

Safety Investigation Report

Ref. AAIU-2012-18

Classification: Accident

Level of investigation: Standard

Date and hour: 26 July 2012 at 15:22 UTC

Aircraft: Cessna P210N, U.S. registered

Total flight time: 2080:53 FH

Type of engine: Continental TSIO-520-P (piston engine, fuel-injected, turbocharging)

Accident location: EBAW, Antwerp Airport

Type of flight: Cross-country in VMC

Phase: Landing

Persons on board: 2

Injuries: None

Abstract:

The pilot, accompanied by a student pilot made an ILS approach on RWY 29 in EBAW. He confirmed he didn't visually check the extension of the main landing gear. Initially the landing was smooth but upon touchdown, the aircraft began to swing and ended up on its belly. It finally came to a stop on the runway. The 2 occupants left the plane uninjured whereupon they noticed that the nose landing gear was fully extended, but that the main landing gear collapsed.

Cause:

The cause of the accident was an undetected malfunction of the landing gear extension which prevented the pilot to take appropriate actions.
This can be classified as a system/component failure non-powerplant (SCF-NP).

Consequence:

Abnormal runway contact (ARC)

Recommendations:

AAIU(Be) has no safety recommendations.

Factual Information

History of the flight

The pilot-owner had planned a holiday trip, leaving on Saturday 28 July. For this reason he had cleaned his aircraft on Thursday morning 26 July and replenished the hydraulic oil of the landing gear system. After this small maintenance, he decided to make a small trip to EBZH and back, accompanied by a friend student pilot. The first leg to EBZH happened uneventfully, but during the take-off on the grass runway, the aircraft bounced before lifting off. According to the pilot, this was due to the calm wind condition and the warm day, requiring more groundspeed to take-off. For the landing in EBAW, he decided to make an ILS approach on RWY 29 as a demonstration to the student pilot. Above the middle marker (approx. 0,5 NM from the runway threshold), the pilot selected gear down. The approach was performed normally, with full flaps. The pilot did not recall hearing the audio warning indicating that the gear had not extended and if the green landing gear indication light was illuminated or not. He confirmed he didn't visually check the extension of the main landing gear. Initially the landing was smooth but upon touchdown, the aircraft began to swing and ended up on its belly. While skidding, the pilot contacted to ATC to ask for assistance. He managed to hold the aircraft on the runway. It finally came to a stop on its right wing tip approx. 300m after the PAPI. The 2 occupants left the plane uninjured before the emergency services arrived. The pilot noticed that the nose landing gear was fully extended, but that the main landing gear collapsed. The approach was captured by a young plane spotter who filmed the whole sequence. From the images it is clear that the main landing gear was not fully extended.



Figure 1: Image from the video showing that main landing gear was not fully extended

Pilot

The pilot held a valid FAA pilot private license and medical certificate class 3 at the time of the accident. His recent experience with the aircraft was 11:06 hours during the last 3 months of which 4:12 hours in the last week.

Initial examination and damage

The belly was chafed and the RH horizontal stabilizer suffered substantial structural damage. There was minor visible damage to both main gear tires and the fuselage skin in the main gear wheel well caused by the brutal retraction of the main gear during impact. .

The landing gear pump circuit breaker was found disengaged.

There was sufficient fuel on board.

Aircraft landing gear system

Each leg of the landing gear is raised and lowered by hydraulic actuators. When the landing gear selector valve in the cockpit is selected in either the up or the down position this will reverse the pressure transfer in the hydraulic lines causing the gear actuators to move in the opposite direction. From either position, the lever must be pulled out to clear a detent before it can be repositioned. When the gear is selected up, both the nose and the main gear are held in the retracted position by hydraulic pressure, there are no uplocks. When the gear is selected down, the main landing gear will be extended forward by the 2 gear actuators and kept in position by 2 downlock actuators. The nose gear extends backwards, its downlock is incorporated in its gear actuator. The hydraulic pressure in the system is generated by an electrically-driven hydraulic power pack which supplies hydraulic pressure by means of a pump. The pump motor is activated by a pressure switch which closes (and starts the pump) when the pressure falls to 1000 psi and opens (and stops the pump) when the pressure reaches 1500 psi.

The electrical power to the system is supplied through two circuit breakers, one for the indication and control circuits (5 amp) and the other for the pump motor (30 amp). If either circuit breaker is disengaged the pump unit will not operate. The gear indication system consists of a single green light to indicate that all landing gears are locked down and an amber light to indicate all gears fully up. These lights will illuminate when the corresponding microswitches on all three legs are closed. There is no indication light when the gear is in transit. The lights are the press-to-test type to check the working. Finally there is a landing gear warning system. This consists of a throttle-actuated switch which is electrically connected to a dual warning unit. The warning unit is connected to the airplane speaker.

An emergency extension system hand pump, which is located between the two front seats, provides the back-up of the power pack. Stroking this hand pump will only cause pressure to increase in the extend side of the system. The gear can't be retracted back without the use of the hydraulic power pack.

