AAIB
Air Accidents Investigation Branch

AAIB Bulletin 5/2017

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Published 11 May 2017

Cover picture courtesy of Stephen R Lynn
(www.srlynnphotography.co.uk)

ISSN 0309-4278

Published by the Air Accidents Investigation Branch, Department for Transport
Printed in the UK on paper containing at least 75% recycled fibre

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AAIB Field Investigation Reports

A Field Investigation is an independent investigation in which AAIB investigators collect, record and analyse evidence.

The process may include, attending the scene of the accident or serious incident; interviewing witnesses; reviewing documents, procedures and practices; examining aircraft wreckage or components; and analysing recorded data.

The investigation, which can take a number of months to complete, will conclude with a published report.

ACCIDENT

Aircraft Type and Registration:	Slingsby T67M MKII Firefly, G-BNSO
No & Type of Engines:	1 Lycoming AEIO-320-D1B piston engine
Year of Manufacture:	1987 (Serial no: 2021)
Date & Time (UTC):	30 April 2016 at 0938 hrs
Location:	Whitwell-on-the-Hill, North Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Fatal) Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	25 years
Commander's Flying Experience:	215 hours (of which 3 were on type) Last 90 days - 34 hours Last 28 days - 14 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft, operating in the vicinity of Castle Howard, North Yorkshire, was engaged in a general handling flight which included aerobatics. It was seen by witnesses in the area and recorded on radar. One witness saw the aircraft carry out a loop and, having passed the apex of the manoeuvre, enter what appeared to be a spin. The aircraft did not recover from the spin and struck the surface of a ploughed field, fatally injuring both persons on board.

History of the flight

The pilot and a friend arrived at Full Sutton airfield at about 0830 hrs. The pilot had booked G-BNSO for two flights that day; the first was for general handling and aerobatics and the second, later, was to take family members flying. The weather was good with a light westerly wind, good visibility in excess of 10 km and broken cloud at about 3,000 ft.

Both the pilot and his passenger were students on the Tucano phase of their RAF flying training and had flown the Grob Tutor, a light piston-engine aircraft, during their initial flying training.

With the assistance of other club members, they pulled the aircraft out of the hangar and then went into the club house and completed the booking-out form. The Chief Flying Instructor (CFI) joined them at the aircraft and checked the fuel and oil levels whilst the pilot carried out the pre-flight inspection, watched by his passenger. Whilst he did not look at the fuel gauges, the CFI estimated that there was 1.5 hours fuel in the left wing tank and 1.0 hours fuel in the right wing tank, based on the engine consuming 45 litres of fuel per hour whilst performing aerobatics.

Another pilot, who had met the G-BNSO pilot and passenger when they had first arrived at the club, was taxiing back to the parking area having flown two circuits when he heard them call for a radio check and airfield information. There was no reply, so he passed them the information he had received earlier. That pilot switched off his engine at 0915 hrs and by that time G-BNSO was at the holding point carrying out the power checks. Shortly after this, the aircraft was seen to backtrack Runway 22 and depart.

A full radar track and Mode C heights of the aircraft were recorded as it climbed through 200 ft after takeoff and, following a right turn, tracked towards Castle Howard. Witnesses in the vicinity of the southern part of Castle Howard estate heard or saw the aircraft. A couple, who were close to the scene in their garden, saw the aircraft perform a loop. On the downward half of the manoeuvre the aircraft appeared to enter a spin, during which the engine was initially heard to "cut out" but then it appeared to restart, before cutting out again. The witnesses lost sight of the aircraft as it descended behind the roof of an outbuilding but they then heard the sound of an impact. Other witnesses reported a similar "corkscrewing" motion before the aircraft struck the surface of a ploughed field, initially with the nose and right wing, in a steep nose-down attitude. The pilot and passenger, who were fatally injured were each found to be holding the top part of their respective control sticks, which had broken off in their hands. The pilot was holding the left stick with both hands and the passenger the right stick with just his right hand.

