

Davis BW Denney Kitfox, G-FOXC

AAIB Bulletin No: 5/99 Ref: EW/C98/10/6	Category: 1.3
Aircraft Type and Registration:	Davis BW Denney Kitfox, G-FOXC
No & Type of Engines:	1 Rotax 582 two-stroke piston engine
Year of Manufacture:	1991
Date & Time (UTC):	31 October 1998 at 1230 hrs
Location:	Near Elie, Fife
Type of Flight:	Private
Persons on Board:	Crew - 1 - Passengers - 1
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Failed crankshaft and substantial damage to the engine
Commander's Licence:	Private Pilot's Licence
Commander's Age:	38 years
Commander's Flying Experience:	340 hours (of which 64 were on type) Last 90 days - 22 hours Last 28 days - 9 hours
Information Source:	AAIB Field Investigation

The aircraft was flying from Perth to East Fortune. As the aircraft was crossing the Firth of Forth, the pilot (who was also the owner) noticed a smell of burning. He immediately carried out a 180° turn to head back to land, reducing power from 5,400 to 4,000 RPM and aimed for Sorbie airfield. Descending through 3,700 feet the engine stopped abruptly so the pilot selected a suitable field into which he was able to perform a safe landing into wind, with no further incident.

Examination after the landing showed that the crankshaft had failed and had then penetrated the engine casing. The engine was removed from the aircraft and, after the engine was dismantled, the failed crankshaft items were sent to the AAIB for further investigation (Figure 1 shows the failed item, next to an intact crankshaft from a later Rotax 582 engine).

The failure was in the crank web adjacent to the main bearing at the rear of the engine. The examination of the fracture surfaces showed that there was clear evidence of fatigue crack growth through the web material. The initiation points were on the 'big end' side of the web, where the forging had been machined to a flat surface with an abrupt change of cross-section. It was also noted that there had been considerable fretting damage to the main bearing. This damage appeared

to have been due to vibration and loads caused by the loss of the plastic cages which hold the balls in their correct relative positions within the two main bearing races.

The aircraft had been completed in 1991 and, up to the time of the accident, had accumulated some 96 hours with the same engine installed. This represents a usage of some 10 hours per year, quite common in this category of aircraft. In discussion with the UK agents for Rotax engines, two mechanisms were discussed which might have led to the failure of the plastic roller cages and thus to the failure of the crank web.

One mechanism would have been the loss of the plastic cages due to chemical contamination over a sustained period. The Rotax 582 is a two cylinder 2-stroke engine and, in common with other 2-stroke engines, after every engine stop products of combustion will enter the engine crankcase. To combat the associated problems of corrosion the UK agent produced a Service Information letter in November 1992 ("Service Information - 51192") advising on both short term and long term protection strategies.

The other mechanism discussed was that bearing damage might have occurred due to crankshaft vibration. Around 1991 the engine manufacturer had started to install a 'hydro damper' in new engines. The damper is an annulus, containing a viscous fluid, which is attached to the crankshaft and acts to reduce torsional vibration in the engine. This damper was also offered for retrofit to the owners of earlier engines and, in another Service Information letter in November 1992 ("Service Information - 111192"), the manufacturer and UK agent recommended the fitting of the damper to, amongst others, all Rotax 582 engines with the Rotax electric starter. The Rotax 582 in G-FOXC was equipped with the electric starter and had not been fitted with the 'hydro damper'.

The examination of the engine from G-FOXC did not give a definite answer as to the failure process but it is possible that one, or both, of the mechanisms noted above were involved. It should also be noted that the design of the Rotax 582 crankshaft has been changed in the intervening years, so that the crank webs in later engines have a machined, rather than forged, surface finish.