

**AAIB Bulletin No: 4/93**

**Ref: EW/G93/01/08**

**Category: 1c**

**Aircraft Type and Registration:** Denney Kitfox MK3, G-BUIT

**No & Type of Engines:** 1 Rotax 582LC piston engine

**Year of Manufacture:** 1992

**Date & Time (UTC):** 18 January 1993 at 1128 hrs

**Location:** Rochester Airport, Kent

**Type of Flight:** Private

**Persons on Board:** Crew - 1 Passengers - 1

**Injuries:** Crew - Serious Passengers - Serious

**Nature of Damage:** Damaged beyond economic repair

**Commander's Licence:** Military Helicopter pilot / Private Pilot's Licence

**Commander's Age:** 23 years

**Commander's Flying Experience:** 1,100 hours on helicopters  
200 hours fixed wing (of which 2 were on type)  
Last 90 days - 130 hours  
Last 28 days - 50 hours

**Information Source:** Aircraft Accident Report Form submitted by the pilot and subsequent AAIB inquiries

Apart from a short hop take-off and landing up to a height of about 20 feet, this was the first flight of G-BUIT. A passenger was carried because the pilot considered that the extra weight would be an advantage in what was a relatively high performance aircraft; his 2 hours familiarisation in the Kitfox were dual. The surface wind was 240°/5 kt and the conditions were generally ideal for the flight. The calculated take-off weight was 905 lb; the maximum allowed was 1,050 lb.

The aircraft took off on the relief runway to the left of Runway 20; the engine was set to 6,000 RPM and the throttle was adjusted during the ground run to maintain that figure. The initial climb was as expected until about 150 feet agl when the indicated airspeed was noted to have been about 45 mph. The pilot then felt that there was a reduction in climb performance; the engine appeared to be functioning normally and he noted that the tachometer read about 6,800 RPM. Roll response appeared normal, pitch response was 'sluggish' and the aircraft slowed and descended. The pilot did not perceive any symptoms which would have indicated to him that the aircraft was in a stalled condition, however, it became apparent that he would have to make a forced landing and, as the area ahead and to

the right appeared unsuitable, he decided to turn left to remain within the airfield boundary. As he banked the aircraft to the left the nose dropped and it entered a steep dive; the engine RPM appeared to increase.

The aircraft struck the ground in a near vertical attitude at the south-west end of the airfield and a small fire started in the cockpit. Both occupants were wearing full upper torso restraint. The passenger released his harness and escaped unaided through the right door. The pilot released his harness and attempted to follow him but found himself trapped by the legs. The accident site was very close to both the AFS base and the Kent air ambulance station so assistance was more or less immediately on the scene. A rescuer released the pilot's legs and he escaped through the right door without further assistance. The lower body clothing of both occupants caught fire but this was soon extinguished by the emergency services; the passenger, who was wearing normal casual clothing suffered burns to his legs but the pilot who was wearing a Nomex flying suit did not.

Film taken from the cameras of interested parties who were observing the flight was analysed. It was possible to determine that the aircraft reached a height of about 150 feet agl at about the intersection of Runway 20 and Runway 16; this was about 400 metres from the start of the take-off run. By the south-western end of Runway 20 it was at a height of about 90 feet agl; this was about 690 metres from the start of the take-off run. Three separate arcs were seen at the propeller disc, one for the area covered by each blade during the period for which the camera shutter was open; the design shutter speed was 1/125 second. Between 80 and 90% of the disc appeared to be covered which would indicate that the propeller speed was greater than 2,000 RPM but less than 2,500 RPM, the speed at which complete disc coverage would have been achieved; the propeller speed at 6,800 engine RPM would have been about 2,270 RPM. The aircraft appeared to be pitched up at an angle of about 17° to the horizontal with a significant amount of up elevator applied. The observers noticed that the aircraft appeared to be flying extremely slowly at this point. The Owner's Manual indicated that the stall speed, dual, with power on would have been 32 mph.

