ACCIDENT

Aircraft Type and Registration:	Ikarus C42 FB80, G-CEDR	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2006 (Serial no: 0606-6833)	
Date & Time (UTC):	7 April 2015 at 1020 hrs	
Location:	Newtownards Airport, Northern Ireland	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	55 years	
Commander's Flying Experience:	89 hours (of which 23 were on type) Last 90 days - 4 hours Last 28 days - 1 hour	
Information Source:	AAIB Field Investigation	

Synopsis

The pilot was practising circuits. About fifty minutes into the flight, just after an increase in power during a touch-and-go landing, the aircraft was seen to enter a climbing left turn at low height. As it continued to climb, the angle of bank was observed to increase steadily until the nose dropped and the aircraft descended, striking the grass surface to the left of the runway in a steep nose-down attitude. The pilot was fatally injured. There was evidence to indicate that the accident could have been due to incapacitation.

History of the flight

It was understood that the pilot's intention was to practise visual circuits. As he prepared the aircraft for flight in the hangar, he spoke to another pilot who later described him as being in a "good, cheerful mood and appearing to be in good health". The latter pilot then watched as the aircraft taxied out and took off from Runway 22, at about 0930 hrs. The aircraft remained in the circuit and, sometime later, the runway in use was changed to Runway 04 due to a change in the wind direction. All visual circuits at Newtownards are flown to the east, ie to the right, when using Runway 04.

About fifty minutes into the flight, having just touched down on a touch-and-go, witnesses heard the aircraft's engine increase to what sounded like full power. The aircraft was then seen to roll left, at low height, soon after becoming airborne. As it continued to climb, the angle of bank was observed to increase steadily until, at a height of 80 to 100 ft, the nose

dropped and the aircraft descended, striking the grass surface to the left of the runway in a steep nose-down attitude.

Numerous people ran or drove to the aircraft and a local ambulance arrived on the scene shortly afterwards. The pilot was given first aid before being transported to the local hospital but did not survive his injuries.

At the time of the accident, the weather was CAVOK, the temperature was 13°C and the wind was from 040° at less than 5 kt.

Pilot's experience

The pilot began learning to fly microlights in 2008 and passed his General Skills Test (GST) in May 2009.

After passing his GST, he underwent conversion training on the CT2K and C42 microlights with the same instructor, although there is no regulatory requirement to do so. The instructor also completed the pilot's subsequent biennial instructor flights. He described the pilot as "a good, safe and meticulous pilot who took flying seriously". He added that the pilot had requested conversion training on the microlights, to improve his competency before flying them solo. The instructor had demonstrated flapless circuits and was content for the pilot to practise them.

Flight trial

A flight trial was carried out in a similarly powered Ikarus C42 by a test pilot, and was observed by the AAIB. Its purpose was to assess the aircraft's handling qualities, particularly with respect to touch-and-go landings, with and without flap. The V_{APP} for these is 55 kt and 65 kt, respectively, with the aircraft touching down about 5 kt slower.

The stall characteristics were also assessed. There was subtle pre-stall buffet and, at the stall, the aircraft was controllable in roll with the control column, and there was no tendency to drop either wing. The stall speeds were:

Configuration	Power	V_s KIAS	Stall warning
Clean	Idle	38	44
One Flap	Idle	36	40
Full Flap	Idle	32	36

The C42 was assessed as possessing strong lateral stability. This meant that the aircraft had a marked tendency to roll away from any sideslip. Applying left rudder generated sideslip to the right resulted in the right wing generating extra lift and the aircraft rolling to the left. Small amounts of sideslip were able to generate a noticeable rolling moment. This could overpower a rolling moment generated by a small amount of aileron. The test pilot commented that it would be possible to have a situation where a small amount of applied rudder could overpower the effectiveness of a small amount of aileron.

