

DHC-1 Chipmunk 22 (Lycoming), G-BCSB

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Aircraft Type and Registration: DHC-1 Chipmunk 22 (Lycoming), G-BCSB

No & Type of Engines: 1 Lycoming O-360-A4A piston engine

Year of Manufacture: 1952

Date & Time (UTC): 4 March 2000 at 1221 hrs

Location: RAF Cosford, Shropshire

Type of Flight: Private

Persons on Board: Crew - 1 - Passengers - None

Injuries: Crew - Fatal - Passengers - N/A

Nature of Damage: Aircraft severely damaged

Commander's Licence: Private Pilot's Licence

Commander's Age: 52 years

Commander's Flying Experience: 583 hours (of which 249 hours were on type)

Last 90 days - 5 hours

Last 28 days - 2 hours

Information Source: AAIB Field Investigation

Background to the flight

The aircraft was carrying out glider aero tows at a gliding club based at Royal Air Force (RAF) Cosford. The club is part of the RAF Gliding and Soaring Association (RAFGSA). Whilst many members of the gliding club were RAF personnel there was also a substantial number of civilian members. The personnel directly involved in this accident were civilians.

At weekends powered light aircraft, engaged in basic flying training, use the single asphalt runway. Glider operations are then confined to a parallel grass runway that is adjacent to the southern edge of this main runway. On such occasions winch launching of the gliders is prohibited and all flights commence with an aero tow.

The accident was the result of the Chipmunk pilot having becoming incapacitated during a take-off run.

History of the flight

At about 0915 hrs on the morning of the accident the Chipmunk pilot completed a daily inspection and pre-flight check of the aircraft. At that time the meteorological conditions were not suitable for gliding, although conditions were forecast to improve. The first aero tow occurred at 1100 hrs when another pilot flew the Chipmunk (G-BCSB). He towed a glider to 5,000 feet and then returned to land. This flight lasted approximately 15 minutes and was uneventful; the aircraft was serviceable, behaved normally and the pilot suffered no ill effects following the flight.

The pilot involved in the accident flew the Chipmunk for the next aero tow which commenced at 1158 hrs. The glider was towed to 5,000 feet before releasing; from the perspective of the glider pilot the aero tow element of this flight was uneventful. The Chipmunk landed and taxied into position to tow a single seat glider. A hand signal was given to the Chipmunk pilot indicating that this glider pilot required a tow to 3,000 feet. This signal was acknowledged in the correct manner. The glider was then attached to the tow rope and the Chipmunk moved forward in order to take up the slack in the rope. Permission was given by ATC for the aircraft to take off. Witnesses noted that the engine noise of the Chipmunk increased and both aircraft began to accelerate at a normal rate along the left side of the grass runway.

The glider pilot and three eye witnesses provided descriptions of the initial element of the take-off run. They all agreed that the glider became airborne slightly before the Chipmunk and settled at a height that was estimated to be between 6 to 10 feet. Two of the witnesses viewed the accident from their squadron accommodation area located on the northern side of the asphalt runway, approximately 500 metres from the accident site. They noted that, after becoming airborne, the glider made brief contact with the ground and bounced back into the air. One of these witnesses believed that this bounce caused the Chipmunk to pitch nose down before adopting a high nose attitude, described as approximately 5 to 10°. The witnesses agreed that by this stage the Chipmunk was airborne, at heights estimated to be between 6 to 20 feet. It then began to turn to the left. The rate of change of bank angle was described by the glider pilot as slow, steady and to a maximum of about 5°. Until the Chipmunk began to deviate to the left it had been accelerating in a straight line and parallel to the edge of the runway. As the Chipmunk deviated to the left the glider pilot decided that something was amiss and so he released his glider from the tow rope, turned to the right to regain the centreline of the grass runway (24L) and landed straight ahead, coming to rest some 625 metres from the starting point. The Chipmunk continued to turn to the left and witnesses describe the nose of the Chipmunk rising to a steep angle before its left wing struck a telegraph pole. The wing then detached and the aircraft rolled, descended and struck the ground in an inverted attitude.

