Aeronca 7AC Champion, G-LEVI, 28 October 1995

AAIB Bulletin No: 4/96 Ref: EW/G95/10/16 Category: 1.3

Aircraft Type and Registration: Aeronca 7AC Champion, G-LEVI

No & Type of Engines:1 Continental A65-8F piston engine

Year of Manufacture:1946

Date & Time (UTC):28 October 1995 at 1210 hrs

Location:1 nm South West of White Waltham Airfield, Berkshire

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - None

Injuries: Crew - None Passengers - N/A

Nature of Damage: Engine damaged

Commander's Licence: Private Pilot's Licence with IMC Rating

Commander's Age:47 years

Commander's Flying Experience:263 hours (of which 29 were on type)

Last 90 days - 6 hours

Last 28 days - 6 hours

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

Just after take off the pilot heard a loud thump from the tailof the aircraft. As there had been tailwheel problems with theaircraft in the past, the pilot requested a visual check of thetailwheel during a flypast along Runway 21. The ground staffreported that the tailwheel appeared normal and the pilot re-appliedfull power at the runway mid point to commence a climb on runwayheading; it was subsequently reported that self centralisationof the tailwheel under spring loading could sometimes producethe type of thump heard.

During the climb, at about 800 ft agl, the engine suddenlybegan to vibrate noisily and the power output reduced to a verylow level. The pilot made an immediate 180° left turn whiletransmitting a Mayday call to Waltham Radio. On rolling levelthe aircraft was heading directly back towards Runway 03. However, the pilot was in some doubt about clearing a line oftall trees between his position and the airfield boundary so heshutdown the engine. As soon as the magnetos were

switched offthe propeller stopped rotating. The aircraft was now at about500 ft agl and the pilot turned 90° left to landin the only available field, approximately 1 nm short ofthe Runway 03 landing threshold. After touchdown in a threepoint attitude followed by gentle wheel braking the aircraft cameto a stop after a ground roll of about 50 yards. No damagewas sustained in the landing.

Engine strip by an overhauler revealed that the exhaust valveof the No 2 cylinder had fractured. The head of the valvehad fallen into the cylinder and then been driven into the cylinderwall by the piston. No other significant engine defects werefound. The valve pieces were forwarded to AAIB. It was apparentthat a flat planar type fracture of the valve stem had occurredat the start of the blend radius between the stem and the head. The head portion of the valve was complete but had been severelymangled and the original fracture surface had been obliteratedby damage; the stem portion of the fracture had been coated witha black deposit but was undamaged. Both the head portion andthe adjacent part of the stem had an overheated appearance. Specialistexamination found that the material composition was consistentwith the VMS201 high-chromium, high-nickel steel specified. Thematerial hardness near either end of the stem was well below theminimum specified (32 HRc (Rockwell C Hardness)); aconsiderably lower value for the head end of the stem (21 HRc)than for the other end (27 HRc) suggested that the low hardnesshad resulted from overheating.

Clear evidence was found showing that the fracture had been causedby the growth of a fatigue crack across almost the entire sectionof the stem, under bending loading. There was no evidence atthe point of crack initiation of any pre-failure damage that mighthave affected the fatigue life of the valve. Some features ofthe severely damaged seating face of the valve could have beenindicative of a small particle having become lodged between thevalve and its seat; it is possible for such an effect to applybending loads to the valve and to result in the type of fatiguefailure identified.