## ACCIDENT

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| **Aircraft Type and Registration:** | Europa, G-BXTD | |
| **No & Type of Engines:** | 1 Rotax 912-UL piston engine | |
| **Year of Manufacture:** | 2000 (Serial no: PFA 247-12772) | |
| **Date & Time (UTC):** | 28 July 2020 at 1226 hrs | |
| **Location:** | Enstone Airfield, Oxfordshire | |
| **Type of Flight:** | Private | |
| **Persons on Board:** | Crew - 2 | Passengers - None |
| **Injuries:** | Crew - None | Passengers - N/A |
| **Nature of Damage:** | Damage to right wing, undercarriage strut, flaps and fuselage aft of the wing | |
| **Commander's Licence:** | Airline Transport Pilot's Licence | |
| **Commander's Age:** | 65 years | |
| **Commander's Flying Experience:** | 20,076 hours (of which 91 were on type)<br>Last 90 days - 37 hours<br>Last 28 days - 21 hours | |
| **Information Source:** | Aircraft Accident Report Form submitted by the pilot and further inquiries made by the AAIB. | |

### Synopsis

During a right turn and climb shortly after takeoff, the engine rapidly reduced speed and stopped. Unable to restart the engine, the instructor carried out a forced landing in a field. The aircraft was badly damaged but both occupants were uninjured.

The cause of the engine stoppage could not be positively determined. It was found that the bend radius of the oil pipe connected to the oil pump had narrowed the cross-section of the pipe, restricting oil flow into the engine. However, there were also possible causal factors of corrosion, due to an extended period in which the aircraft was not flown, and fatigue damage related to a previous incident.

### History of the flight

On the morning of the accident, the weather at Enstone airfield was dry, clear and bright with over 10 km visibility. There was a light westerly wind with scattered clouds and the airfield runway surfaces were dry.

The intended flight was to be the first of a series of flights to enable an instructor to familiarise the owner with operating his Europa aircraft. The instructor was an experienced pilot holding an ATPL and Class Rating Instructor (Single Engine). The owner was also an experienced general aviation pilot.

The owner and instructor removed the aircraft from its trailer to prepare it for reassembly. Once satisfied it was rigged and assembled correctly, they prepared the aircraft for flight. Concerned that the engine had only been run for 44 minutes since the Permit to Fly check flight in December 2019, the instructor gave a detailed brief to the owner on the actions to take in the event of an emergency.

With the start-up checks complete, the engine was started and the aircraft taxied by the owner to grass strip Runway 26S. After completing engine power checks, the owner selected full power and commenced the takeoff roll. Both pilots reported that engine rpm, temperatures and pressures all remained normal during the takeoff. Both pilots also reported that it took slightly longer to achieve rotational speed than expected. They later attributed this to rolling resistance from the grass strip, the strip's upwards slope and the aircraft's weight, which had been calculated at just 2.1 kg below its maximum of 589.8 kg.

Once airborne and climbing, the rate of climb was 800 ft/min at 200 ft agl, which the owner and the instructor considered normal. The owner started a right turn to comply with local noise abatement measures when, at 520 ft agl, the engine rpm decreased over a period of approximately 5 seconds and then stopped. There were no indications of engine problems prior to the loss of rpm.

The instructor immediately took control of the aircraft and turned right, away from a large house near a wooded area and towards open fields. Estimating that they could not reach Enstone airfield safely, he promptly selected the most suitable field available for a forced landing. He pitched the nose of the aircraft down aggressively to maintain enough airspeed to reach the field while the owner attempted to restart the engine, but to no avail. The propeller did not move. The instructor called for the owner to switch the master and fuel switches off and touched down in the field of crops. As the landing speed was higher than normal, he realised they were going to run into a nearby hedgerow. He pulled hard on the brake lever, causing the aircraft to turn to face the opposite direction and the aircraft stopped before it reached the hedgerow.

Police, fire and ambulance services attended the scene but both pilots were uninjured and had climbed out of the aircraft before their arrival.

**Accident site**

Measuring the length of the path through the crops revealed that the aircraft had travelled approximately 50 metres along the ground before stopping. The landing and subsequent turn damaged the aircraft's right undercarriage outrigger, wing, flap and aileron. Cracks were evident in the rear fuselage between the cockpit and tail (Figure 1) and the tail section below the left elevator was also cracked and the skin distorted. There was no damage to the cockpit area.

