required to open the door check valve which will automatically open the priority valve to extend the nose gear. The emergency system operation couldn't extend the nose gear as it depends on the opening of the check valve which failed to open.

3. Findings

3.1 The pilot had been issued with a Commercial Pilot Licence (CPL) on 7 July 2017, which expired on 31 July 2018. He had been properly rated on the aircraft type prior to the incident, however, at the time of the incident, his licence was not valid due to the expired medical certificate. The pilot's medical certificate expired on 31 January 2018.

3.2 The pilot had flown a total of 1079 hours and had a total of 12.3 hours on aircraft type.

3.3 The MPI was carried out on 6 December 2017 at 4106.1 airframe hours. The aircraft had a total of 4130.3 airframe hours at the time of the incident. The aircraft had flown a total of 24.2 hours since its last MPI.

3.4 The aircraft was being operated under Part 141 of Civil Aviation Regulations as amended.

3.5 Weather conditions were fine at the time of the occurrence and were not a contributory factor to the incident.

3.6 The aircraft had been issued with a certificate of airworthiness (C of A) on 19 January 2014 and a certificate of registration (C of R) on 31 January 2018 with an expiry date of 31 January 2019.

3.7 The aircraft landed with the nose gear retracted, causing damage to the nose gear doors, the propeller and the bottom nose cowling.

3.8 The pilot declared an emergency by broadcasting a "Pan Pan Pan" before executing a landing on Runway 29 with the main landing gear extended.

3.9 Operational check and rigging were performed by the AMO.

3.10 It was reported that during the aircraft's last MPI, the nose gear doors were removed as they were incorrect (composite/fibre glass doors) and were replaced with the approved Cessna 210 nose gear doors made of aluminium.

3.11 The investigation revealed that it is likely that there was a blockage and/or leakage in the nose gear door check valve system which prevented the flow of the hydraulic fluid into the nose gear door actuator system as a result the required 400 psi pressure could not be reached resulting in the nose gear failing to extend.

4. PROBABLE CAUSE/CONTRIBUTING FACTOR

4.1 It is likely that there was a blockage and/or leakage in the nose gear door check valve system which prevented the flow of the hydraulic fluid into the nose gear door actuator system as a result the required 400 psi pressure could not be reached resulting in the nose gear failing to extend.

5. REFERENCES USED ON THE REPORT

5.1 None.

6. SAFETY RECOMMENDATION

6.1 None.

7. ORGANISATION

7.1 None.

8. APPENDICES

8.1 None.