The aircraft and site were examined the day after the accident. The initial impact was near vertical, yawed to the left, and had caused severe disruption to the engine and cockpit area. The fuselage aft of the cockpit was largely undamaged as was the left wing. The outboard part of the right wing had struck the ground, the leading edge member had been bent rearwards and all the right flaperon hinges were distorted in consequence. The control rod to it was connected but the flaperon would not move due to the distortion caused by the impact. The left flaperon control rod was severed in the impact but the surface itself could be moved without restriction. The turnbuckle at the base of the left control column which connects the column to the flaperon control rod had failed during the impact sequence but the rod itself was free to move to the point where it joined the flaperon. The bracket which retains

the right end of the control column torque tube had failed, however, fore and aft movement of the right control column produced the appropriate movement of the elevator. This could not be repeated with the left control column as the box section through which the control column retaining bolt passes had failed at the rear vertical weld and the forward flange. This was removed and taken to the AAIB facility at Farnborough for further examination; it was determined that the failure was a result of the impact. Although the rudder pedals had become separated and distorted the control wires were connected and were free to move the rudder surface.

It was reported that, during taxiing tests, the airspeed indicator had displayed some 'stickiness' at the lower end of the range on deceleration. This instrument was removed and tested by a PFA inspector; no fault was found which would have caused it to read incorrectly in flight.

The right fuel tank still contained a residual amount of commercial four star fuel, the fuel valve was open and there was fuel in the line. The left tank was empty and the fuel valve was selected to off. The engine fuel valve was selected to 'ON'. The battery master switch was 'ON' and the ignition switch was 'OFF' with the key removed; this latter selection had been made by the emergency services.

Of the three propeller blades one was intact and one had broken near the root and the detached part was on the site immediately under the impact point. The third blade had broken about a third of the way along its length and the detached part was reported to have been found some 30 metres from the impact point. The leading edge of all three blades showed little sign of rotational damage. The engine, gearbox and propeller were taken to the AAIB facility at Farnborough for detailed examination.

The aircraft kit had been obtained from the USA in 1990 and the Rotax 582 engine came with a type 'B' gearbox and a 66 inch 10° pitch propeller. In June 1992 the gearbox was exchanged for a type 'C', serial number V4, with the Rotax UK agent. The type 'C' gearbox has a 3:1 reduction ratio compared with a 2.58:1 reduction ratio on the type 'B'. The standard propeller for use with a Rotax 582 engine with a type 'C' gearbox is 68 inch long and requires to be set at a pitch angle of about 16°; the 66 inch propeller could be used but the pitch angle would have to be altered from 10°. The propeller was separated from the gearbox, and was found to be fixed pitch with no provision for ground adjustment. The blades were marked with numbers indicating that the overall diameter was 66 inches and the pitch angle, at the designated radius, was 10°.

Data supplied by the Rotax UK agent indicated that, with the type 'B' gearbox and 10° pitch propeller as initially supplied, the maximum power output was achieved at an engine speed of about 6,500 RPM, the propeller speed being around 2,520 RPM. With the type 'C' gearbox and 10° pitch

propeller as found fitted, the maximum power output would have been about 12.5% less and would have been achieved at about 7,200 RPM at the lower propeller speed of about 2,400 RPM. At the engine speed of 6,800 RPM observed by the pilot, the power output would have been significantly less than that which would have been expected from the original gearbox/propeller combination.

The type 'C' gearbox reduction gear is secured to the propeller shaft with a taper collet retained with a large nut. In the past these collets have slipped preventing the full engine power being delivered to the propeller. To counter this the nut torque requirement had been increased from 190 Newtonmetres (Nm) to 300 Nm. This problem was the subject of Rotax Service Information Leaflet 2 UL 91E, dated February 1991. The Rotax UK agent had no cause to check the torque of the retaining nut as the gearbox had come from the manufacturer and had been produced in November 1991, after the torque setting of the nut had been increased to 300 Nm. The gearbox was dismantled and confirmed to be a 'C' type gearbox. When the taper collet retaining nut was torque checked it was found to be 95-100 Nm. Further dismantling showed evidence of rotation against the taper collet. Trials were conducted on a similar gearbox, at Farnborough in conjunction with the Rotax UK agent; these concluded that both the rotation marks and the loss of torque could have occurred as a result of the propeller contacting the ground in a manner similar to the actual accident impact .