Another witness, who only saw events after the glider had separated from the tow rope, was certain that the Chipmunk was still on the ground whilst it veered to the left. He described the aircraft becoming airborne just prior to the telegraph pole, adopting a high nose attitude and then striking the pole at an estimated height of 25 feet.

The two witnesses who viewed the accident from the northern side of the asphalt runway instructed one of their colleagues to inform ATC of the accident and then drove, with other colleagues, directly to the accident site. One of the two vehicles used was the squadron crash vehicle that was equipped with foam fire extinguishers. When they arrived on site fuel was leaking from the Chipmunk so they sprayed foam over the wreckage in order to inhibit any fire. The airfield fire and rescue services then arrived and assumed control. The resident air ambulance unit arrived on site at 1240 hrs. Although the pilot had received only minor injuries in the impact he was found to be dead, having suffered a heart attack.

Description of the operating area

Runway 24/06 at RAF Cosford, is 1,149 metres in length with an asphalt surface. To the south of this runway is a grass runway designated Runway 24L, which was in use for glider operations (Figure 1). This runway is approximately 1,100 metres in length and essentially level. On the day of the accident the grass was short and the surface was firm and dry. Normal practice was for the gliding club to use the side of the grass runway furthest from the main runway. To the left of Runway 24L there was an area of longer grass and weeds that extended along the first 400 metres of the runway edge and thus restricted the width of the runway to about 50 metres in this area. Further along the runway, beyond this scrub, there was an extensive area of flat grass leading to the airfield boundary.

A windsock was located at the far end of the rough grass, 380 metres from the start of Runway 24L and approximately 30 metres left of the runway's left edge. Near to the windsock was a 30 foot high telegraph pole. In the prevailing wind conditions the bright orange windsock would have been fully deployed to the left as seen by the Chipmunk pilot. The supporting pole for the windsock, painted white, would also have been clearly visible. Further to the left were trees, up to about 30 feet in height, with sparse foliage but surrounded by bushes. Some touring caravans were parked in front of this line of trees. The telegraph pole struck by the aircraft was not easily visible against this background.

Thus from the start of the take-off run the pilot had an area ahead of him and to the right that was clear of any obstructions. Any deviation to the left would take the aircraft into an area containing obvious obstructions which became progressively more significant as the deviation increased.

Take off performance

After the accident tests were conducted by the RAFGSA to accurately measure the take-off distance required by a tug-glider combination similar to the accident pair. Three take offs were made with the surface, ambient conditions and wind broadly similar to those for the accident. A somewhat shorter tow rope was used but this would not have affected the results significantly. The ground run taken by the Chipmunk before becoming airborne averaged 160 metres, with less than a 10 metre variation between the three runs.

Meteorological conditions

The local meteorological conditions had been recorded at hourly intervals from 0850 hrs on the morning of the accident. These records indicate that the surface wind had been from the north west and had gradually increased in speed from 8 kt to 15 kt, the visibility was generally more than 20 kilometres with occasional light snow showers, the cloud was scattered at 2,500 feet and broken at 21,000 feet.

A special meteorological observation was taken at 1238 hrs in order to record the conditions close to the time of the accident. This observation recorded a surface wind of 310°/15 kt and a visibility of 26 kilometres with no weather. There were a few clouds at 2,000 feet and broken clouds at 3,000 feet. The surface temperature was +6°C and the dew point was +2°C.

These conditions were relatively benign for glider towing operations. The only significant element was the crosswind that was calculated to be 14 kt from the right. The published crosswind limit for this aircraft operation was 15 kt.

Pilot experience

The pilot held a valid Private Pilot's Licence that had been issued in 1987. He was also an experienced glider pilot and a qualified gliding instructor. Within the gliding club he was the 'Tug Master' responsible for authorising other pilots to fly the Chipmunk on aero tow operations. He had completed 1,288 aero tows in the Chipmunk and had been a member of this gliding club for 15 years. He was thus both qualified and experienced as an aero tow pilot and was familiar with this aircraft and the local operations.