Previous flight

On 16 January 2016, the accident pilot and another colleague, also a student pilot, had flown together and recorded their manoeuvres and their return flight to the airfield on an action camera. It showed them sharing the flying and performing aerobatics. The colleague recalled that, following a reverse stall turn that was obviously not going to be completed, the accident pilot took the recovery action of 'throttle to idle and control column centralised'. He then put the throttle to full power and the engine returned to full power quickly, but not smoothly. After the flight, the pilot remarked that the reason he used full throttle was that he realised that for an incipient [spin] recovery he should have left the throttle at full power. Closing the throttle is part of the incipient spin recovery action for the Tucano.

Survivability - parachutes

The Civil Aviation Authority (CAA) Safety Sense Leaflet Number 19, '*Aerobatics*' contains valuable information on carrying out this activity. In Section 4, 'Personal Equipment and Clothing', it addresses the wearing of parachutes and contains the following guidance:

> *'In some aircraft for physical or weight and balance reasons it may not be possible or practicable to wear a parachute. However, in the event of the failure to recover from a manoeuvre a parachute may be the only alternative*

to a fatal accident, although the time and height lost while exiting the aircraft (and while the canopy opens) must be considered. A static line deployment system might save vital seconds. A parachute should be comfortable and well-fitting with surplus webbing tucked away before flight, and maintained in accordance with manufacturer's recommendations. Know and regularly rehearse how to get out of the aircraft and use it, and remember the height required to abandon your aircraft when deciding the minimum recovery height for your manoeuvres.'

In this instance, neither pilot was wearing a parachute and the impact with the ground was not survivable. A representative of the flying club stated that parachutes were in general available at the club but there was no club requirement for them to be worn and they were not normally worn in the Slingsby Firefly at the club.

Weight and balance

A post-accident weight and balance calculation was carried out. The exact fuel in the aircraft tanks is not known but, based on an estimate of 40 kg, the calculation gave a total mass at impact of 939 kg and a centre of gravity (CG) of 905 mm aft of the CG datum (the forward face of the engine compartment firewall). The CG limits were 860 to 917 mm aft of the CG datum and the maximum permitted operating weight was 975 kg. The aircraft was therefore being operated within the permitted weight and CG envelope.

Aircraft performance

The Flight Manual for the Slingsby T67 aircraft covers spin recovery actions:

'<u>7.2.10 Erect Spin Characteristics</u>

At entry, the aircraft pitches nose up slightly whilst rolling rapidly in the direction of applied rudder. The aircraft rolls almost to the inverted during the first half turn of the spin and then the spin progressively stabilizes over about 3 turns, ending up with about 50° of bank and the nose about 40° below the horizon. The rate of rotation is about 150° per second or 2.5 seconds per turn. The average load factor throughout is 1.2 G. The IAS stabilizes at about 75 kts to the right and 80 kts to the left. If full pro-spin control is not maintained throughout the spin, the aircraft may enter either a spiral dive or a high rotational spin. A spiral dive is recognized by a rapid increase in airspeed with the rate of rotation probably slowing down as the spin changes to a spiral dive. The wings can be levelled by using aileron with rudders central and the dive then recovered using elevator and the dive then recovered using elevator (whilst observing the 'g' limits). A high rotational spin is recognizable by a steeper nose down attitude and a higher rate of rotation than in a normal spin; airspeed will be higher than a normal spin but will not increase rapidly; recovery is as given in Section 3, Para. 3.7.2 Incorrect Recovery.'

