-

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division Accident and Incident Investigations Division Form Number: CA 12-57

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/3/2/1440								
Classification	Serious Incident		**Date**	17 February 2024		**Time**	1200Z		
Type of Operation	Training (Part 141)								
Location									
Place of Departure	Bram Fischer International Airport (FABL), Free State Province		Place of Intended Landing	Springs Aerodrome (FASI), Gauteng Province					
Place of Occurrence	Open field, approximately 20 nautical miles (nm) north-east of FABL								
GPS Co-ordinates	Latitude	28º57'86.9" S	Longitude	26º25'8.86" E		Elevation	5 337ft		
Aircraft Information									
Registration	ZS-PWR								
Make; Model; S/N	Construczioni Aeronautiche; Tecnam P-92 (Serial Number: 1651)								
Damage to Aircraft	None			Total Airframe Hours		613.6			
Pilot-in-command									
Licence Type	Commercial Pilot Licence (CPL)		Gender	Female		Age	24		
Licence Valid	Yes	Total Hours	259.2	Total Hours on Type		6.6			
Total Hours 90 Days	8.9		Total Flying Hours on Type Past 30 Days	0.8					
People On-board	2 + 0	**Injuries** 0	**Fatalities**	0	**Other (on ground)**	0			

What Happened

On Monday, 17 February 2024, a flight instructor and a student pilot on-board a Tecnam P92 aircraft with registration ZS-PWR were on a navigational training flight from Springs Aerodrome (FASI) in Gauteng province to Bram Fischer International Airport (FABL) in Bloemfontein, Free State province, with the intention to return to FASI. Visual meteorological conditions (VMC) by day prevailed at the time of the flight which was conducted under the provisions of Part 141 of the Civil Aviation Regulations (CAR) 2011 as amended.

The flight instructor reported that before departure, they obtained the weather report of the departure aerodrome (FASI), en route weather conditions and the destination airport. The weather was conducive for a safe flight. A pre-flight inspection of the aircraft was conducted by the flight instructor and the student pilot, and nothing abnormal was noticed. The student pilot was the pilot flying (PF) and the flight instructor was the pilot monitoring (PM). Later, the student pilot started the engine and taxied the aircraft to the threshold of Runway 32 to perform the before departure checks; all the engine indications were within the normal operating range (green arch). The student pilot opened the throttle to 5 500 revolutions per minute (RPM) and commenced with the take-off run. The aircraft rotated and climbed to 6 000 feet (ft) above mean sea level (AMSL).

The engine indications remained within the green arch and the student pilot later retarded the throttle lever to 5 100 RPM, cruising at a speed of 90 knots. The en route segments of the flight to FABL were uneventful. Upon arrival at FABL, the flight instructor broadcasted their intentions to the FABL air traffic control (ATC) officer on very high frequency (VHF) 120.8-Megahetz (MHz) and were cleared to land on Runway 02. The student pilot executed an uneventful touch-and-go landing on Runway 02. Thereafter, the aircraft climbed to 6 000ft, routing back to FASI. Approximately 20 nautical miles (nm) north-east of FABL whilst overhead Winnie Mandela residential area and almost outbound FABL terminal manoeuvring area (TMA), the flight instructor noticed a reduction in engine oil pressure. The flight instructor informed the FABL ATC officer of their situation via VHF 120.8-MHz. The ATC officer instructed the flight instructor to return to FABL when it is safe to do so and to report when their aircraft was inbound. The flight instructor complied with the instruction and took control of the aircraft. Whilst heading back to FABL, they heard a loud bang from the engine which was followed by a rough running engine before it (the engine) stopped. The flight instructor broadcasted a Mayday call as she searched for an open field to conduct a forced landing. The flight instructor then glided the aircraft to a field and executed a safe landing. The aircraft was not damaged, and none of the occupants was injured.

After disembarking from the aircraft, the flight instructor noticed engine oil residue on the aircraft's underbelly. He then opened the engine top cowling and noticed a hole (or damage) to the right of the crankcase which was caused by the Number 1 (right front) connecting rod that had failed.

