AAIB Bulletin No: 1/2003 **Ref: EW/G2001/08/09** **Category: 1.3**

INCIDENT

Aircraft Type and Registration:	Europa XS, G-IOWE	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2001	
Date & Time (UTC):	10 August 2001 at 1137 hrs	
Location:	Wolverhampton	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	18 years	
Commander's Flying Experience:	52 hours (of which 2 were on type) Last 90 days - Not known Last 28 days - Not known	
Information Source:	AAIB Field Investigation	

History of flight

The passenger was an experienced pilot who held a flying instructor rating and had a total of 8,500 hours flying experience of which 50 hours were on type. He was acting as a safety pilot for the commander who was the owner's daughter.

According to the passenger, all the normal pre-flight ground and cockpit checks were carried out satisfactorily. After a normal engine start and taxi, the engine power checks were completed in accordance with the check list. There were no problems during the ground roll and early part of the take-off but at approximately 100 feet agl, the engine started to surge and vibrate, losing nearly all of it's power. The passenger took control and as there was no suitable area ahead, a 40° turn was used to position the aircraft for a forced landing in a short, uphill cornfield. On landing in the corn, the engine stopped. The aircraft was undamaged and neither pilot was injured.

Engineering investigation

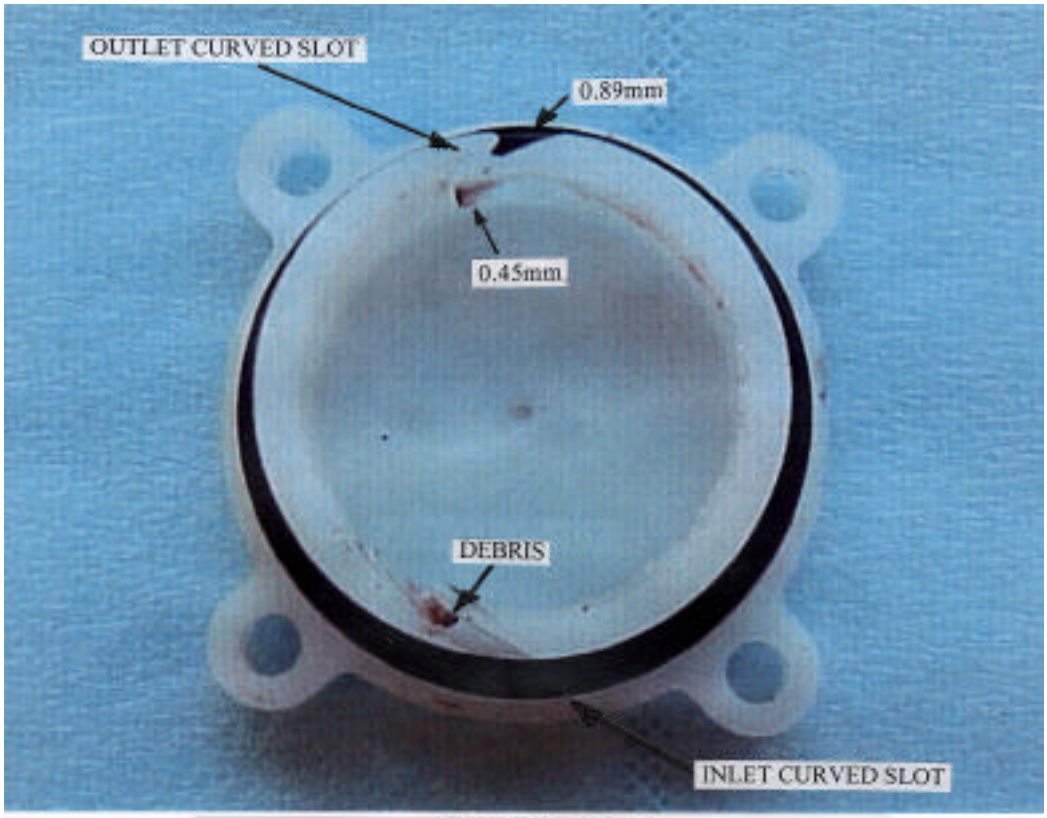
Following recovery of the aircraft, the owner stated that all the fuel lines, filters and carburettor float chambers were examined but no faults were found. A fuel flow check revealed that a restriction was present within the fuel flow transducer. The transducer had been fitted between the fuel filter and the carburettors.

The fuel flow transducer was sent to the AAIB for examination. It was a small unit manufactured in Germany. The internal diameter of the flow chamber containing the rotor was smaller than a £1 coin (see photograph 1 below).

