

ACCIDENT

Aircraft Type and Registration:	Reims Cessna F152, G-BMCV	
No & type of Engines:	1 Lycoming O-235-N2C piston engine	
Year of Manufacture:	1963	
Date & Time (UTC):	24 August 2006 at 1310 hrs	
Location:	Leicester Airport, Leicestershire	
Type of Flight:	Training	
Persons on Board:	Crew 1	Passengers None
Injuries:	Crew None	Passengers N/A
Nature of Damage:	Damage to propeller and right wing	
Commander's Licence:	Student pilot	
Commander's Age:	18 years	
Commander's Flying Experience:	32 hours (of which all were on type) Last 90 days - 32 hours Last 28 days - 11 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and metallurgical examination of damaged components	

Synopsis

At around 2,000 ft while in the Leicester Airfield overhead, the engine lost power and the student pilot performed a forced landing onto the runway. He landed successfully but overshot the end of the runway. The cause of the power loss was due to the break-up of the No 4 cylinder cam follower.

History of the flight

The training flight was authorised by the instructor as a solo VFR navigation exercise from the Leicester overhead to the Sywell overhead, then to Conington and returning to land at Leicester. The student pilot performed his pre-flight checks and the aircraft took off and climbed normally into the overhead position to begin

the exercise. At around 2,000 ft, the pilot noticed the engine noise become fainter, the indicated rpm dropped and the aircraft stopped climbing. The pilot declared a 'MAYDAY'. The aircraft descended and, despite the throttle being fully open, the engine continued to lose power. The pilot turned the aircraft onto final approach and closed the throttle; the touchdown was a considerable distance beyond the threshold to the extent that the aircraft overshot the end of the runway, coming to rest in an adjacent field.

Engine examination

The engine was dismantled and inspected by the overhaul agency. The loss of power was due to the failure of

**Figure 1**

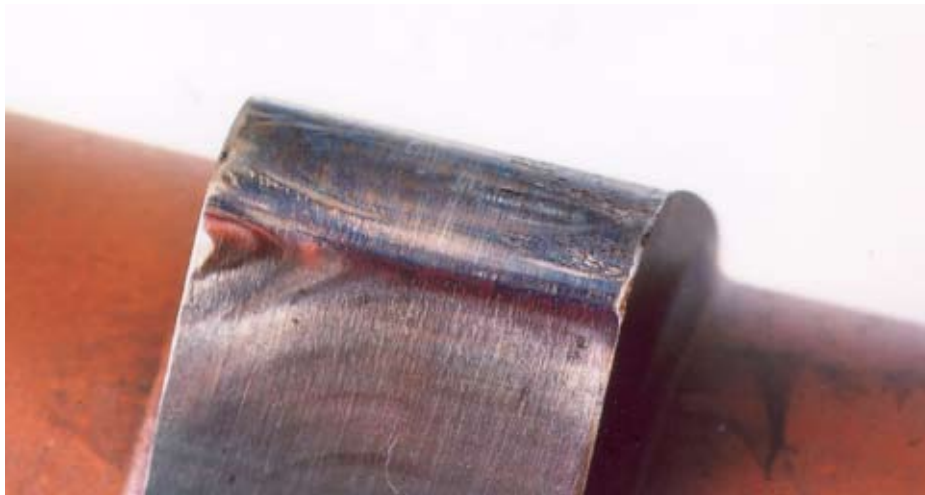
Damaged cam follower

the No 4 exhaust cam follower, the head of which had broken away from its shaft (see Figure 1) and was found in several pieces in the bottom of the oil sump. There was also consequential damage to the engine caused by the debris from the failed cam follower.

The No 4 cam follower, the camshaft and the crankcase were returned to the AAIB for metallurgical examination. The cam follower head had broken into seven pieces; many of the failures showed evidence of flexural fatigue from loads applied by the associated cam lobe. All but one of the pieces recovered had been damaged on the cam lobe contact face by circulating debris; the undamaged piece was considered to be the first to have separated. It contained a fatigue initiation site, in the junction between the rim and the cam contact face, which had progressed more slowly than the separations on the other pieces (see Figure 1).

Examination of the camshaft showed that the surface of the rear lobe (No 4) had been mechanically damaged. The other lobes showed offset wear indicating that the shaft had not been sitting square with the related cam follower head for a considerable period of engine running time (see Figure 2). Microsection examination of the camshaft material showed that it had been carburised and case-hardened before final machining; microhardness tests on the case-hardened layer were satisfactory.

The crankcase showed no visual evidence of distortion; the right side had been mechanically damaged, consistent with high energy contact with the cam follower pieces. The camshaft bearing faces on both crankcase sides had been scored, most likely from debris circulating in the oil. The bearing lands on the camshaft were also scored, the nature of the damage indicating that it had resulted from cam follower debris in the oil.



(Photo: H T Consultants)

Figure 2

Integral cam for No 2 cylinder exhaust cam follower showing offset wear

Engine history

The engine (serial No L-20058-15) was last overhauled in February 2003, at which time a new camshaft was fitted. In September 2005, following the reported tightness of the crankshaft when rotated by hand using the propeller, the engine was removed from G-BMCV. The engine was dismantled and the crankcase was found to be fretted. The crankcase was replaced with an overhauled component and the engine was reassembled.

The engine had accumulated 1,293 hours 5 minutes since the overhaul and 396 hours 15 minutes since the re-build in 2005.

Discussion

It was concluded that the break-up of the cam follower resulted from a flexural fatigue mechanism caused by offset cyclic loading from the related camshaft lobe. No conclusion could be made about the cause of the offset loading.