

No: 1/91

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Category: 1c

Aircraft Type and Registration: Grumman AA-5, G-BDCK

No & Type of Engines: 1 Lycoming O-320-E2G piston engine

Year of Manufacture: 1975

Date and Time (UTC): 3 July 1990 at 1411 hrs

Location: Old Macmerry Airfield, East Lothian, Scotland

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - 1

Injuries: Crew - None Passengers - None

Nature of Damage: Extensive damage to propeller, nose landing gear leg and cowlings

Commander's Licence: Private Pilot's Licence

Commander's Age: 65 years

Commander's Total Flying Experience: 231 hours (of which 4 were on type)

Information Source: Aircraft Accident Report Form submitted by the pilot and AAIB enquiries and examination

The aircraft was flying from Brunton to Edinburgh. Approaching Dalkeith at 2300 ft, the engine banged loudly and the aeroplane began to vibrate violently. With the throttle fully open the engine would only deliver 1200 rpm and the pilot turned the aircraft towards the Old Macmerry airfield. He had sufficient power and height to make a diagonal approach into a corner of the airfield which was being used for grazing cattle and touched down just inside the overgrown and broken-up perimeter track.

The pilot reports that the landing run was longer than normal because of the downhill gradient (about 1-in-25) and the wet grass and, after some 450 yards, the nosewheel struck an overgrown drainage ditch about 2 feet deep and the nose leg collapsed under the nose. The aeroplane stopped within a few yards, just short of the boundary fence.

Examination of the engine, which had been run for 1800 hours since new, showed that the exhaust valve of the No. 3 cylinder had disintegrated, leaving the valve stem in place but with no trace of the valve head. There were chatter marks on the head of the No. 3 piston and it appeared that the pieces of the valve head had been ejected through the exhaust manifold. Metallurgical examination of the remaining portion of the valve stem showed that the original fracture surface had been obscured by the subsequent combustion products but that the failure was consistent with fatigue cracking.

This accident has several points in common with the accidents to a Piper PA28-180C, G-AVZR, and a Piper PA28-140, G-ASVZ, both described in this edition of AAIB Bulletins. In each case an attempted forced landing was made following vibration and the loss of power from the engine and in each case subsequent examination of the engine showed that the fracture of an exhaust valve stem had resulted in the detachment of the valve head. In this design of engine the exhaust valves, when stuck fully open, are in a position to be struck by the crown of the piston before it reaches top dead centre.

In 1988 the FAA noted continuing service problems with exhaust valves in Lycoming reciprocating engines. Service Instruction No. 1425A was issued by Textron Lycoming dated 19 January 1988 on the subject "Suggested Maintenance Procedures to Reduce the Possibility of Valve Sticking" and stated:

"Field experience has shown that engine oil contamination increases the possibility of sticking and/or stuck valves. This situation occurs when the contaminants in the engine lubrication oil become deposited on the valve stems, restricting the valve movement and resulting in intermittent engine hesitation or miss. If corrective action is not taken to remove the deposits, a valve could become stuck causing engine damage.

Since the rate of oil contaminant accumulation is increased by high ambient temperatures, slow flight with reduced cooling and high lead content of fuel, owners and operators experiencing these conditions are encouraged to consider the following suggestions for operation and maintenance if they have experienced valve sticking.

PART I - OIL AND FILTER CHANGES

The prime cause of valve sticking is the accumulation of harmful contaminants in the oil and oil filter. Textron Lycoming recommends 50-hour interval oil change and filter replacement for all engines using full-flow filtration system and 25-hour intervals for oil change and screen cleaning for pressure screen systems. Operating the engine with a clean air filter is also important for keeping dirt from accumulating in the oil supply. Therefore the entire air induction system should be well sealed to prevent the entry of unfiltered air.

It is also important that the cooling air baffles and baffle strips be in good condition to prevent localized overheating problems.

When the aircraft cannot be flown frequently, the oil should be changed even sooner than the 50-hour interval. The oil should then be changed every 25 hours to eliminate moisture and acid that collect in the oil of an inactive engine. For aircraft that are not flown for long periods of time, the oil should be changed every four (4) months, if the aircraft is not flown at least 25 hours within this 4-month period. Short ground runs should be avoided.

Exposing the engine to sudden cool down, as in a rapid descent with the power reduced, or shutting the engine down before it has sufficiently cooled down can also induce valve sticking."

Part II of the Service Instruction stresses that deposit build-up in the valve guides, resulting in valve sticking, is more likely in operations with high ambient temperatures, slow flight with reduced cooling or using fuel with high lead content. Part III comprises a Cleaning Procedure for the exhaust valve guides, using a hand reamer.