

# Occurrences investigated

## Emergency landing due to smoke in cockpit, Cessna 550 Citation II, PH-SVZ

20 NM northeast of Groningen Airport Eelde, 16 April 2021

### History of flight

The Cessna 550 Citation II, registered as PH-SVZ, departed from Teuge International Airport and flew to an area northeast of the province Groningen, the Netherlands, for an aerial photography survey flight at FL 058. There were two pilots onboard the aircraft. The flight was formally conducted as a single pilot operation.<sup>14</sup>

Based upon the air safety report (ASR) of the operator, at approximately 20 NM northeast of Groningen Airport Eelde (EHGG), the crew suddenly heard a bang and felt a vibration. It immediately checked the engine instruments which reportedly showed normal indications. Within seconds smoke entered the cockpit from over the dashboard.

The crew subsequently donned its oxygen masks, switched the microphone to the oxygen mask, set 7700 on the transponder and declared an emergency (Mayday call) to air traffic control. Thereafter, the pilots disconnected the autopilot, started a shallow descent by retarding the power levers and turned towards Groningen Airport Eelde for an immediate landing.

In the ASR the crew mentioned that while descending, approximately 2 – 3 minutes after it had heard the bang, the red LO OIL PRESS warning light<sup>15</sup> of the left engine illuminated. Both the ASR and initial information of the crew did not reveal the engine oil pressure when the warning light was observed.

According to the Aircraft Flight Manual (AFM) checklist, for an Eng LO OIL PRESS light, depending on the engine oil pressure, engine power of the affected engine should be reduced or the engine should be shut down, followed by a landing as soon as practical.

The crew stated that because of the approach towards Runway 23 and the presence of smoke in the cockpit, it decided to continue for an immediate landing. Reportedly, the pilot flying reduced power of the left engine to flight idle at about 4 to 5 NM prior to landing and smoke started to disappear. Once landed, the crew stopped the aircraft on the runway and shut down the left engine, set the parking brake and opened the door for fresh air. After a first inspection, without any indication of fire, the crew taxied the aircraft to the parking spot whilst escorted by the fire-brigade.

### Data recorders

The aircraft was not equipped with an area mike in the cockpit and no parameters of the aircraft and engines were recorded that could have been used to reconstruct the flight. An FDR and CVR were not required.

### History of the left engine

The aircraft Certificate of Registry and the Certificate of Airworthiness (CoA) were both issued on 25 September 2015. The Airworthiness Review Certificate (ARC) was issued on 22 September 2020 and valid till 24 September 2021.

<sup>14</sup> An additional pilot assisted to relieve the workload of the pilot flying for flight and survey tasks.

<sup>15</sup> The engine oil indicating description and operation in the aircraft maintenance manual (chapter 79-30-00) shows that there is no oil quantity indication in the cockpit.

▼ Overview flight cycles and hours of engine PC-E 71354, based on information of the maintenance organization.

	Total time (hours)	Total cycles	Time since overhaul (hours)	Cycles since overhaul
07 September 2015 Airworthiness review <sup>16</sup> doc.	8,789.9	6,248	unknown	unknown
29 June 2016 Repair shop	8,990.2	6,335	1,997.2	1,298
16 April 2021 Engine failure	9,836.4	6,702	2,843.4	1,665

The operator bought the aircraft from a Swedish owner. On 25 September 2015, when it was registered as PH-SVZ (Dutch), the relevant left engine, a Pratt & Whitney JT15D-4 engine with serial number PC-E 71354 was in place. Due to foreign object damage (FOD) to the engine caused by a bird strike, it was removed from the aircraft. On 29 June 2016 the engine arrived at a repair shop. On 3 November 2016 the engine was re-installed on the aircraft.

### Technical investigation

Following the event and engine failure, a visual inspection at EHGG of the left engine showed no evidence of FOD in the fan air inlet. When rotating the fan by hand, a slight abrasive sound was heard and, when hands off, the rotation slowed down quickly. The engine oil dipstick showed no oil level.

Since the operator has no system for trend monitoring, no data was available to analyze engine parameters or aircraft systems. Maintenance documentation showed a complaint<sup>17</sup>

of the left engine LO oil press warning light. The abnormal behavior of the warning light as reported in October 2020 could not be related to the engine failure during the event flight on 16 April 2021. Reportedly, the complaint did not re-occur after replacing the LO oil pressure switch. The performed maintenance on the engine was in compliance with the requirements.