The test pilot concluded that the 80 hp C42 aircraft was a "very benign" aircraft with "good" handling qualities and stall characteristics. Takeoffs and landings were easy to perform and flapless landings were no more difficult to fly than full flap landings. Applying full power after a flapless touch-and-go landing required minimal pilot control input to stabilise the aircraft in a 60 KIAS climb. Open loop[1], a mild neutral phugoid[2] developed but this could easily be damped. Overall, it was not possible to replicate a combination of power and control inputs likely to cause the aircraft to behave as witnessed in the accident.

Medical and pathological information

The pilot held a CAA Medical Declaration[3], with no 'special limitations', countersigned by his General Practitioner (GP) on 22 October 2013. It was valid for five years, until 22 October 2018. The GP did not know of any condition, prior to the accident, which would have given him cause to suspend the pilot's medical declaration.

A post-mortem examination of the pilot was carried out by a State pathologist for Northern Ireland. He stated that the pilot died as a result of chest injuries. The findings were reviewed by a Royal Air Force (RAF) consultant aviation pathologist. The RAF pathologist commented that the pilot had a considerably enlarged heart for an adult male of the pilot's height and weight. He added that:

> *'…*[symptoms related to the heart] *could potentially have produced a degree of distraction or incapacitation which could have led to the final fatal manoeuvre; there is no definite pathological evidence to indicate that they had done so, but equally lack of such evidence does not preclude the possibility.…if a medical event has occurred it is likely it would have been sudden rather than insidious in its onset.'*

Toxicology tests showed no evidence of alcohol or drugs.

Engineering

Aircraft description

The Ikarus C42 is a two-seat, high-wing microlight aircraft. The fuselage consists of a tubular structure covered by non-load bearing composite fairings and panels. The wings are constructed of two tubular spars which support the wing ribs. The wings and flying control surfaces are covered in a Kevlar/Mylar material. The aircraft is equipped with a single control column, mounted between the two seats. Both occupants are restrained by a four-point harness which is designed to withstand a 9g forward deceleration[4]. Engine power is controlled by folding throttle levers mounted between the legs of the occupants. The flaps

Footnote

[1] Open loop means not interfering in the feedback process from the flying controls. This was achieved by relaxing the touch on the control column so as not to restrict its movement following the touch-and-go.

[2] A phugoid is a long-period oscillation of the pitch axis, where the aircraft perpetually hunts about an attitude and trimmed speed.

[3] CAA Form SRG (Safety Regulation Group) 1204.

[4] EASA Certification Specifications for Very Light Aircraft Amendment 1, 5 March 2009, CS-VLA 23 & CS-VLA 561.

are operated by the use of a centrally mounted, overhead lever. G-CEDR was fitted with an 80 hp Rotax 912 engine, driving a three-bladed propeller. The engines carburettors had been fitted with engine coolant carburettor heaters to minimise the possibility of carburettor icing.

Initial examination

The aircraft came to rest approximately 100 m from the left edge of Runway 04. The limited ground markings indicated that the aircraft had been on a heading of approximately 360°M and had struck the ground in a steep nose-down attitude before falling backwards, coming to rest upright.

The impact had caused significant damage to the forward fuselage. The engine mounts had failed and the engine had been pushed rearwards and upwards, disrupting the forward section of the cockpit. Examination of the pilot's seat harness confirmed that remains of both lap straps were secured to their mounting points, the straps having been cut by the airfield fire service after the accident. The pilot's shoulder harness was not attached to the aircraft. The fitting which secured it to the aircraft had failed at the point where it attached to the aircraft structure, releasing the harness. The flap handle was in the UP position and the fuel selector was ON. It was not possible to determine the pre-impact position of the throttle or carburettor heat control.

Both wing leading edges exhibited impact damage. The left wing leading spar had failed approximately one metre from the wing root and the left wing had been pushed rearwards during the impact. This had resulted in the failure of the wing mounting structure and the right wing rotating forward.