The standard erect spin recovery technique is described:

> *'3.7 ERECT SPIN RECOVERY*
>
> *3.7.1 Standard Recovery Technique*
>
> *a) Close the throttle.*
> *b) Raise the flaps.*
> *c) Check direction of spin on the turn co-ordinator.*
> *d) Apply full rudder to oppose the indicated direction of turn.*
> *e) Hold ailerons firmly neutral.*
> *f) Move control column progressively forward until spin stops.*
> *g) Centralise rudder.*
> *h) Level the wings with aileron.*
> *i) Recover from the dive.*
>
> *WARNING*
>
> *WITH C of G AT REARWARD LIMIT THE PILOT MUST BE PREPARED TO MOVE CONTROL COLUMN FULLY FORWARD TO RECOVER FROM SPIN.'*

The incorrect recovery action is described:

> *'3.7.2 Incorrect Recovery*
>
> *A high rotation rate spin may occur if the correct recovery procedure is not followed, particularly if the control column is moved forward, partially or fully, BEFORE the application of full anti-spin rudder. Such out-of-sequence control actions will delay recovery, and increase the height loss. If the aircraft has not recovered within 2 complete rotations after application of full anti-spin rudder and fully forward control column, the following procedure may be used to expedite recovery.*
>
> *a. Check that FULL anti spin rudder is applied.*
> *b. Move the control column FULLY AFT – then SLOWLY FORWARD until the spin stops.*
> *c. Centralise the controls and recover to level flight, (observing the "g" limitations).'*

When compared with the Spin Recovery action for the Grob Tutor and Tucano aircraft, the Slingsby T67 differs in that the control column must be moved progressively forward to effect spin recovery. Initially on moving the stick forward, the rate of spin rotation will increase before coming out of the spin. Application of the Tutor or Tucano spin recovery technique of placing the stick in a central position is not the correct recovery action for the Firefly. An instructor who has regularly carried out spin recovery training in the Slingsby T67 stated that providing the correct recovery action was taken, the aircraft recovers from the spin.

Pilot and passenger experience

The pilot commenced flying in November 2009, and flew the piston-engine Grob Tutor until November 2012. During this time he won an aerobatic trophy. He recommenced flying in July 2014 as a student pilot in the RAF, completing his basic course on the Grob Tutor in February 2015 and accumulating a total of 152 hours. During that time, specific flights, which involved spinning training, were carried out, the most recent of which were two sorties in September 2014. In November 2015, he commenced intermediate flying training on the Tucano aircraft and had completed 63 hours in the aircraft and an additional 21 hours in the flight simulator. He had carried out spinning training in the Tucano aircraft in the early stages of his course.

He held a civilian Private Pilot's Licence with aerobatic endorsement and a current civilian aircrew medical. The pilot had recorded four flights in the Slingsby T67; two were dual check flights and two were flights where he had been the Pilot in Command (PIC). The instructors who flew with him to clear him to fly the club Slingsby T67 had not carried out spin recovery training and so the pilot had not been taught type-specific spin recovery training in this aircraft type.

The passenger commenced flying training in August 2015 as a student pilot in the RAF, accumulating 59 hours during basic training on the Grob Tutor during which he would have carried out spinning and spin recovery training. He started his Tucano training on 4 April 2016, had accumulated 5.7 hours on type but had not yet carried out spinning training. He did not hold a civilian Private Pilot's Licence.

Engineering - aircraft description

The Slingsby T67M MkII is two-seat, dual-control fully aerobatic monoplane aircraft of fibreglass construction. It is fitted with a tricycle fixed landing gear and is powered by a Lycoming AEIO-320-D1B four-cylinder fuel-injected piston engine fitted with a Hoffman HO-V72L two-blade variable-pitch propeller.

Fuel is held in left and right fuel tanks within the inboard leading edge sections of the wing and within each tank there is a separate chamber fitted with flapper valves to maintain a positive supply of fuel for aerobatic or inverted flight. Fuel is picked up within these chambers by a weighted filter attached to a flexible tube, designed to stay immersed as the fuel moves around during flying manoeuvres. There is a valve in the cockpit to enable the pilot to select the left or right tank and fuel is drawn from the tanks by an electric pump, which provides a pressure supply to the engine-driven injection pump. The engine pump suction is sufficient to draw fuel throughout the flight envelope so it is not necessary to run the electric pump constantly.

The flying controls are conventional, consisting of ailerons, elevator and rudder operated via pushrods and cables. The elevator trim wheel is fitted in the centre panel between the seats, directly behind the flap lever and the trim wheel is connected to an elevator trim tab fitted to the right elevator.

The wing inboard trailing edges are fitted with twin-section flaps operated by a three-position lever in the cockpit. The lever locks into these positions as required and is released by a push button on the end of the lever.

The aircraft is fitted with mechanical, electro-mechanical and pneumatic analogue instruments. It has a conventional electrical system consisting of a battery and alternator, with the various system circuits protected by resettable breakers mounted on the instrument panel.

Maintenance and airworthiness

The aircraft was serial number 2021, built in 1987, with a valid Airworthiness Review Certificate and an EASA Part M Release to Service issued on 11 April 2016. The aircraft had been maintained in accordance with the manufacturer's recommendations and had a continuous and comprehensive set of maintenance records.

Accident site

The aircraft crashed into a ploughed field and came to rest upright, pointing north. The engine cowl had detached and the engine was partially buried, at an angle approximately 50º to the horizontal. Marks had been left in the ground by the wing leading edges and there was severe disruption to the aircraft structure. Both propeller blades had detached and were fractured at their roots. The blade surfaces and edges were lightly scuffed and dented. Both wings had sustained severe leading edge damage and the left and right integral fuel tanks had split open, with no fuel in either tank. The emergency services had noted a very strong smell of fuel around the aircraft and observed fuel seeping away into the ground.

The rear section of the fuselage had fractured midway between the trailing edge of the wing and the tailplane and was bent around to the right side of the aircraft. The tailplane, elevators and rudder were still attached and had sustained minor damage. There were large indentations on the fin leading edge. The flaps had been in the retracted position; the left flaps were in place and the right flaps had detached, with the inner flap section beneath the aircraft and the outer section approximately 12 metres behind the aircraft. The left and right ailerons had broken free from their pivots but were still attached to their control rods and were lying on the ground beneath the aircraft. The plastic windscreen and canopy had disintegrated and the fragments were scattered around the crash site. The canopy handle was in the closed position and the latches, although separated from the windscreen frame receptacle, were also in the shut position, consistent with the closed handle. The pilot and passenger were wearing the five-point safety straps, which were still fastened and attached to the integral airframe seat structure. The pilot and passenger were not wearing parachutes.

Within the cockpit all of the instruments, switches and controls had been severely damaged or displaced and the left and right control column hand grips, as described earlier, had detached. The flap lever was set in the fully retracted position and the trim wheel was undamaged.

Engineering examination

The aircraft wreckage was recovered to the AAIB at Farnborough for closer examination.

Aircraft structure

The aircraft was severely damaged in the impact, with the wings losing their structural integrity, split open along the leading edges. The upper and lower skin outboard sections of both wings had separated from the ribs and were severely distorted, with some ribs displaced by the wing distortion. The cockpit and seat area above the wing box was largely intact but the forward area of the cockpit and instrument panel was badly crushed.

Fuel system

The fuel system components had been severely disrupted in the accident and there was no fuel in the system. Both fuel caps were in place and the leading edge damage had exposed the fuel tank internal components. The tank chambers had been damaged but the flapper valves were clear of debris and free to move. The weighted filters and flexible pipes were correctly connected, free to move and clear of debris. There was no evidence of pre-accident leakage around the tank structures and there were no foreign objects or debris in either tank. The supply pipes leading to the tank selector valve had broken away from their tank outlet unions and the linkage from the fuel selector valve operating handle had sheared; examination of the valve showed that it was fully selected to the left tank, allowing an unrestricted fuel flow. A sample of fuel was taken from the airfield where the aircraft was last refuelled and analysis showed the fuel, AVGAS 100LL, to be uncontaminated and normal. The fuel pumps were only slightly damaged and testing showed that they were capable of fuel delivery.

Flying controls

The flying control surfaces had sustained varying degrees of damage in the accident. Both ailerons had detached from the wings at their pivot points but were still attached to their control input rods. Despite this, the aileron control rod and bellcranks were intact, had continuity and operated in the correct sense. The rudder was correctly attached, had sustained only minor damage and was free to move through its full range. The rudder control cables had dislocated from their fuselage support pulleys but were continuous and correctly attached to the damaged rudder pedal mechanisms. However, the left and right rudder pedal assemblies were severely disrupted in the accident and the ‘pedal reach’ set by the pilot and passenger could not be determined. The elevators were still attached and free to move through their full range. Despite the fracture of the fuselage, the elevator push rods and linkages were intact, had full continuity and operated in the correct sense. The trim wheel was found set slightly forward of its neutral setting and the elevator trim tab was found deflected 4 mm upwards.

Engine and propeller

The engine mountings had been crushed and the engine forced back against the firewall, with much of the ancillary equipment between the engine and firewall damaged. The propeller spinner was fragmented and the two blades had broken at their roots. Both pitch change counterbalance weights were still attached and the counterbalance weights, and the fractures in the blade roots, showed the propeller to have been in fine pitch at impact with the ground.

The engine and its equipment were removed. Both magnetos had been damaged but appeared to have been in good condition, with no pre-existent damage or wear. Examination of the spark plug electrodes indicated that the engine was in a good state of tune and examination of all four cylinders found no fault. The sump had cracked during the impact but the engine retained lubricating oil, the accessory gearbox was in good condition and the engine could be turned smoothly by hand, with all the components moving in the correct sense without restriction.

The four injector jets were in place and clear of blockage and the injector distributor and its internal components were undamaged. The throttle body was damaged but free of debris and very small quantities of clean fuel were found in the various pipes of the fuel injection system, though too small for analysis.

Cockpit instruments and equipment

All the instruments and switches had suffered damage. Several of the instrument needles had been trapped in position by the distortion of the impact. The altimeter was found set to 1019 hPa and an imprint left by the airspeed indicator (ASI) needle indicated a speed of 108 kt at impact - Figure 1 shows the needle strike in the ASI. The severity of the damage meant that none of the primary instruments could be tested. Examination of the pitot-static tubes found them severed in numerous places as a result of the impact but no pre-impact damage was found.

Figure 1

Needle strike on ASI face showing 108 kt

Some of the engine instruments and one of the two fuel gauges needles appeared to have been trapped at, or close to, the position they were at the point of impact (Figure 2). In particular the engine oil temperature was indicating in the green sector, the cylinder head temperature at 180ºC and the left fuel gauge was showing 12 imp gals. In contrast, less plausible were the oil pressure (at full deflection in the red sector), the right fuel gauge (showing zero) and the ammeter (at full deflection to the left).

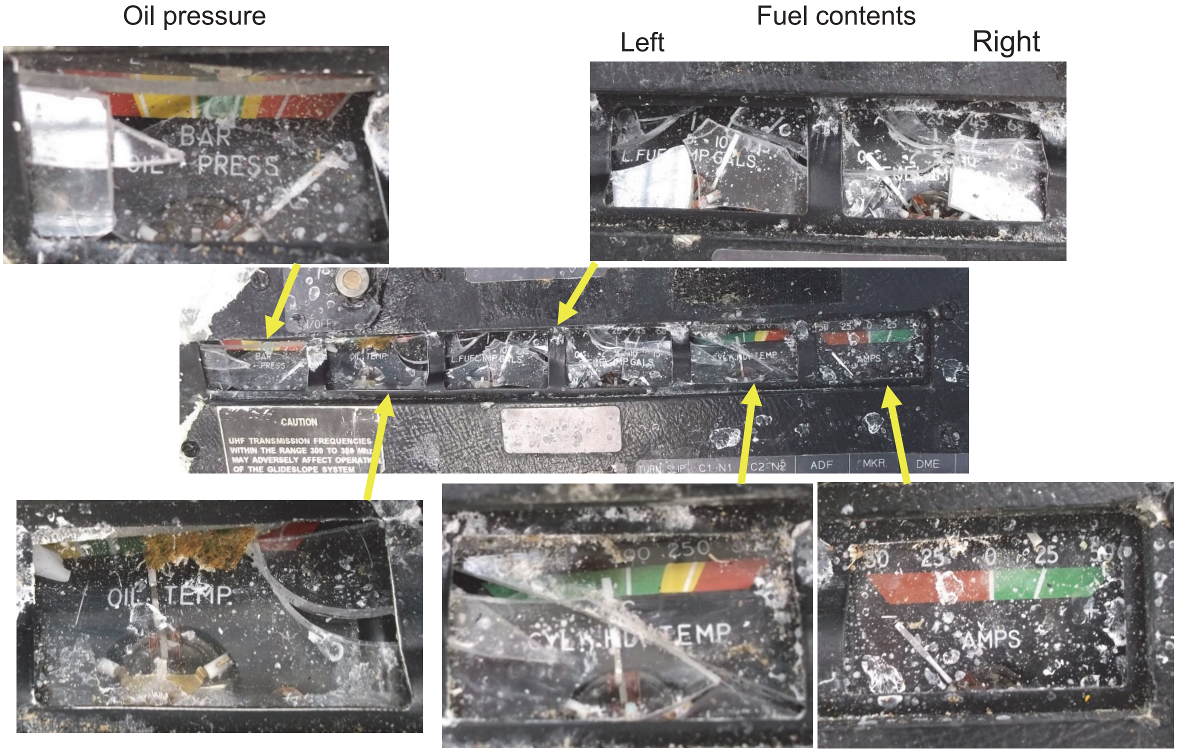


Figure 2

Engine and fuel gauges

The combined fuel and manifold pressure gauge was badly damaged, with no meaningful readings, and the position of the mixture, pitch and throttle controls at impact could not be determined. However, the mechanical rpm gauge, although damaged, showed a needle strike mark similar to that on the ASI, and its needle had bent and precisely matched the contour of a small area of distortion on the instrument face. The strike mark and the bend position indicated a reading of 1,150 rpm when the aircraft hit the ground.

Damage to the transponder selector panel meant that the transponder setting at the time of the accident could not be determined.

Electrical system

The aircraft electrical system could not be tested due to the severity of disruption. The battery was ruptured and the circuit breaker panel in the cockpit was badly damaged, with the majority of breakers fractured from their mountings or appearing to have tripped.

Analysis - engineering

Despite the extensive damage to the aircraft it can be determined that there had been no structural failure or loss of control surfaces in flight. Detachment of the ailerons and flaps was as a result of structural distortion of the wings during the impact sequence.

The ground marks and damage to the aircraft suggest the outer portion of the right wing leading edge hit the ground simultaneously with the propeller spinner, suggesting a slight left yaw to the aircraft. The clear imprint made by the right and left wing leading edges on the ground at impact showed no evidence of rolling or spinning of the aircraft at this point.

Examination has found that there was continuity and operation in the correct sense of the flying control system and that there was no pre-accident fault or control failure of the aileron, rudder or elevators. An unremarkable elevator trim setting had been made and is not relevant to the causes of the accident. The position of the flap lever, set to retracted, verified by the position of the remains of the linkages, was as would be expected in an aircraft configured for straight and level or aerobatic flight. The large indentation on the fin leading edge had been caused by the canopy frame as it derailed and travelled upwards, meeting the fin as the rear fuselage structure 'bent' during the impact and is also not relevant to the accident.

Despite the damage to the rest of the aircraft, the engine was largely undamaged. The bend in the throttle butterfly valve lever and fuel control unit linkage was caused during the impact and would only have occurred with the throttle in the near-closed position. This throttle position, along with the needle showing 1,150 rpm, would be reasonable in this situation. The engine instrument readings, and the condition of the engine's mechanical components, indicate the engine was operating normally up to the impact with the ground.

Testing could not be carried out on any of the primary instruments. The sub-scale setting on the altimeter of 1019 hPa was the QNH for the day and is likely to have been set by the pilot in preparation for the flight. The needle strike on the ASI shows an airspeed of around 108 kt at the impact, plausible considering the damage sustained by the aircraft.

Analysis - operations

The pilot was properly licensed to conduct the flight and the weather was suitable for the intended aerobatics.

From witness evidence, the aircraft appears to have inadvertently entered a spin from some form of looping manoeuvre shortly after the apex of that manoeuvre. From the recorded radar data, the altitude at that point was probably between 3,500 and 4,000 ft, which should have provided sufficient height for the spin to have been stopped and the aircraft pulled out of the dive if spin recovery action had been taken correctly and promptly. The same witness also described hearing the engine faltering during the descent but no physical evidence has been found to suggest an engine problem. It is possible the witness was hearing the effect of rapid opening or closing of the throttle, coupled with the masking effect on the engine sound as the aircraft rotated during the spin.

Both pilot and passenger had been taught spin recovery in the Grob Tutor. The pilot had undergone a Slingsby T67 check flight on 16 January 2016 with the club CFI which was a single circuit and did not cover aerobatics or spin recovery.

The spin recovery action in the Grob Tutor, and in the Tucano, requires that following the application of opposite rudder, the control stick is centralised. This is taught by using both hands in the Tucano and there is no requirement to move the control stick forward. In the Slingsby T67, the control stick should be moved progressively forward until the spin stops and with an aft CG the Flight Manual emphasises that the pilot must be prepared to move the control stick fully forward. As the stick is moved forward the spin's rate of rotation initially increases. The pilot in this accident had not received type-specific spin recovery training in the Slingsby T67 aircraft.

The aircraft appeared to have descended in a spin, however, the aircraft attitude and ground marks at impact suggest that it had started to recover, albeit too late to avoid hitting the ground. An instructor who regularly spins this aircraft type states that if the correct recovery action is taken, the aircraft will come out of the spin.

Conclusion

The extensive damage to the aircraft was wholly consistent with a high-energy impact with the ground. Examination of the aircraft and its systems found no evidence to suggest the aircraft had suffered a structural failure or technical malfunction which could have contributed to this accident. The investigation established that, when found, both occupants were holding their respective control column but it was not possible to establish which occupant was handling the aircraft at any point during the flight.

Given that the aircraft may have been in the process of recovering from the spin in the very last moments of the descent, it is possible that an incorrect spin recovery technique was used as the requirement to move the control stick progressively forward is a critical element of the spin recovery action in the Slingsby T67. This was not a requirement for spin recovery in the Tutor or Tucano; aircraft on which the pilot had previously received spin training. It is possible that if the pilot initially adopted the technique applicable to those aircraft, the spin recovery would have been delayed.

ACCIDENT

Aircraft Type and Registration:	Socata TB20 Trinidad GT, G-SCIP
No & Type of Engines:	1 Lycoming IO-540-C4D5D piston engine
Year of Manufacture:	2000 (Serial no: 2014)
Date & Time (UTC):	19 July 2016 at 1535 hrs
Location:	Sleap Airfield, Shropshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller blades damaged, nose underside abraded and engine presumed shock loaded
Commander's Licence:	Private Pilot's Licence
Commander's Age:	61 years
Commander's Flying Experience:	2,642 hours (of which 1,651 were on type) Last 90 days - 26 hours Last 28 days - 13 hours
Information Source:	AAIB Field Investigation

Synopsis

When the landing gear was retracted after takeoff, the pilot found that the nose gear 'down and locked' green light remained on. During repeated gear extensions in preparation for landing, the pilot established that the nose leg had not locked down, despite the indicator light remaining on. The aircraft subsequently landed and the nose leg collapsed during the latter part of the landing roll.

