



DUTCH
SAFETY BOARD

Unsuccesfull emergency landing



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Source photo cover: National Police Force, Aviation police

De Onderzoeksraad voor Veiligheid

In Nederland wordt er naar gestreefd het gevaar van ongevallen en incidenten zoveel mogelijk te beperken. Wanneer het toch (bijna) misgaat, kan herhaling voorkomen worden door, los van de schuldvraag, goed onderzoek te doen naar de oorzaak. Het is dan van belang dat het onderzoek onafhankelijk van de betrokken partijen plaatsvindt. De Onderzoeksraad voor Veiligheid kiest daarom zelf zijn onderzoeken en houdt daarbij rekening met de afhankelijkheidspositie van burgers ten opzichte van overheden en bedrijven. De Onderzoeksraad is in een aantal gevallen verplicht onderzoek te doen.

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GENERAL OVERVIEW



Figure 1: Archives picture of the aircraft involved. (Source: Texel Airport)

Identification number:	2012084
Classification:	Accident
Date, time of occurrence:	4 August 2012, 11:40 hours
Location of occurrence:	Hollandscheveld
Registration:	D-EGIT
Aircraft type:	Piaggio P149D
Aircraft category:	Single-engine propeller aircraft
Type of flight:	Local flight
Phase of operation:	En route
Damage to aircraft:	Destroyed
Flight crew:	Two
Passengers:	None
Injuries:	One seriously injured, one light injured
Other damage:	Destroyed shed
Light conditions:	Daylight

SUMMARY

The crew was forced to make an emergency landing following a complete engine failure. While executing this emergency landing, the aircraft collided with a line of trees and subsequently came to a halt against a shed adjacent to a residential building. The pilot in command was seriously injured, while the co-pilot sustained light injuries. The aircraft was destroyed. The engine failure was probably caused by structural damage of the engine as a result of a fractured connecting rod partly due to smoke development in the cockpit, the co-pilot did not succeed to reduce the aircraft's speed while executing the emergency landing, and overflew the emergency landing field. The pilot did not succeed to avoid the line of trees after which a crash became inevitable.

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FACTUAL INFORMATION

History of flight

The D-EGIT took off from Hoogeveen Airport (EHHO) on a local flight at 11:20 a.m. There were two people on board, both of whom had a valid pilot's license. After having flown for approximately 15 minutes and at a position south of Noordscheschut, the engine started to run rough. The emergency procedure "engine failure in flight" was executed subsequently. As a part of this emergency procedure, both magnetos were tested, the fuel/air mixture was set to "full rich", the carburetor pre-heater was set to "warm" and the fuel pump was set to "on". None of these measures had any effect. Soon after, the engine stopped and black smoke from the engine compartment seeped into the cockpit. The aircraft was flying at an altitude of approximately 2,000 feet at that time. The co-pilot, who had more flying experience, took over the controls. Fearing a fire, the co-pilot wanted to land as soon as possible. After a mayday call, the co-pilot selected a suitable field for an emergency landing, but overflew this area due to the aircraft's speed and altitude. The aircraft was now heading towards a line of trees. The co-pilot pitched the nose in order to avoid the trees, but failed to avoid a collision. Part of the left wing was torn off, after which the aircraft became uncontrollable and came to a rest in the garden of a residential building. In the process, the aircraft collided with an adjacent shed. The pilot in command was seriously injured, while the co-pilot suffered light injuries. The aircraft was damaged beyond repair.



Figure 2: The aircraft after the accident.

The pilot in command

The pilot in command was a 59-year-old male. He held a valid license. His Private Pilot License (Aeroplanes), (PPL (A)), was valid until 31 July 2013, while his Class 2 medical certificate was valid until 2 August 2013.

Total number of flight hours	Approx. 1192
Number of flight hours on type	Approx. 600

Table 1: Pilot in command's flight experience.

The co-pilot

The co-pilot was a 75-year-old male. He held a valid license. His Commercial Pilot License (Aeroplanes), (CPL (A)), was valid until 1 August 2013, while his Class 2 medical certificate was valid until 12 March 2013.

Total number of flight hours	Approx. 1850
Number of flight hours on type	Approx. 800

Table 2: Co-pilot's flight experience.