Pathology report

The pilot had last been seen by his authorised medical examiner on 28 August 1999. No abnormalities were found and there was nothing in his previous medical history that gave rise to concern. In 1995 his blood pressure had been raised but the level was not considered to be significant and no treatment was prescribed. At the time of the accident the pilot was not receiving medical treatment of any sort. On the evening prior to the accident he had been doing some heavy gardening work after which he looked pale and complained of feeling tired. He made no complaints of illness whilst at the gliding club on the morning of the accident.

The post mortem examination revealed evidence of a myocardial infarction (heart attack). The pathological evidence suggests that the sequence of events was initiated by this myocardial infarction which probably occurred in the early morning of the day of the accident. Although this was not fatal at the time it is believed that the infarction extended while the pilot was initiating his second take off and that he became incapacitated. This led to the aircraft deviating to the left of the runway and subsequently crashing. The pilot had utilised the full shoulder harness fitted to the aircraft and suffered only minor injuries as a result of the impact.

There was no evidence of any alcohol or drugs which may have caused or contributed to the cause of the accident. The carbon monoxide saturation was 1%, which is entirely within the normal range.

Aircraft handling characteristics

This Chipmunk, in common with others that are used for aero towing, had been fitted with a Lycoming engine. With this installation the propeller rotates clockwise (as viewed from the cockpit) and consequently the aircraft has a tendency to yaw to the left during the take-off run until the wings take the weight off the main wheels. At the time of this accident this yawing tendency would have been reduced slightly since the aircraft would naturally turn into the prevailing wind, ie to the right. However, as soon as full engine power had been applied the slipstream effect from the propeller over the rudder surface would have provided the pilot with adequate control authority to maintain aircraft direction.

Ground marks

Two parallel tyre tracks were found in the area of scrub on the left side of Runway 24L (Figure 1). The spacing between the tracks equalled that between the main landing gear tyres of a Chipmunk and portions of each track bore a tread imprint that matched the individual tread pattern of G-BCSB's respective main gear tyres. The characteristics of the tracks indicated normal wheel rotation. They started at the left edge of the grass runway approximately 240 metres from the start of the runway. Based on witness evidence of the point at which the tow commenced, G-BCSB would have travelled 156 metres from its starting position at this point. At their start the tracks were angled 14° left of the runway heading of 244°M. After curving to the left initially, they became straight and headed directly towards the area near the airfield perimeter road occupied by the

windsock pole and the telegraph pole. The tracks continued through the scrub for a total distance of 87 metres before ceasing 52 metres before the telegraph pole. The evidence therefore left no doubt that the marks had been made by G-BCSB and the orientation of the tracks strongly suggested that they had been made during the accident take off.

It was not possible to identify positively G-BCSB's wheel tracks on the grass runway. By projecting the initial curved tracks in the scrub back along the ground run reported by witnesses, it was estimated that G-BCSB began to diverge to the left of the runway heading some 90 metres after the start of its take-off run (Figure 2).

Impact parameters

The outer portion of G-BCSB's left wing was found at the base of the telegraph pole. Markings on the wing and the pole showed that the wing had struck the pole with its leading edge 6 feet from the wingtip at a point on the pole 24 feet above ground. The collision caused the outer wing to detach, severed the telephone line and displaced the pole slightly in the ground.

Ground impact marks were found starting 98 metres after the collision with the telegraph pole. An initial scrape made by the tip of the left wing stub was shortly followed by marks from the propeller, engine and cockpit windscreen, all with the aircraft inverted. The propeller and the windscreen detached shortly after initial ground contact and the aircraft came to rest inverted on a heading of 173°M, after a 23 metre long ground slide.

Markings on the left wing and the telegraph pole showed that the aircraft had been heading 225°M at the time of the collision with the pole, with a nose-up pitch attitude of approximately 30° and a right bank of approximately 25°. No evidence was available to indicate clearly the speed at the point of collision; the subsequent travel of the aircraft suggested a groundspeed in the order of 50 to 70 kt. The evidence indicated that the aircraft had left the ground 52 metres before the telegraph pole and climbed approximately 20 feet before the collision.

