Hoac Flugzeugwerke DV20 Katana, G-BWLV

AAIB Bulletin No: 11/2003	Ref: EW/G2002/08/21	Category: 1.3
Aircraft Type and Registration:	Hoac Flugzeugwerke DV20 Katana, G-BWLV	
No & Type of Engines:	1 Rotax 912-A3 piston engine	
Year of Manufacture:	1996	
Date & Time (UTC):	22 August 2002 at 0830 hrs	
Location:	Near Cranfield Airport, in a field off Runway 22	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Undercarriage collapsed, significant wing damage	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	24 years	
Commander's Flying Experience:	975 hours (of which 300 were on type)	
	Last 90 days - 119 hours	
	Last 28 days - 51 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot; engine running and examination carried out in AAIB presence after aircraft salvage; AAIB examination of engine component	

Details of Flight

The aircraft was being used for an instructional flight and the instructor reported that three circuits took place without problems. At approximately 400 feet QFE on the climb-out for a fourth circuit, however, a smell of smoke was noticed which was initially assumed to emanate from a local brick-works, well known for producing such smells. However, white smoke started to fill the cockpit and, at the same time, the engine power reduced and began to fluctuate.

The instructor took control of the aircraft, transmitted a MAYDAY call and, as he did not think he could reach the airfield, he looked for a field for a forced landing. Although a limited choice was available, as most of the adjacent fields were ploughed or contained standing crops, a nearby grass field was chosen. A successful touch-down, with one stage of flap selected, was made 20 or 30 metres into the field, at a speed estimated by the instructor as approximately 65 kts. After touch-down, he closed the throttle and began to brake hard, but dew rendered the braking action ineffective and so the instructor aimed for a gap in the fence in order to pass into the adjacent

cornfield. However, the right wing tip struck the fence-post at the edge of the gap, which spun the aircraft around through approximately 140 degrees, following which it ran backwards through a wire fence and came to rest in a ditch alongside the cornfield.

The instructor stated that two days earlier he had rejected the aircraft after finding the underside covered in oil and no indication of oil visible on the dipstick. The aircraft had been passed to a local maintenance company who cleaned off the external oil and replenished the engine contents. One circuit was then flown in the aircraft with no reports of any problems on that flight. On carrying out the 'A' check on the day of the accident flight, the instructor noted an oil level of $2^{3}/4$ quarts and took particular time to check that there was no oil on the underside of the aircraft. He observed that, after the accident, the engine oil did not register on the dipstick, and that there was an oily film emanating from the engine cowling vents.

Subsequent Examination

The aircraft was dismantled and transported back to the airfield. The oil was replenished and an engine run was attempted. The engine started and ran, but oil was found to be leaking rapidly from the base of one of the No 3 cylinder push-rod tubes.

The cylinder was removed, the flexible rubber O-ring seal from the leaking tube was found to be damaged. More detailed examination revealed that an area of seal had been cut away in a manner consistent with its having been trapped by the sharp lip of the lower edge of the push-rod tube as the latter was installed. A tensile failure had taken place across the reduced cross section resulting from the cutting damage.

Although it was not possible to determine how or when this failure occurred, it was noted that the No 3 cylinder head was one of three which had been removed and refitted during recent maintenance.

Maintenance Practices

The Maintenance Manual draws attention to the need for care when inserting the push-rod tube, with the O-ring seal in place on it, into the recess in the crankcase. Information received from an overhaulier of this engine type indicated that these seals are soft and easily cut if the push-rod tube is not installed accurately into the crankcase recess. When installed, the O-ring is compressed between a circumferential ridge on the tube and a base ledge in the recess. There is only just sufficient length of tube between the ridge and the end of the tube to support the O-ring, which has been said to be easily dislodged during the process of the installation.

Once installed, it is not possible to see if the O-ring is damaged.

Assessment of Seal Behaviour

The extent of leakage from the damaged rubber seal would have been influenced by the residual tightness of its fit around the tube and within the recess into which the latter was inserted, together with the end loading from the push-rod tube ridge. It would also have been influenced by whether or not the tensile failure of the seal, observed during the examination, was present at the time of leakage. Expansion and contraction of the metal components of the engine, during operating cycles, would vary the tightness of fit between these components and alter the end-load in the push-rod tube. Such dimensional changes may also have opened or closed the gap made available by the tensile failure in the O-ring.

It is thus reasonable to assume that a damaged seal, which functioned acceptably during one operating condition, would be capable of leaking once the engine temperature rose and the temperature distribution in the engine components changed.

Reason for Power Loss

It has not been possible to obtain evidence to determine why the engine had lost power in flight, yet appeared to function satisfactorily on a subsequent ground run, (albeit with a severe oil leak) once the

oil contents had been replenished. It is possible that local overheating of internal components, as a result of reduced oil contents caused by oil loss in flight leading to a partial seizure. Such a seizure may have eased once the engine had cooled fully and not been apparent during the subsequent test-run, after correct lubrication (and hence internal cooling) was restored by replenishment of oil contents. Without direct evidence, however, this possibility cannot be confirmed.

Discussion

Although the precise mechanism for the power reduction could not be determined, it is reasonable to conclude that it was most probably a consequence of the oil-loss caused by the O-ring seal being damaged.

The seal was damaged in a manner consistent with its being trapped by the sharp edge of the push-rod tube when the No 3 cylinder was reinstalled during recent engine maintenance. The Maintenance Manual warns of the possibility of damaging this seal during replacement.