The aircraft

The Piaggio P149D is a four-seater single-engine propeller aircraft. The D-EGIT was built in 1957 and had accumulated 2702 flight hours at the time of the accident.

The engine

The engine was a six-cylinder air-cooled Lycoming GO-480-B1A6 built under license by BMW, with 194 kW of engine power. The engine had been fully overhauled approximately 2 months before the accident in June 2012, and had accumulated four runtime hours since the overhaul.

The weather

According to data provided by the Royal Netherlands Meteorological Institute (KNMI), ground visibility at the time of the accident was more than 10 kilometers. The wind near the ground came from direction 220 degrees at a speed of 6 knots.

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INVESTIGATION AND ANALYSIS

Engine examination

Oil was found on the engine exterior after the accident. Once the aircraft had been salvaged, it became clear that the engine crankcase had sustained a hole near the rearmost two cylinders (numbers 5 and 6). Approximately 8 of the maximum allowed quantity of 11.3 litres (12 US quart) of oil were still in the engine. After removal of cylinder 5, it became clear that the piston was detached from the connecting rod. The crank shaft was still in position in the engine. The engine was disassembled after having been removed from the aircraft. Both halves of the crankcase, the main bearings and cylinders 5 and 6 and their respective pistons and connecting rods were sent to the US National Transportation Safety Board (NTSB) for further examination. This report is partly based on the NTSB investigation.

The upper rear section of the engine crankcase had broken into several pieces, see figure 3.



Figure 3: Overview of the crankcase components. The numbers indicate the cylinder positions. (Source: NTSB)

The investigation focused on the number 5 cylinder/piston/connecting rod combination, see figure 4. The connecting rod of piston number 5 had broken off and became detached from the piston. The small connecting rod eyelet connecting the connecting rod to the piston had disappeared and was never recovered. The piston was in the uppermost position in the cylinder. This position could only be reached if the piston was not connected to the crank shaft by the connecting rod. The piston could be rotated manually, moving down was not possible.

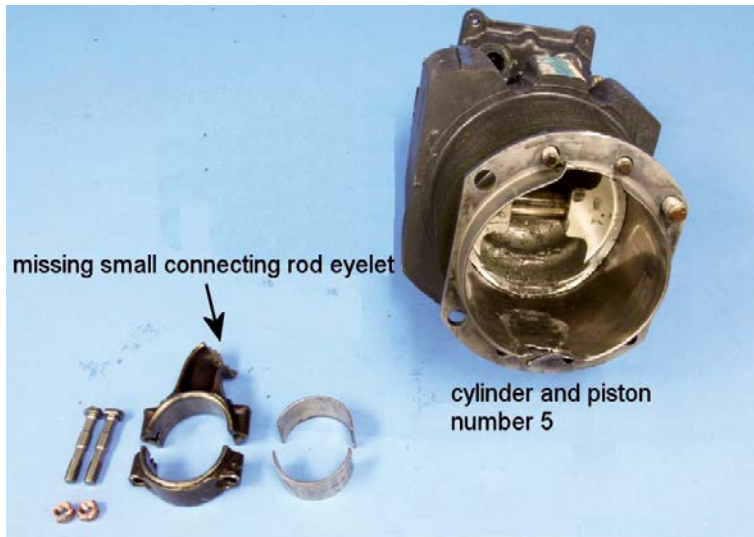


Figure 4: Overview of the number 5 cylinder, piston and connecting rod. (Source: NTSB)

The fractured surface of the number 5 connecting rod was examined, see figure 5. Parts of the fractured surface were relatively shiny, pointing to shearing stress as a result of compression. Other parts of the surface were rough and had a matt grey color, indicating ductile fracturing of a forged steel alloy. The flange section adjacent to the fractured surface was lightly twisted. No evidence was found of any existing faults that could have caused the fracture.



Figure 5: Fractured surface of the number 5 connecting rod. (Source: NTSB)

There was damage on the lower and upper side of the number 5 cylinder attachment location on the crankcase. Given the nature and dimensions of the damage, this was caused by the up and down moving connecting rod. See figure 6. Brackets indicate contact damage corresponding to contact with the number 5 connecting rod.