Two of the propeller blades had dug into the ground during the impact sequence and failed close to the propeller hub (see Figure 1). The third blade remained attached to the hub but had split along the leading edge. The forward face of this blade had broken into two sections and had separated from the rest of the blade. These sections were located approximately 10 m to the right of the wreckage.

An inspection of the runway surface showed no evidence of recent propeller strike marks. Prior to removal of the aircraft, the continuity of all the flying control circuits was confirmed and approximately 45 litres of fuel was recovered from the fuel tank.

Aircraft maintenance

Examination of the aircraft's maintenance records confirmed that it had been maintained in accordance with regulatory requirements and that there had been no reported issues regarding the performance of the aircraft prior to the accident. The records showed that 12 days prior to the accident the propeller blades had been replaced with new units, supplied by the propeller manufacturer.

Figure 1
Propeller blades embedded in the ground

Detailed examination

Inspection did not identify any evidence of a pre-existing defect or restriction in the aircraft flying control circuits.

Damage to the engine and carburettors prevented any operational testing of these units being carried out. The carburettors were stripped and no evidence of any pre-accident defects was found within either unit. Quantities of fuel were recovered from both carburettor bowls, and the engine fuel filter was free from contamination and restriction and contained fuel. Disassembly of the engine showed no evidence of a pre-existing defect which would have prevented normal operation. Damage was observed on the inner face of the reduction gearbox rear case, which had been caused by the propeller drive gear being pushed against the casing, while rotating.

Tests carried out on the fuel recovered from the aircraft confirmed that it was free from contamination and met the required specification for MOGAS.

Detailed examination of the remains of the propeller confirmed that the two propeller blades which had broken close to the propeller hub had been the first two blades to strike the ground during the impact sequence and had failed in overload. The forward face of the third blade, which had split along its leading edge during the impact, had failed due to bending and torsional overload. No pre-existing structural abnormalities were found within the blades and no evidence was found that the blades had struck the runway surface prior to the accident.

Optical examination of the shoulder harness attachment fitting confirmed that it had failed in tensile overload. No evidence of fatigue or a metallurgical defect was found in the fitting.

The shoulder harness fitting from the aircraft's other seat was removed and its load carrying capability was tested. The tests confirmed that the shoulder harness fitting was capable of carrying loads in excess of its design requirements.

Recorded data

Radar

Radar recordings from the surveillance and en route radar heads at Belfast International Airport were made available to the investigation.

Only the en route radar was able to observe radar returns in the vicinity of Newtownards at the time G-CEDR was airborne. However, these radar returns were intermittent and G-CEDR could not be positively identified.

Photographic evidence

A member of the public, walking along a path on the eastern edge of the airfield, had taken photographs of G-CEDR during the accident flight. Three of these were of particular interest. The first showed the aircraft proceeding along the runway after its last landing. The second showed the aircraft airborne and in a climbing turn to the left. The final photograph showed that the aircraft had turned through approximately 180° and had rolled between 70° and 90° to the left. Examination of the second and third photographs confirmed that the flaps were in the UP position and that the rudder remained central. The second photograph showed that the ailerons were deflected to correct the left roll.

CCTV

During the investigation, a CCTV camera, with its field of view covering part of the runaway, was downloaded. The downloaded footage showed G-CEDR taxiing prior to the accident flight and on two other occasions when the aircraft was flying. The first of these was for a period of four seconds, which showed the aircraft airborne in a shallow climb. The second occasion, recorded nine minutes and four seconds later, showed the aircraft in view for five seconds. In this recording, the aircraft initially appeared close to or on the runway surface and it was then seen to pitch nose-up and start to climb. The aircraft began to roll to the left immediately after it pitched up, and continued to climb, roll and turn to the left until it passed out of the camera's field of view.