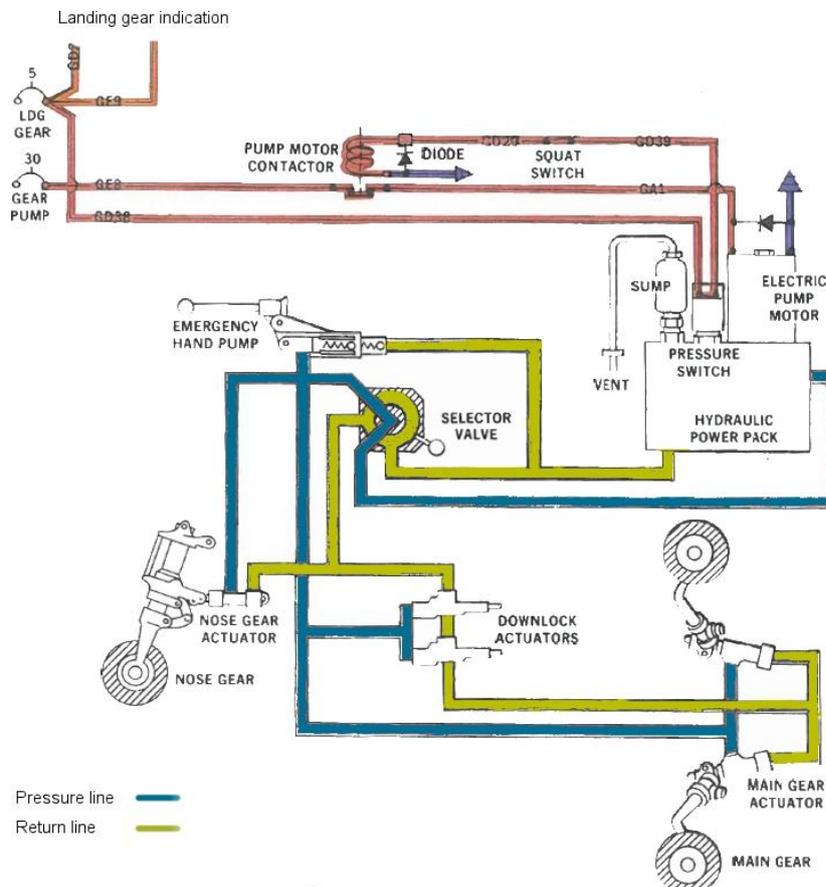


Figure 2: Landing gear system when selector valve is selected down

Airplane flight manual (AFM)

In section 3 of the AFM the procedures in case of a landing gear malfunction are described.

LANDING GEAR FAILS TO RETRACT

1. Master switch – ON
2. Landing Gear Lever – CHECK (lever full up)
3. Landing Gear and Gear Pump Circuit Breakers – IN
4. Gear Up Light – CHECK
5. Landing Gear Lever – RECYCLE
6. Gear Motor – CHECK operation (ammeter and noise)

LANDING GEAR FAILS TO EXTEND

1. Landing Gear Lever – DOWN
2. Emergency Hand Pump – EXTEND HANDLE and PUMP
3. Gear Down Light – ON
4. Pump Handle – STOW

In analysing a landing gear malfunction, first check that the master switch is ON and the LDG GEAR and GEAR PUMP circuit breakers are in; reset if necessary.

In section 4 'NORMAL PROCEDURES' there is clearly stated what to do to check the extension of the landing gear.

BEFORE LANDING

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3. Landing Gear – EXTEND (below 165 KIAS).
4. Landing Gear – CHECK (observe main gear down and green indicator light on).
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Meteorological conditions

CAVOK (ceiling and visibility ok) and calm wind

Further examination and tests

The hydraulic oil level in the power pack was found too low. Oil was only visible on 2 or 3 mm of the underside of the dipstick which means around 5 mm beyond the minimum level marking of the 'refill' area. Traces of oil were found in the area of the emergency pump in the fuselage floor centre section. Additionally, a screen filter was found lost in the airframe structure under the hydraulic power pack. This filter is likely to be the one coming from the filling opening of the power pack.

The tripped gear pump circuit breaker was pushed back in and five complete cycles (retraction and extension) were performed of which 2 using the aircraft battery. No abnormalities with the gear selector and its detents were found. The green light was illuminating when landing gear was extended and locked, no light illuminated during the transfers and an amber light was brightening

when the landing gear was up. During the above tests no visible oil leak could be detected. Despite the low hydraulic oil level no abnormal noise was heard coming from the power pack. When the lever was repositioned from the down to the up position but not fully in the gear up detent (i.e. an intermediate position), it was noticed that the hydraulic pump continued to run.

After these tests the landing gear extension with the gear pump circuit breaker popped out was simulated. In this configuration, both the nose and the main landing gear went down but it is only the nose gear that locked down while the main gear obviously remained unlocked showing both legs hanging under the fuselage. Then the hand emergency pump was used to fully extend and lock the main gear. This operation was satisfactory.

Analysis

It could not be determined why the circuit breaker had been disengaged. It is likely that the pump motor continued to operate after the landing gear was retracted in EBZH causing it to overheat. One possible explanation is that the gear lever was not put fully in the gear up detent during lift-off at EBZH.

The flight manual describes how to check if the landing gear has been retracted and which steps to take if there is a malfunction. However the pilot was not aware of the initially malfunction as he didn't check the indication light and did not observe the landing gear. It was confirmed that the indication lights and the emergency hand pump were functional.

The weather conditions were good and there was enough fuel on board so there were no external factors that made this landing particularly hard. However the pilot performed an ILS approach on runway 29 as a demonstration to the student pilot who joined him for the flight.

Probably they were too focused on the flight track and other factors of the ILS approach, and they did not check the full extension of the landing gear.

When the lever is selected down, the pressure in the actuator falls causing the landing gear to drop only due to gravity. However in case of lack of hydraulic pressure, the main gear will not be moved further in the full extended position.

Conclusion

The cause of the accident was an undetected malfunction of the landing gear extension which prevented the pilot to take appropriate actions. This has led to an abnormal runway contact.