**Aircraft history**

Built in January 2000, the previous owner had reported that the aircraft had suffered a propeller strike and the propeller had been replaced. The engine was shock-load tested but no further repairs or replacement parts were considered necessary. The aircraft had flown less than 580 hours when it was placed in storage in 2013. He reported that he had run the engine monthly to keep it in working condition.


**Figure 1**

Aircraft final resting position and cracks evident in the rear fuselage section

The new owner purchased the aircraft in March 2019 and started work to restore the aircraft to flight capability. He consulted with the aircraft manufacturer and an experienced Europa aircraft engineer to produce a detailed aircraft restoration and maintenance programme. He also completed a number of type conversion flights between March 2019 and February 2020 in a similar Europa aircraft.

The aircraft's LAA inspection and Permit to Fly check flight were completed on 2 December 2019 without incident and with the owner as passenger. Two more flights followed in February 2020 but no further flights were made in the aircraft before the day of the accident.

**Engine examination**

The exterior surfaces of the aircraft around the engine bay were clean although there was a small trail of oil under the aircraft from the oil breather 'catch-pot' overflow pipe. The oil tank and coolant levels were full.

When the propeller was turned, it rotated by 15° but would not turn any further. Rotax 912 UL engines are fitted with a torsional load absorption mechanism to reduce the effect of instantaneous loads during engine start, shut down and rapid power changes. This mechanism allows the propeller shaft to be rotated 15° before further rotation turns the engine crankshaft.

Before removing the engine, the owner noticed the cross-sectional shape of the pipe from the oil cooler had narrowed where it had been bent by 90° in order to connect it to the oil pump (Figure 2). On checking the Europa engine installation manual, the owner realised that an oil pipe with a pre-formed 90° bend was available, to avoid bending the pipe when connecting it to the pump. However, the owner also commented that later testing on a bench showed that this geometry only created an 'oval' cross-section in the pipe and did not 'kink' it. Further, the aircraft had flown with the pipe in this geometry for its Permit test flight and for a further flight as part of the owner's type conversion, with no indication of oil pressure problems at any stage.

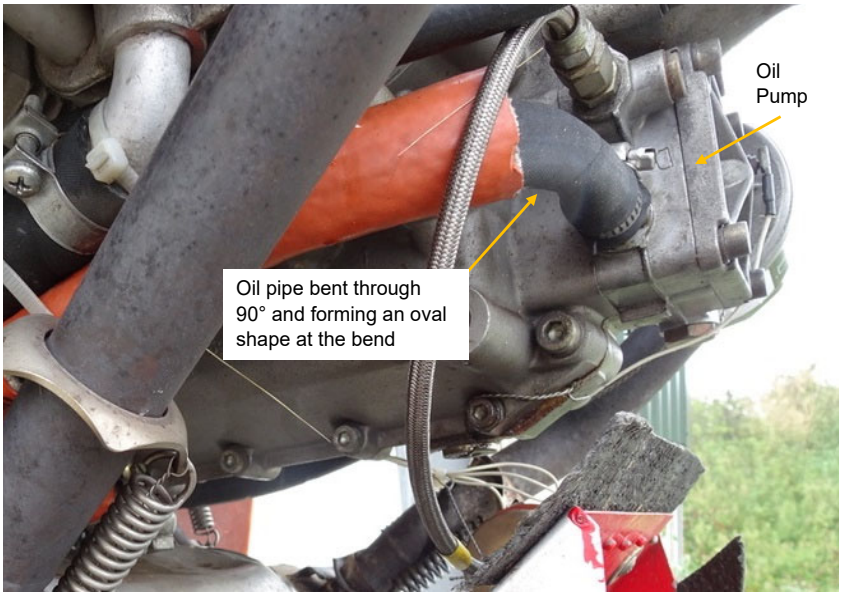


**Figure 2**

Oil pipe showing narrowing at the bend connecting it to the pump

After removing the pistons from the engine, dents were found on the top surfaces (crown). The shape of the dents matched the edges of the cylinder inlet valves. None of the inlet valve stems were bent and the edges of the valves showed no signs of impact damage. The dents in the piston crowns were also coated with carbon deposits (Figure 3).


**Figure 3**

Piston crowns showing dents from impact with inlet valves

The No 4 piston had also been in contact with the cylinder head, creating cylinder head shaped dents in the crown (Figure 4).