### Engine teardown Investigation

In April 2021 the engine was removed for further investigation. It was shipped to the Pratt & Whitney Canada Service facility at Bridgeport (West Virginia, United States of America) for an engine teardown.<sup>18</sup> The FAA, under the direction of the National Transportation Safety Board and Pratt & Whitney Canada Corp., under the direction of the Transportation Safety Board of Canada, assisted in this by carrying out the teardown works and assessing the damage.

<sup>16</sup> The operator, being the new owner, had to show an Airworthiness review of the aircraft to the responsible CAA-NL by means of an acceptance report.

<sup>17</sup> The complaint originated from October 2020: the engine oil light illuminated with delay when battery power was applied to the electrical system and after engine shutdown. Corrective action was carried out in December 2020.

<sup>18</sup> The engine teardown was accomplished on 19 and 20 January 2022, resulting in an Initial Findings Summary report, marked on 25 January 2022.



▲ Archive photo of PH-SVZ. (Source: C. Schmitt)

The Initial Findings Summary report revealed blade tips rubbing damage and the front inner bypass duct rear flange was fractured at numerous locations. Oil wetness and partially burnt oil contamination were found in the turbine section. Metallic particulate were found in the engine oil filter housing and remnants of bearing #3 in the accessory gearbox. The bearing #3 air seal was damaged and all roller elements and the cage of the #3 bearing were liberated from their respective positions and blocking the scavenge port. Both jets of the bearing oil nozzle were unobstructed and the oil pump was capable of manual rotation, but during the engine tear down it appeared that components were stuck together when trying to disassemble them.

The FAA inspector, who witnessed the engine teardown, noted that the engine had not been overhauled during the last shop visit when it was disassembled due to FOD inspection. The original bearings remained installed and according to Pratt & Whitney no pre-emptive requirements<sup>19</sup> exist to replace them for engines undergoing FOD repair. The main line bearings, specifically bearing #3, had been visually inspected (for pitting, corrosion, et cetera) prior to re-assembly.

### Laboratory analysis of the failed engine bearing

On the 1 February 2023, Pratt and Whitney Canada issued its engine/component investigation report, which – in addition to the Initial Findings Summary report – included more factual engine teardown details and in particular elaborate an in-depth bearing materials laboratory analysis.

Along with the evidence of the engine investigation, it suggests that distress of the bearing #3 was the initiating event causing secondary damage to its air/oil seals and disruptions in the engine oil scavenge and pressure systems. This likely resulted in engine oil being expelled both internally and externally.

Evidence found on the roller bearing #3 components indicated a load - consistent with engine thrust – that is considered to be a main contributing factor to the distress on the bearing. The exact reason for this abnormal load on this bearing could not be established with certainty. The bearing #3 components were found to meet material drawing specifications.

<sup>19</sup> As per JT15D-4 manual, light overhaul procedures for FOD conditions inspection.

Based on the above account, the Dutch Safety Board concludes that

- At first smoke penetrating the cabin and cockpit caused an emergency condition which forced the crew to use oxygen masks and to land as soon as possible. Additionally, a few minutes later during the diversion a left engine low oil warning was observed.
- As for the LO OIL PRESSURE warning light which illuminated, without recorded engine oil pressure data it could not be analysed whether keeping the engine running (with reduced power) was in compliance with the checklist.
- Engine oil being expelled in the engine caused smoke in the cockpit via the air conditioning and pressurization system of the cabin.<sup>20</sup> The smoke was the result of a failure in the engine, initiated by the distress of a bearing. The loss of engine oil resulted from secondary internal damage to the engine.

**Classification:** *Serious incident*

**Reference:** *2021027*

### **Airprox, Piper Aircraft Corporation PA-18-135, PH-WDR and Reims Aviation S.A. F172P, PH-AVB**

International Airport Teuge, 28 April 2022

Aboard PH-WDR, a Piper Aircraft Corporation PA-18-135, a pilot and an instructor were practicing circuits at International Airport Teuge. After the eighth touch-and-go, the Piper climbed to 500 feet and made a climbing right turn to follow the circuit. Just before that, PH-AVB, a Reims Aviation S.A. F172P with only one pilot on board, made a go-around. When both aircraft made a right turn to follow the circuit, they came close to each other. Both aircraft then continued their flight without further reported details.

*The Dutch Safety Board has not further investigated this occurrence.*

**Classification:** *Serious incident*

**Reference:** *2022127*

<sup>20</sup> Engine bleed air from the high pressure compressor is used for air conditioning and cabin pressurization.