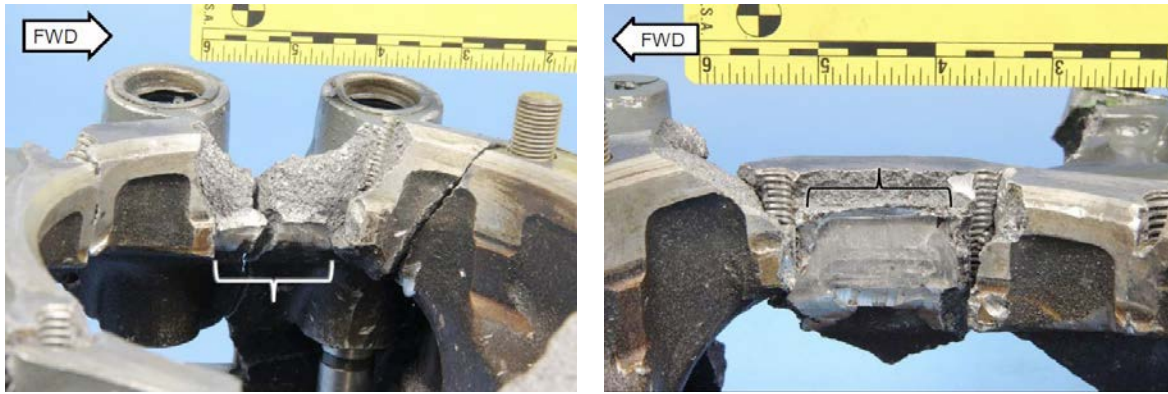


Figure 6: Damage on the upper and lower side of the crankcase. (Source: NTSB)

There was damage on both sides of the barrel end of the number 5 cylinder. The width of the damages corresponded to the width of the piston pin end of the connecting rod and was indicative of a repeated movement of the connecting rod against the inside of the cylinder. See figure 7.

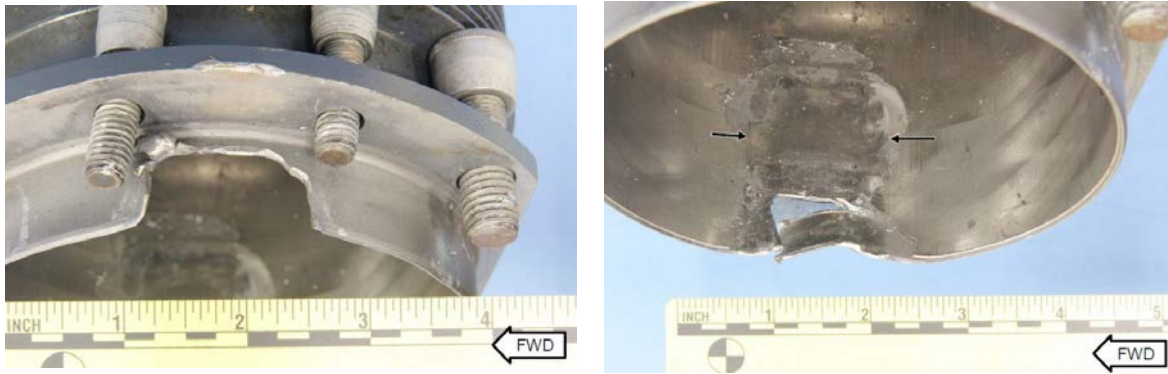


Figure 7: Cylinder damage caused by the connecting rod. (Source NTSB)

The cylinder with the piston as a whole was cut a few millimeters below the top of the piston. After the cylinder head of the cylinder was removed, the (cut) piston head could be observed. Also, the piston could be removed from the cylinder. On the upper side of the piston imprints of the inlet and outlet valve were visible. See Figure 8.

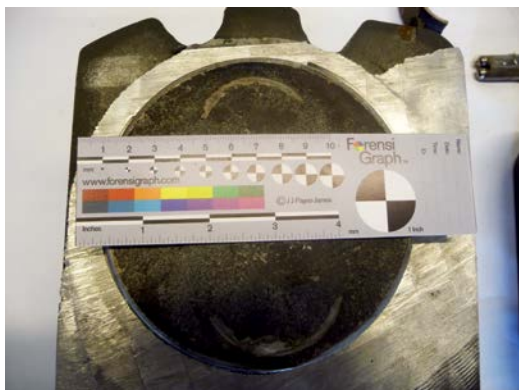


Figure 8: Upper side of the piston.