The serious incident occurred during daylight on an open field at Global Positioning System (GPS) co-ordinates determined to be 28º57'86.9" South 26º25'8.86" East, at an elevation of 5 337 feet (ft).

Figure 1: The aircraft after it had come to a stop on the field. (Source: Flight instructor)

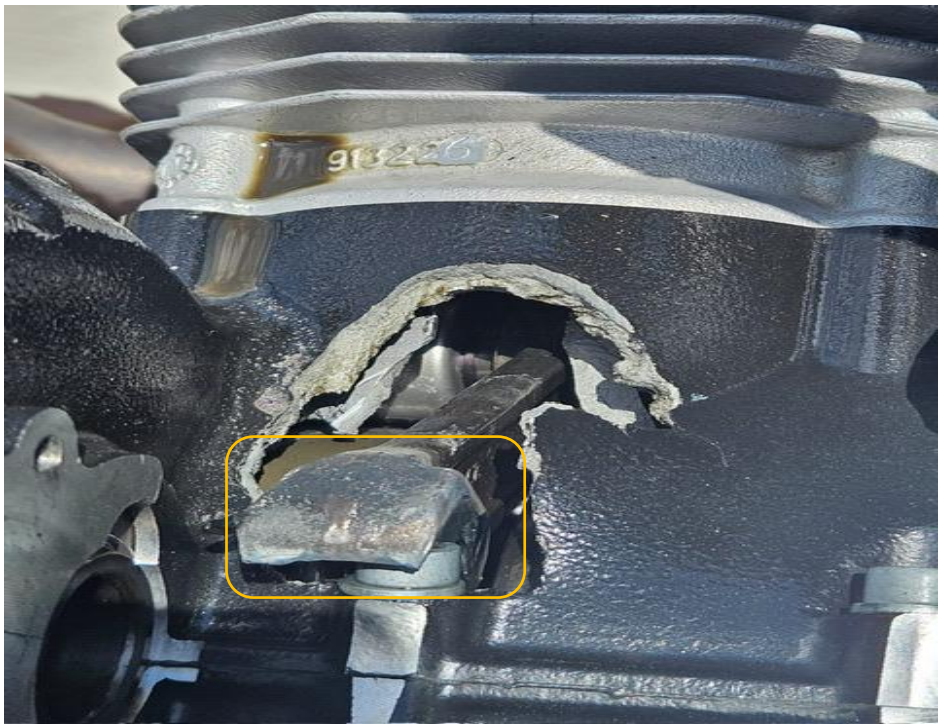


Figure 2: The Number 1 connecting rod protrudes from the crankcase. (Source: Flight instructor)

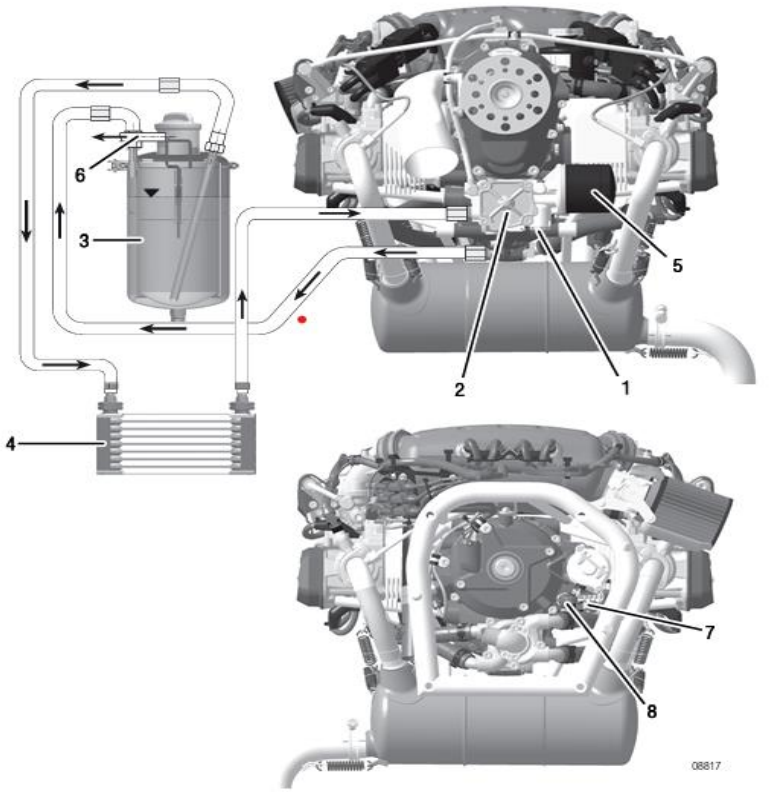
Aircraft Description (Source: Tecnam P92 Pilot's Operating Handbook [POH])