Detailed examination of the recordings, taking into account the camera's position and field of view, allowed an estimation of the aircraft's speed and height to be calculated. On the first occasion, the aircraft had a groundspeed of approximately 61 kt and climbed from approximately 20 ft agl to approximately 40 ft agl. During the second recording, the initial ground speed of the aircraft was calculated as 61 kt, which decreased to approximately 54 kt prior to the aircraft leaving the camera's field of view. The initial nose-up pitch attitude of the aircraft was calculated as 7.5°. This appeared to be maintained throughout the recording, during which the aircraft reached a height of approximately 40 ft.

Analysis

Conduct of the flight

When the pilot arrived at the airfield he appeared to be in good health and to carry out the normal pre-flight preparations and checks. His takeoff and subsequent circuits also appeared to be normal, until the last touch-and-go landing.

In the second CCTV recording, the aircraft had a groundspeed of approximately 61 kt and climbed from approximately 20 ft agl to approximately 40 ft agl. During the third CCTV recording, just prior to the accident, the initial groundspeed of the aircraft was calculated as 61 kt, which decreased to approximately 54 kt prior to the aircraft leaving the camera's field of view. The nose-up pitch of the aircraft, calculated to be 7.5°, appeared to be maintained throughout the recording. Given that the wind was from 040° at less than 5 kt, the IAS would have been up to 5 kt greater than the calculated groundspeeds. Therefore, with the aircraft's clean stall speed being about 38 KIAS, its minimum speed would have been approximately 20 kt above the stall speed when last recorded by the CCTV.

The third CCTV recording also showed the aircraft beginning to roll to the left immediately after the initial pitch-up. Given that there was no evidence of a pre-existing defect or restriction in the aircraft's flying control circuits, it is likely that this roll was a result of an input on the flying controls. Had the pilot been applying some pressure to the left rudder pedal, this would have generated sideslip to the right, the secondary effect of which would have been a rolling moment to the left. However, it could not be determined if this roll to the left was the result of an intentional input by the pilot or not. Since the circuit direction on Runway 04 was to the right and there was no evidence that he had not followed the expected flightpath on previous circuits, is was considered more likely that it was unintentional.

One of the subsequent still photographs showed the aircraft's ailerons deflected to induce a roll to the right. This would have opposed the roll to the left. However, as the left roll continued, the amount or extent of this control input was not enough to curtail the manoeuvre. While it is likely that the control inputs required to make the aircraft climb and induce a correcting roll to the right were made by the pilot intentionally, how much control he exerted could not be determined.

As the aircraft continued to climb and roll, its speed would have decreased. The evidence indicated that the aircraft subsequently developed a steep nose-down attitude, before striking the ground.

Engineering

The damage to the airframe, together with the ground marks at the accident site, were consistent with the aircraft striking the ground in a steep nose-down attitude, with the aircraft rotating to the left.

No evidence was found of a pre-impact restriction or defect within the aircraft's flying control circuits. Nor was there evidence of any defect which would have prevented the engine from operating normally. Fuel, which met the required specification, was present, in quantity,

throughout the aircraft's fuel system. Although an estimation of the engine's power at impact could not be made, the damage to the propeller and the ground marks it produced were consistent with the engine operating at relatively high power as it struck the ground.

Testing of the unoccupied seat shoulder harness attachment fitting demonstrated that it exceeded the certification requirements. Given that the pilot's shoulder harness fitting failed in tensile overload, and that no abnormalities were identified during its examination, it is reasonable to conclude that the fitting failed after being subjected to loads which exceeded its design criteria.

The pilot

The consultant aviation pathologist commented that:

> *'…*[symptoms related to the heart] *could potentially have produced a degree of distraction or incapacitation which could have led to the final fatal manoeuvre; there is no definite pathological evidence to indicate that they had done so, but equally lack of such evidence does not preclude the possibility.'*

Conclusion

In the absence of any conclusive evidence, the investigation considered that the accident occurred due to the pilot not intervening sufficiently to correct the increasing roll to the left after the last touch-and-go landing. There was evidence to indicate that this could have been due to incapacitation.