AAIB Bulletin No: 1/96 **Ref: EW/C95/09/6** **Category: 1.3**

INCIDENT

Aircraft Type and Registration:	Cessna R172K Hawk XP, G-FANL	
No & Type of Engines:	1 Continental IO-360-K piston engine	
Year of Manufacture:	1978	
Date & Time (UTC):	15 September 1995 at 1545 hrs	
Location:	15 nm north of Cherbourg	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	49 years	
Commander's Flying Experience:	5,435 hours (of which 2 were on type) Last 90 days - 30 hours Last 28 days - 4 hours	
Information Source:	AAIB Field Investigation	

The aircraft was on a flight from Roughay Farm Airfield, near Southampton, to Dinard. Whilst cruising at 8,500 feet on a direct track from St Catherines Point to Cherbourg, the propeller RPM suddenly increased from its cruise setting of 2,300 to more than 3,500. The pilot retarded the throttle to bring the RPM to below 2,700, and made a 'PAN' call to Brest stating his intention to land at Cherbourg. He called Cherbourg on the appropriate frequency, but on obtaining no response re-called Brest. Whilst operating the radio, he noted that the engine oil pressure was reducing. The pilot then trimmed the aircraft at 75 kt, whilst maintaining low power. At about 7,500 feet he was 12 nm from Cherbourg with the runway in sight. A 'MAYDAY' call was made to Brest, who contacted Cherbourg by telephone. The engine was shut down as soon as audible signs of distress were heard, although the propeller continued to windmill. The aircraft arrived at the airfield boundary at 1,500 feet, and made a successful landing on Runway 29, with the wind reported as 020°/15 kt, gusting to more than 20 kt.

After landing, an examination of the aircraft revealed that the underside was covered with oil and that the engine oil dipstick was indicating 'empty'. It was also clear that the No 2 cylinder connecting rod had broken, and that the 'conrod' end had penetrated and ruptured the top of the crankcase. The apparent lack of oil around the ruptured area suggested that very little oil had escaped as a result, which suggested that the conrod failure had resulted from a lubrication problem within the engine. There was a similar lack of oil elsewhere within the engine compartment. The engine itself appeared intact other than the hole in the crankcase, with components such as the oil drain plug secure, and no obvious source of an oil leak. The only untoward feature was that the mixture control operating cable had not been 'P-clipped' to its bracket on the right side of the engine. However, it was still possible to function the mixture control.

Following in-situ inspection, the engine was removed and taken to an overhaul facility where it was subjected to a strip examination.

Internally, the engine had suffered extensive damage, and it was apparent that there had been a failure of the No 2 big end bearing, leading to seizure and consequent bending fatigue failure of the conrod. The associated crankshaft journal surface was heavily 'blued', and fragments of bearing shell material appeared to have been 'friction-welded' onto it. Damage to the interior of the crankcase, and to the Nos 1 and 2 cylinder skirts, had been inflicted by the lower end of the (failed) conrod before it had finally broken away from the bearing. Fragments of bearing cap material were found outside the engine, lodged in the cylinder baffles. When the No 1 conrod lower end was removed from the crankshaft, it was found that the bearing surfaces were discoloured as a result of heat, and that it had been running in a 'dry' condition. All the other bearings were in good condition, although a degree of 'speckling' was visible on the No 4 main bearing. The suction filter, which has a coarse screen, was full of bearing shell fragments. The pressure filter was heavily contaminated with finer material, which appeared to be white bearing metal. The oil pump was found to be in good condition.

Information from the engine manufacturer indicated that, in the event of oil starvation, the first bearing to fail is invariably the No 2 big end, closely followed by the No 1. The evidence found on the subject engine thus strongly supported a lubrication failure resulting from a loss of oil, although it was not immediately apparent how the oil had escaped. The propeller rpm excursion, as reported by the pilot, is also symptomatic of oil loss, as once the propeller governor becomes starved of oil, it can no longer perform its governing function. Thus the rpm increases as spring pressure within the propeller hub, which is normally opposed by the governor output oil pressure, causes the blades to 'fine-off' in pitch.

During the disassembly, a loose jubilee clip was noted on a section of flexible hose that connected the upper and lower halves of the oil filler tube. Thus the seal between the hose and the tube may not have

been airtight. A similar condition was found on the oil dipstick tube, which was located close by. It was considered that this may have led to pressurisation of the crankcase, as the tops of both tubes were located ahead of the rearmost engine compartment baffle, in a comparatively high pressure area. In April 1989, the engine manufacturer published a Service Bulletin, No M89-9, which dealt with the testing of engines in which high crankcase pressure was suspected. The Bulletin contained the following statement:

> *"Excessive crankcase pressure in flight can be induced by ram air entering an improper fitting oil filler cap seal and/or defective crankshaft nose seal....."*

The effect of excessive crankcase pressure would be to expel oil from the sump and into the breather tube, which exhausts close to the cowl flap aft of the nose landing gear on the underside of the aircraft.

The front of the crankcase breather tube was attached to the front of the right half of the crankcase; there was evidence of oil staining in this area. Although only small quantities of oil appeared to have been involved, it was considered that it may have been an indicator of high crankcase pressure. The rubber seals on the dipstick and on the underside of the oil filler cap were in good condition. The crankshaft front seal was also appeared to be in a satisfactory condition.

New piston rings were recently fitted to the No 5 piston following heavy oil consumption, with the underside of the aircraft having been smeared with oil. The rectification work was dated 7 September, which was only some 7 flying hours before this incident. The work included removing 'glaze' from the No 5 cylinder bore, and there was also a report of the "gaps in the piston rings being found lined up." It had apparently been concluded that these conditions had been responsible for combustion gas 'blow-by', with consequent crankcase pressurisation. The engine was subsequently re-filled with straight mineral oil, which is a requirement for the piston ring bedding-in process. During strip examination after this recent incident, all the cylinder bores appeared in good condition, with no evidence of glazing. The engine had achieved 1,447 hours in total, and 268 hours since a top overhaul.