The Tecnam P92 is a single-engine two-seat aircraft with a strut braced high wings and fixed landing gear. The aircraft is powered by a four stroke Rotax 912iS fuel injected engine with serial number 7705765, driving a composite Warp drive three-blade ground adjustable propeller with serial number 1054. The engine has a rated maximum continuous power output of 100-horsepower (hp) at 5 800 RPM. The engine is equipped with two sets of electronic fuel injectors, two electrical generators, two engine control units (ECU's [Lane A and B]), dual ignition, and high-pressure electrical fuel pumps.

Lubrication System (Source: Rotax Operator's Manual)

The engine is provided with a dry sump forced lubrication system with a main oil pump with integrated pressure regulator. The oil pump sucks the oil from the oil tank via the oil cooler and forces it through the oil filter to the points of lubrication in the engine. The surplus oil emerging from the points of lubrication accumulates on the bottom of crankcase and is forced back to the oil tank by the piston blow-by gases. The oil pump is driven by the camshaft. The oil circuit is vented via bore on the oil tank. The oil temperature sensor for reading of the oil temperature is located on the crankcase, on

the mag side of the engine. The oil pressure sensor for reading of the oil pressure is located on the ignition housing.



1	*Pressure regulator*	2	*Oil pump*
3	*Oil tank*	4	*Oil cooler (optional)*
5	*Oil filter*	6	*Venting tube*
7	*Temperature sensor (oil)*	8	*Pressure sensor (oil)*

Illustration 1: Engine lubrication system. (Source: Rotax Operator's Manual)

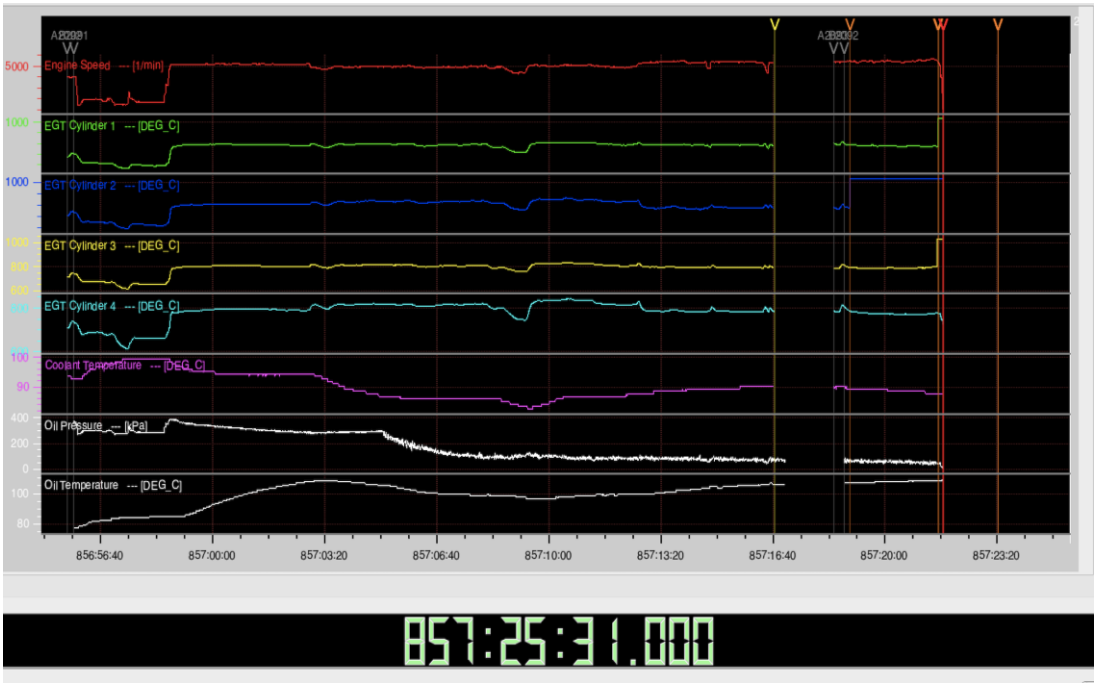
Engine control unit downloaded by the engine approved agent:

The aircraft was equipped with an engine control unit (ECU), model number ECU-204-102D, which is an engine monitoring system (Graph 1) with a non-volatile memory. The unit was downloaded after the serious incident and the following data was retrieved:

- The total fuel remaining in the tanks indicated 73 litres (l) / (19.2 United States [US] gallons).
- There was no chip detector warning observed.

- At 05:46:02 the Ng (Gas generator rotation speed indication), was 95 percent (%) the intermediate turbine temperature (ITT) was 625° Celsius (C), and Np (propeller speed) was 1 960RPM with the torque at 68%.
- At 05:47:33 the Ng had dropped to 61.1% with the ITT at 483°C, Np at 1 080RPM and the torque was 8%.

- Between 05:46:02 and 05:47:03 there was a slight fluctuation in torque as well as the propeller rpm, which might have been indicative of a change in airspeed.
- At 05:47:37 the Ng peaked at 84.9%, ITT 628°C, Np at 1 520RPM, and the torque was 38%. This increase in engine parameters was after the pilot engaged the emergency circuit (EC) and advanced the emergency lever.
- At 05:50:20 the aircraft came to a stop following the forced landing with the engine at ground idle Ng at 62.9%, ITT at 509°C, and torque at 18%. The pilot then switched off the engine.



Graph 1: The data downloaded from the ECU shows an increase in temperature, depicted by multiple sensors. It also depicts the decrease in oil pressure.

Oil Pump Examination

The oil pump was removed from the engine and stripped. It was found damaged, and metal particles were found inside the pump. It was concluded that the oil pump was defective. There was no oil pressure, and this caused the engine to overheat due to lack of lubrication (see Figure 2).