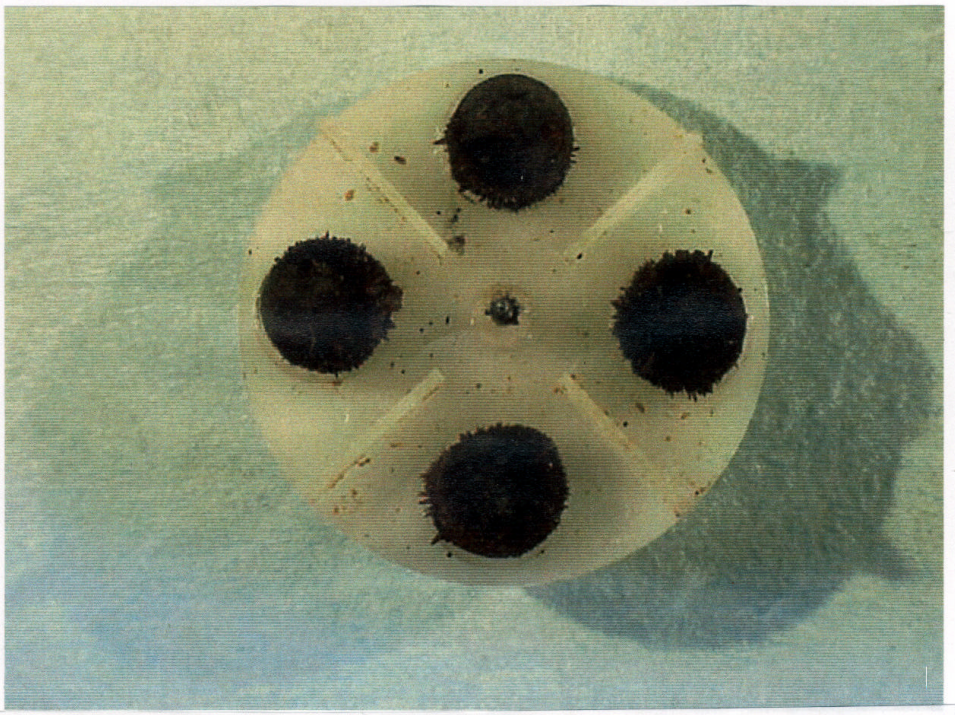
Photograph 1 fuel flowmeter chamber size

An identical new transducer was obtained by the AAIB and flow checks were carried out on both units. From the flow tests it was found that the incident transducer was restricting the flow to one third of that achieved through the new transducer. Upon disassembly, it was found that an inlet internal flow channel was partially blocked with unidentified debris (photograph 2). It was noted that this inlet internal flow channel was a curved slot that tapered from approximately 0.85mm at the inlet end to 0.30mm at its outlet end. It was also noted that the magnets mounted on the central revolving sensor were heavily coated with ferrous particles (photograph 3). There was no bypass system within this fuel flow transducer.

No explanation was forthcoming for the means by which debris (particularly the ferrous debris) entered the fuel flow transducer downstream of the fuel filter. The transducer was supplied as a sealed unit. The manufacturer's instructions contained the following caution: *'Do not open, loosen or in any way alter the transmitter as by doing so the measuring results will inevitably be falsified and there will be no more guarantee on the appliance'.*



Photograph 2
Inner body of the fuel flow transducer



Photograph 3
Ferrous debris on the magnets of the central revolving sensor

Flow meter approval

The fuel flow meter system modification had been approved by the PFA as a 'one off' modification to this aircraft. The owner stated that, to prevent a recurrence, he had decided to remove the fuel flow meter system from his aircraft.

The UK supplier of the system is currently developing a bypass modification to the original design to prevent fuel supply restriction caused by a blockage within the transducer.

Fuel system requirements

The requirements for light aircraft fuel systems fitted to aircraft on the UK register are currently specified in JAR 23 (for aircraft with a type certificate), JAR VLA (for aircraft with a MTOW of less than 750 kg) and BCARs Section S for microlight aircraft. JAR 23 and JAR VLA requirements specify that if a flowmeter is fitted, it must be blocked during a fuel flow test and fuel must flow through the meter bypass. The word 'blocked' has been interpreted as meaning '*with the moving parts fixed in a position for maximum pressure drop*' so this requirement could be met by an internal bypass. BCARs Section S does not contain any technical requirements for a fuel flowmeter.

Safety recommendation

The fuel flow transducer was fitted in the single fuel supply pipe to the engine. The design was such that there was one path, with no bypass facility, for the fuel to pass through the transducer. The dimensions of the inlet passageway were of a size and shape susceptible to restriction or total blockage by small debris particles.

Therefore, the following safety recommendation was made:-

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It was recommended to the Popular Flying Association that fuel flow transducers fitted to PFA 'Permit to Fly' aircraft types should either be invulnerable to blockage by small particles or have an automatic, remedial bypass mechanism that prevents fuel supply restriction.