When the piston was removed, the piston pin could be examined. Scuffing and longitudinal contact damage was observed around the circumference. See figure 9. A bracket indicates an area of heavier scuffing, and arrows indicate several linear contact marks.

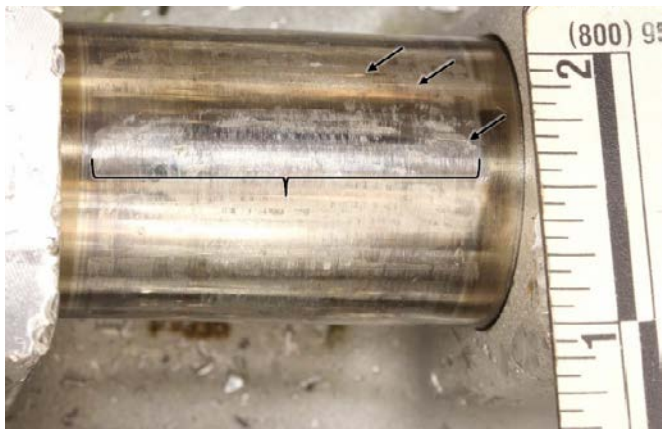


Figure 9: Damage on the number 5 piston pin. (Source NTSB)

Likely scenario

The primary cause was the fracture of the piston end connecting rod. The reason for this failure is not known. This part of the connecting rod could not be examined because it was not found after the accident. Due to the failure, the connecting rod could freely move up and down and back and forth in the cylinder causing damage. The connecting rod also came into contact with the edge of the crankcase which consequently got damaged. Most likely the broken upper side of the connecting rod got jammed at sometime, causing an extremely high compression stress on the connecting rod which then collapsed at the weakest (thinnest) section. Finally the engine got locked as a result of consequential damage.

Because the piston was not connected to the connecting rod anymore, the piston could move upwards to the cylinder head. At this point the upper piston ring could catch a rear edge, so that the piston could not go down. Since the piston was now at a higher position than was possible during normal operation, the inlet and outlet valve hit the top of the piston when they were in open position. This damage is all consequential damage.

According to the maintenance documents, the engine had been overhauled in accordance with the Lycoming Overhaul Manual. Over the course of the overhaul, all six cylinder sets (cylinder and piston) were replaced by overhauled cylinder sets. According to the maintenance documents, the tolerances of these cylinder sets were measured. The maintenance documents showed that these tolerances were within the specified limits.

There was sufficient oil in the engine after the accident. No evidence of overheated engine components was found. For this reason, lack of lubrication and cooling did not seem likely.

Emergency landing

After complete engine failure the crew was forced to perform an emergency landing. Because of the smoke in the cockpit and the fear of fire, the crew wanted to land as soon

as possible. They therefore chose to descend with a high vertical velocity which is also the horizontal velocity remained high. The selected field was suited to an emergency landing, but was over flown due to the aircraft's excessive speed, leaving the crew with few options. In spite of the aircraft was pitched up, the co-pilot did not succeed to avoid a line of trees. The pilot stated that due to the high speed the manually operated flaps could not be selected because the required manual force was too high. Due to the collision with the trees a part of the left wing was torn off and the aircraft became uncontrollable. Finally the aircraft came to a rest against a shed adjacent to a residential building. The execution of the emergency landing was possibly hampered by smoke in the cockpit.

CONCLUSION

The accident was preceded by an engine failure. This failure was probably caused by the fracture of the piston end connecting rod of cylinder five resulting in large consequential damages which eventually led to the failure of the engine. Partly as a result of smoke development in the cockpit and the inability to select flaps, the co-pilot could not reduce the aircraft's speed sufficiently while executing the emergency landing, and overflowed the emergency landing field. The co-pilot then did not succeed to avoid a line of trees, after which the accident became inevitable.



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