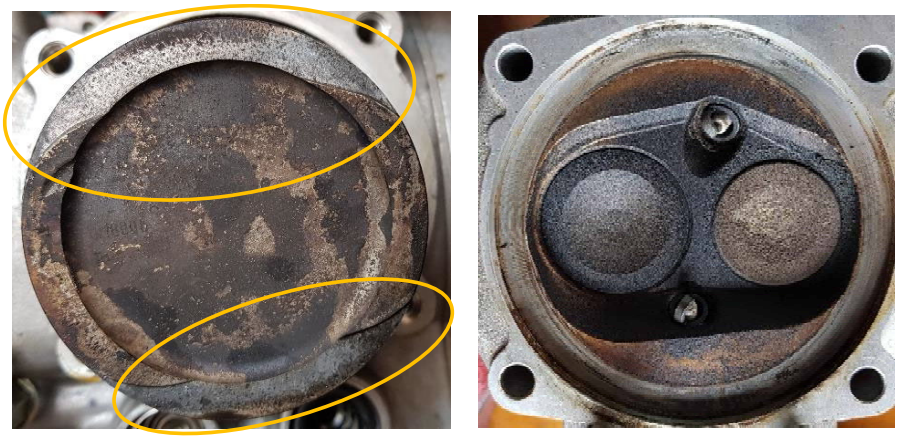

**Figure 4**

Piston crown (left) showing dents made by the cylinder head (right)

When the engine crankcase was opened, it was evident the No 4 piston connecting rod and bearing had failed at the attachment to the crankshaft (Figure 5). There were impact marks along the lower edges of the adjacent No 3 piston and cylinder.

**Figure 5**

Failed No 4 piston connecting rod

Surface pitting caused by corrosion was found around the sides of each piston below the piston rings.

## Analysis

The inability to rotate the propeller beyond 15° indicated that the engine crankshaft was jammed and unable to rotate following the accident.

The sharp bend radius and distortion of the oil pipe at the connection to the oil pump would have caused oil flow to be restricted to the engine to some degree. However, the presence of oil in the crankcase, and over the working parts, shows that oil was reaching the working parts and the aircraft had flown a number of times in this condition, without adverse indications.

The inlet valve impact marks on the piston crowns indicate that an abnormal event, such as an engine overspeed after a propeller strike, had caused the valves and the pistons to collide at some point before the aircraft's purchase in 2019. The presence of carbon deposits in the dents also showed that the damage had occurred prior to the accident flight. Once the valves were removed and inspected, the owner determined that the valve stems were straight and there were no impact witness marks on the edge of the valve heads; the valves may have been replaced during a previous engine repair. The owner commented that he should have given more weight to the propeller strike information when deciding the depth of inspections necessary to restore the aircraft after the purchase in 2019.

Evidence of surface pitting around the sides of the pistons showed that a corrosive environment had existed within the crankcase and 'regular running' of the engine had probably not been enough to avoid corrosion damage during the extended period in which the aircraft was not flown. Corrosion-initiated fatigue may have weakened the engine's working parts, resulting in failure of the No 4 connecting rod.

**Conclusion**

The cause of the engine stoppage could not be positively determined. It was found that the bend radius of the oil pipe, connected to the oil pump, narrowed its cross section, restricting oil flow into the engine to some extent. However, bench tests of this geometry, and the fact that the aircraft had flown like this a number of times, indicated that it is unlikely to have been the major factor in the engine failure.

There were also indications of corrosion within the engine, probably due to an extended period in which the aircraft was not flown. There was further evidence of mechanical damage within the engine related to a previous incident, probably of a propeller strike and likely engine overspeed. The combination of these factors, the corrosion and mechanical damage, is more likely to have brought about the engine failure, through a fatigue mechanism in the No 4 connecting rod.

In considering these factors, the owner noted (as above) that after his purchase he should have given more weight to the reported propeller strike when deciding the depth of maintenance necessary to restore the aircraft. He also commented that his 'take-home' is that engines that have not been flown for many years should be treated with great caution.

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**Bulletin Correction**

Prior to publication it was noted that the incorrect version of this report had been sent to the printers, therefore the version that appears in the hard copy of the April Bulletin is incorrect. The version that appears online and above is the corrected version.

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