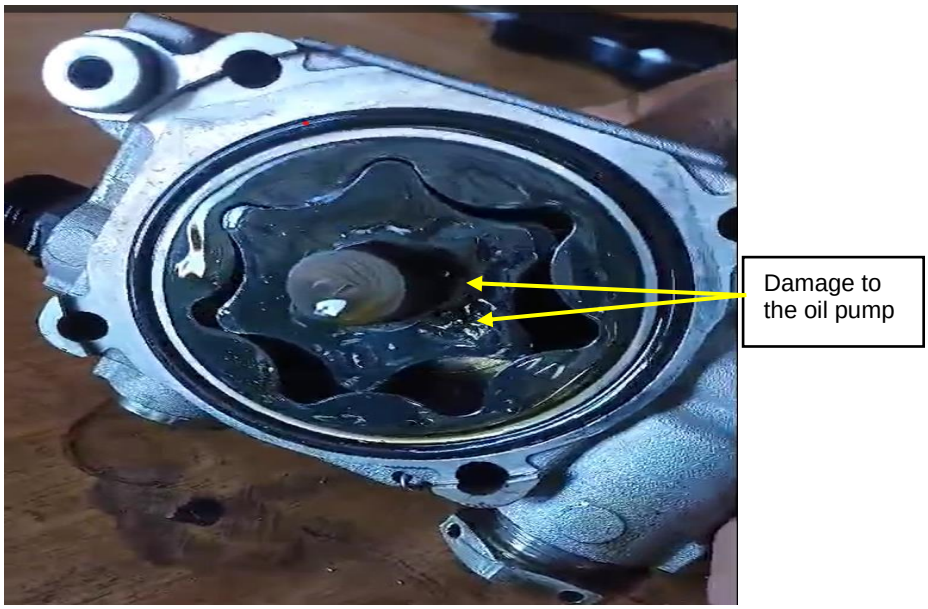


Figure 3: Disassembled oil pump with metal particles visible. (Source: Operator)

Conclusion

Without the oil pressure supplied by the pump, all bearings will eventually fail, some will start failing under load within a few seconds. The oil pressure fills the gap between moving components. When there is no oil wedge to keep components from contacting each other, there will be metal-on-metal contact which will create extreme heat levels and friction and might permanently destroy the components.

Meteorological Information

The weather information in the table below was obtained from the flight instructor who completed the pilot questionnaire (form CA 12-03).

Wind Direction	020	Wind Speed	10kts	Visibility	9999 m
Temperature	31ºC	Cloud Cover	Few	Cloud Base	5 000ft
Dew Point	15	QNH	Unknown		

Findings

1. The flight instructor had a Commercial Pilot Licence (CPL) that was initially issued on 13 May 2022. Her licence was reissued on 12 February 2024 with an expiry date of 28 February 2025. The flight instructor had flown a total of 259.2 hours, of which 6.6 hours were on the aircraft type.

2. The flight instructor had the aircraft type endorsed on her licence.

3. The flight instructor was issued a Class 1 aviation medical certificate on 29 November 2023 with an expiry date of 30 November 2024.

4. The last 100-hour Mandatory Periodic Inspection (MPI) was certified on 16 February 2024 at 610.7 airframe hours. The aircraft had accumulated a total of 613.6 hours at the time of the serious incident, which meant that it accrued 2.9 hours since the last MPI.

5. The aircraft was issued a Certificate of Release to Service (CRS) on 16 February 2024 with an expiry date of 15 February 2025 or at 710 airframe hours, whichever occurs first.

6. The aircraft had a valid Certificate of Airworthiness (C of A) that was issued on 8 February 2023 with an expiry date of 7 February 2025. The aircraft was airworthy when it was dispatched for the flight.

7. The aircraft's Certificate of Registration (C of R) was issued to the present owner on 7 October 2022.

8. The aircraft maintenance organisation (AMO) which certified the last MPI of the aircraft prior to the serious incident flight had a valid AMO Certificate that was issued by the Regulator on 12 February 2022 with an expiry date of 28 February 2025.

9. The AMO had Category A, B and C ratings listed on their approval certificate.

10. The operator had an Approved Training Organisation (ATO) Certificate that was issued by the Regulator on 17 June 2020 with an expiry date of 30 June 2025.

11. The operator had an Operation Specifications Certificate that was issued by the Regulator on 14 April 2023 with an expiry date of 30 June 2024.

12. The oil pump failed which caused oil starvation to the rotating components of the engine and, thus, the failure of the Number 1 connecting rod.

Probable Cause
Engine cessation in-flight as a result of failure of the Number 1 connecting rod due to lack of lubrication that was caused by a defective oil pump; this resulted in the pilot executing a successful forced landing.
Contributing Factors
None.
Safety Action(s)
None.
Safety Message
None.
About this Report
The decision to conduct a limited investigation is based on factors including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation, and that will determine the scope of an investigation. For this occurrence, a limited investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desktop inquiries to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar occurrence. *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
In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and not apportion blame or liability.
Disclaimer
This report is produced without prejudice to the rights of the AIID, which are reserved.

This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa