

ACCIDENT

Aircraft Type and Registration:	Europa XS, G-JAPS	
No & Type of Engines:	1 Rotax 914 Turbo piston engine	
Category:	1.3	
Year of Manufacture:	2003	
Date & Time (UTC):	29 May 2005 at 1820 hrs	
Location:	Hulam Farm, Co. Durham	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - 2	Passengers - N/A
Nature of Damage:	Beyond economical repair	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	51 years	
Commander's Flying Experience:	1,364 hours (of which 1,232 were on type) Last 90 days - 50 hours Last 28 days - 22 hours	
Information Source:	AAIB Field Investigation	

Synopsis

During an endurance test flight, the engine started to run rough and pulse between 2,000 rpm and 4,000 rpm. A forced landing in a field was carried out, but the left wing struck the ground during the flare resulting in the aircraft flipping inverted. Despite a thorough examination of the engine and fuel system, the cause of the engine failure was not determined.

History of the flight

G-JAPS had recently been constructed and, following about 3½ hours of engine ground running, it had been issued with a permit to carry out test flights. The aircraft's first three test flights of 30 min, 50 min and 1 hour 5 minutes, which were all carried out on the

morning of the accident flight, were accomplished without incident and, between each flight, the aircraft was thoroughly inspected. The accident occurred on the next flight, which was intended to be a test of the aircraft's endurance, and was carried out by a test pilot with the owner flying as an observer. The aircraft had been fuelled earlier in the day with MOGAS obtained from a local garage and, prior to this flight, there was approximately 46 litres of fuel on board.

After carrying out satisfactory engine runs, the pilot took off from Fishburn and the aircraft and engine both performed as expected for about 1 hour 30 minutes. At this point in the flight, whilst cruising at 1,500 ft, the engine

started to misfire and ran roughly with the engine speed pulsing between 2,000 and 4,000 rpm. When the pilot set the throttle to an engine speed of 2,000 rpm, its operation seemed to improve, but on re-opening the throttle in an attempt to achieve 4,000 rpm, the engine speed again pulsed and started to reduce toward 2,000 rpm. The fuel supply valve was cycled from MAIN to RESERVE, even though there was about 12 litres of fuel remaining in the main fuel tank, the auxiliary fuel pump was switched to ON, the electric automatic constant speed propeller system was set to manual and the turbo control unit was briefly selected off, all of which had little effect.

The engine was no longer providing enough power for the aircraft to maintain altitude and so preparations were made for a forced landing. A field was selected close to Hulam Farm and an approach was made with 10° flap with the aircraft trimmed for 75 kt, full flap being selected late on the final approach to the field. The chosen field had an uneven surface and, during the flare, the left wingtip contacted the ground at the same time as the main landing gear. This caused the aircraft to flip inverted before finally coming to rest. There was no fire and both the pilot and passenger, who had been wearing four point harnesses, were able to exit the aircraft, having only suffered minor injuries.

Weather

The observed weather at Fishburn at 1530Z, prior to the departure of the accident flight, was a wind of 290° at 8 kt, a temperature of 13°C and good visibility. The METAR for Durham Tees Valley Airport at 1650 hrs gave the wind as 260° at 10 kt, a temperature of 17°C, a dew point of 6°C and good visibility.

Engine and fuel system description

G-JAPS was equipped with a Rotax 914 Turbo piston engine. This is a four cylinder horizontally opposed

engine fitted with two balanced carburettors, each supplying two cylinders, fed with air from a turbo-charger. This is controlled electronically from a 'turbo control' unit which, via a servo and pushrods, controls the turbo-charger waste-gate.

The fuel system on the aircraft consists of a single inverted horseshoe shaped fuel tank in the fuselage, with a 65 litre capacity. One side of the horseshoe is the main fuel tank, with the other side being the 8.5 litre reserve tank. The fuel from both these tanks is fed via three way fuel supply valve selectable by the pilot to either MAIN, RESERVE or OFF. From the fuel supply valve the fuel flows through two electric pumps (main and auxiliary), fuel filters, a fuel flow sensor and a gascolator before finally reaching the carburettors. Unused fuel returns to the fuel tank via an additional fuel flow sensor.

Carburettor examination

Following the accident, the owner removed both the carburettors and took them for a detailed examination to a local facility that specialises in Europa aircraft. Both carburettors contained uncontaminated fuel in their float chambers. Further examination did not reveal any defects with the left carburettor. However, upon examination of the right carburettor it was discovered that the main fuel jet needle was loose within its piston housing, allowing the needle to 'float' up and down by between 4 to 5 mm of travel. There were no other defects found within the right carburettor. Later discussions with the engine manufacturer revealed that a floating main jet needle would result in an enrichment of the fuel air mixture, but should not result in a problem with the engine operation. However, it was not established what effect it might have on the operation of the engine should the needle float cyclically or vibrate up and down in flight.

Engine and fuel system examination

A full examination by the AAIB of the engine and fuel system took place with the aircraft in the owner's hangar. The engine was free to turn and showed no signs of a catastrophic failure and an inspection of the spark plugs, cylinders, ignition system and engine compression checks revealed no evidence of any pre-existing defects. A functional test of the turbo-charger system was also satisfactory.

An inspection of the aircraft's fuel system found both fuel filters to be clean and a test of the system showed that the flow of fuel from the tanks, via the pumps, to the carburettors to be more than adequate for normal engine operation.

The aircraft had been equipped with an R-DAT, a device which records engine speed, exhaust gas temperatures, oil temperature, oil pressure and cylinder head temperature once every six minutes. A review of this data did not reveal any previous exceedences, or any significant variation in the temperatures or pressures.

Discussion

The only anomaly discovered during the investigation was the loose main fuel jet needle in the right carburettor which would likely cause enrichment of the fuel mixture but should not have caused the symptoms that were experienced by the pilot.

These symptoms seem to indicate that fuel starvation to one or both the carburettors had possibly occurred. However, there was sufficient of fuel in both the main

and reserve tanks, and later tests did not reveal any system problems which would have restricted the flow of fuel. In addition, the fuel system was found to be clear of contamination and both carburettors contained fuel in their float bowls.

Carburettor icing was considered as another possibility. With the temperatures of the day being given as 17/06°C, the carburettor icing probability chart places the aircraft in the 'moderate icing at cruise power and serious icing at descent power' area of the chart. However, the aircraft was equipped with a turbo-charger which raises the temperature of the air being induced into the carburettor and, therefore, reduces the likelihood that carburettor icing occurred.

Vapour lock in the fuel system was another possibility considered but, as the aircraft had been in flight for over 1 hour 30 minutes without any difficulties, and the previous flights had been without incident, it was thought that this was unlikely to be the cause of the loss of power.

Conclusions

Despite a thorough inspection of the engine and fuel system the exact cause of the engine failure was not determined. However, the presence of a 'loose' needle in the right carburettor was the only anomaly found during the investigation. This defect was likely to enrich the mixture in two of the four cylinders, but the possibility that it could float cyclically, and affect the normal operation of the engine could, in the absence of any other defects, not be entirely dismissed.