

Grob G115E Tutor, G-BYXJ

AAIB Bulletin No: S3/2004	Ref: EW/C2004/06/03	Category: 1.3
Aircraft Type and Registration:	Grob G115E Tutor, G-BYXJ	
Serial Number:	82170/E	
No & Type of Engines:	1 Lycoming AEIO-360-B1F piston engine	
Year of Manufacture:	2001	
Date & Time (UTC):	29 June 2004 at 1650 hrs	
Location:	4.5 nm Southwest of Salisbury, Wiltshire	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - Nil	Passengers - N/A
Nature of Damage:	1 blade and part of propeller hub detached; substantial damage to engine and airframe	
Commander's Licence:	Royal Air Force Qualified Flying Instructor	
Commander's Age:	28 years	
Commander's Flying Experience:	1,450 hours (of which 215 were on type)	
	Last 90 days - 60 hours	
	Last 28 days - 20 hours	
Information Source:	AAIB Field Investigation	

History of the flight

The aircraft was carrying out a short sequence of aerobatic manoeuvres at the end of an uneventful navigation training exercise. The weather was fine with a surface wind of 210°/12 kt, visibility of 35 km with a few clouds at 2,300 feet and broken cloud at 25,000 feet.

After a climb to FL50, using high RPM and full power, the instructor completed the 'HASELL' checks, selected 2,500 RPM and confirmed that the auxiliary fuel pump was OFF and that the fuel was balanced between the two wing tanks. After a clearing 'Wing Over' to the right the aircraft completed a loop at 130 kt, flew level briefly and then entered a '1/2 Cuban', climbing at 130 kt with a 60° nose-up attitude. When the airspeed reduced below 100 kt, full back control column and full left rudder was applied. The aircraft snap rolled left through 180° and was stabilised inverted in the climb before being 'pulled through' to the horizon.

As the aircraft levelled, at approximately 120 kt with full power set, there was a loud bang accompanied by extreme vibration. The instructor saw debris passing the canopy and could feel airflow entering the cockpit. His immediate thought was that his aircraft had been involved in a mid-air collision. As he transmitted a 'Mayday' call he was aware of the canopy moving backwards and then detaching; neither occupant had touched the canopy latching system. The instructor could see that the propeller blades were damaged but the resultant vibration was such that he could not read the cockpit instruments. As the engine was shut down the vibration increased but then stopped. When the propeller blades were stationary it was possible to see that one appeared to be missing and one was badly damaged. Oil was also visible on the right windscreen.

The instructor had initially considered abandoning the aircraft but with the vibration stopped he now elected to carry out a forced landing. He was familiar with the area and able quickly to identify a suitable field that he had used previously in practice exercises. Passing through his planned 'High Key' position, he completed his 'Forced Landing' checks and informed ATC of his present position and intention to land. The aircraft touched down, in a field in standing crop, at approximately 60 kt. On the ground, the nose started yawing to the right and the aircraft began sliding to the left. The left gear collapsed and the aircraft came to rest after a ground roll of about 50 metres. The crew members were uninjured and able to vacate the aircraft without difficulty.

Subsequently, a coastguard helicopter transported the crew to Salisbury hospital for medical checks. During his pre-flight exterior check, the instructor recalled visually checking the propeller and associated area and noted nothing unusual.

Initial findings

The aircraft was examined by the AAIB at the accident site. It was immediately apparent that the Number 1 propeller blade had detached due to a failure of the hub. The blade was found approximately 3.5 km from the aircraft location, with the fractured part of the hub attached to it. Examination of the fracture surfaces (Figure 1) suggested that the aluminium hub had failed due to high cycle fatigue cracking, originating at the front and back of the blade arm. This was later confirmed by the initial metallurgical examination findings.

Figure 1: Propeller hub showing fractured blade arm



As the blade departed the hub it was struck by the following blade, causing the detachment of a large portion of the latter (Figure 2). The out of balance forces generated prior to engine shutdown caused the canopy to detach from the aircraft and also resulted in significant damage to the engine and its mountings. This included the severing of the left-hand upper engine mounting lug from the crankcase and cracking and severe distortion of the engine mounting frame. The left-hand magneto had pulled out of its mounting and the exhaust mufflers had severed from the exhaust down pipes. The left-hand main landing gear and the nose gear were extensively damaged during the forced landing.

Figure 2: General view of propeller damage



At the time of the accident, the propeller, (part number HO-V343K-V/183GY, serial number G22AB), had completed approximately 1,710 hours since manufacture in May 1999 and approximately 249 hours since the previous overhaul in August 2003.

The investigation to establish the cause of the propeller hub failure is continuing.

Immediate safety actions

Operation of the Grob 115E Tutor aircraft ceased immediately after the accident.

The propeller manufacturer, Hoffmann Propeller GmbH & Co KG, issued Service Bulletin 61-10-03 SB E 15 requiring eddy current non-destructive testing of type HO-V343 propeller hubs to check for cracks in the blade arms. The Service Bulletin also requires the propeller blades to be checked for looseness ('blade shake') and calls for checks of the blade retention nut torque values. The procedure for accomplishing this is described in Hoffmann Service Instruction 61-10-05 SI E 4.

Service Bulletin 61-10-03 SB E 15 has been mandated by the German Luftfahrt Bundesamt (Civil Aviation Authority) under EASA approved Airworthiness Directive LTA D-2004-352R2.