The ground impact occurred in a shallow descent with the aircraft inverted, banked approximately 160° left and pitched nose down approximately 20°, relative to the ground. The aircraft was tracking 205°M at the time.

Wreckage examination

The aircraft came to rest generally intact, with the exception of the outer part of the left wing, the propeller and the windscreen. The canopy was found near the aircraft; it may have been displaced somewhat during rescue efforts. The fuselage sustained heavy structural damage in the areas of the engine firewall and just behind the rear cockpit, but it was not severely deformed. There was little damage to the remainder of the aircraft. The fuel system was not breached, but fuel tank contents had leaked from the tank vents. The tow rope remained attached to G-BCSB's tow hook, streamed back towards the telegraph pole collision point. The rope was 63 metres long.

Inspection of the flight control systems revealed no evidence of pre-impact problems. Flap position at the time of the collision could not be positively established. The brake lever was found off and there were no signs that the wheel brakes had been dragging. The engine control levers were found in the normal position for full power.

The engine suffered localised damage but remained generally intact. Markings on the propeller blades and forward bending of the tip portion of both blades indicated that the engine was rotating at significant speed at the point of ground impact. A circumferential crack was found in the No 4 exhaust pipe close to the integral welded flange bolted to the cylinder head and distortion of the flange was evident. Specialist metallurgical examination concluded that the pipe had suffered a small fatigue crack prior to the accident; the crack had been extended by overload stresses, consistent with the effects of accident forces. It was assessed that the rate of exhaust gas leakage through the pre-accident crack would have been relatively small. Localised overtemperature damage to engine components indicated that the flange distortion had allowed a more substantial pre-accident exhaust gas leak into the engine bay. The damage was minor and unlikely to have had a significant effect on the functioning of the engine. The likely pressure differential between the engine bay and the cockpits was unknown and the pre-accident sealing standard of the firewall could not be established.

Summary

The Chipmunk pilot was a qualified and experienced aero tow pilot who was familiar with this aircraft and the local operations. The weather conditions were good and the prevailing surface wind would have assisted the pilot in controlling the inherent tendency of the aircraft to turn to the left during the take-off run.

The physical evidence of the wheel tracks in the scrub to the left of Runway 24L showed that G-BCSB's main wheels had been on the ground in this area. The distance that the Chipmunk had travelled to the point where the wheel tracks first became evident at the left edge of the grass runway was close to the measured take-off ground run for such a tug/glider combination in similar conditions. This indicated that the tracks were a continuation of the ground run and that the aircraft had probably not been airborne before this point. The divergence to the left of the runway heading had started approximately 90 metres after the start of the take-off run. The aircraft finally left the ground approximately 52 metres before the telegraph pole and climbed relatively steeply.

During the take off the pilot should have been able to see clearly that the area ahead of him and to the right was clear of any obstructions. Any deviation to the left would take the aircraft into an area containing obvious obstructions which became progressively more significant as the deviation increased. It is considered to be improbable that the pilot would have allowed any such deviation to the left if he had full control over the aircraft at the time. Furthermore, there were no indications of problems with the rudder, landing gear or wheel brakes. If the pilot had been unable to control the direction of the aircraft, for any reason, the safest option would then have been to close the throttle and stop the aircraft on the ground, but this did not occur.

Cracking and distortion of an engine exhaust pipe flange had allowed exhaust gas to leak into the engine bay for some time before the accident and, from the examination of the aircraft, the possibility that exhaust gas could have leaked into the cockpit could not be dismissed. However, the pathological evidence showed no unusual indications of carbon monoxide and the pilot who had flown the aircraft earlier that day had suffered no ill effects. The evidence therefore strongly

suggests that the pilot's cardiac condition incapacitated him early in the take-off run such that he was unable to control the aircraft and prevent it from striking the obstacles.