It was found that the internal components of the nose gear downlock microswitch assembly were disrupted to the extent that the electrical outputs were random. A possible reason was that the switch was damaged during a previous accident.

History of the flight

The aircraft was returning to Welshpool following an uneventful flight to Goodwood. After taking off for the return flight the nose gear 'down and locked' green light remained illuminated, the 'in-transit' light was extinguished. Although the pilot was concerned, he assumed that there was an issue with a sticking microswitch and decided to continue the flight to his Welshpool base. While still some distance south of his destination, the pilot informed Welshpool Radio that he wished to conduct a low pass over the runway so that someone could confirm that all three gears were retracted. On passing low (200 ft) the radio operator confirmed that all the gears appeared to be retracted; however the nose gear green light was still illuminated. The pilot turned the aircraft onto the downwind leg and selected the gear DOWN. The indication changed to three greens although the pilot did not "feel", through the rudder pedals, the nose gear lock into position, as he usually did. During the subsequent low pass over the runway, the radio operator confirmed that the nose gear did not appear to be in the locked position and was being pushed rearwards by the airflow. The pilot then conducted two further circuits, during which he continued to cycle the landing gear, but the nose gear would still not lock down. He then decided that he would divert to Sleap airfield, approximately 10 minutes away, where there were two runway options plus the maintenance company where the aircraft was usually maintained.

The pilot asked the Welshpool Radio operator to contact Sleap to inform them of the aircraft's circumstances and its imminent arrival. During the short flight, the pilot continued to cycle the gear and to pull 'g' in order to encourage the nose gear into its downlock. As the aircraft approached Sleap, the pilot spoke on the radio to an engineer from the maintenance company and asked him to observe the landing gear during a series of passes 200 ft above Runway 18, which was the one in use. The nose gear failed to lock into position despite the green indicator light being illuminated.

On the third approach, this one to land, the pilot selected half flap and reduced speed to 65 kt, into a southerly wind of 10 kt. At around 50 ft he cut the mixture and throttle with the intention of avoiding propeller damage by stopping the engine. The aircraft sank onto the main wheels but the nose gear collapsed as soon as it contacted the ground and the nose dropped onto the runway. The aircraft slowed rapidly and came to a halt after approximately 100 m. After turning off the fuel and electrics, the pilot exited the aircraft quickly, mindful of the 200 litres of fuel in the wings. The airfield Rescue Truck and another vehicle arrived within 2 to 4 minutes.

After some discussion the aircraft nose was lifted up and an engineer attempted to pull the nose leg into its locked position. However, this could not be achieved until he had disconnected a hose, which dissipated the hydraulic pressure. The aircraft was then towed to a hangar.

Other information

The same aircraft was involved in a similar accident on 21 January 2016, approximately 25 flight hours before the subject accident, and a report was published in AAIB Bulletin 5/2016. On that occasion, after selecting the gear down the nose gear green light remained unlit but the red 'gear-in-transit' light illuminated. The pilot was aware of the electrically-driven hydraulic pump operating. After conducting a number of low passes over the airfield, the aircraft landed, with the nose leg collapsing as it contacted the ground. The subsequent investigation failed to find any fault, although a hydraulic lock was suspected. After a number of components were changed as a precaution, the aircraft was repaired and returned to service.

Aircraft examination

Following the second event, the nose gear downlock microswitch, Part Number TB2061032005, was removed from the aircraft and sent to the AAIB. Figure 1 shows the switch after removal.

Figure 1

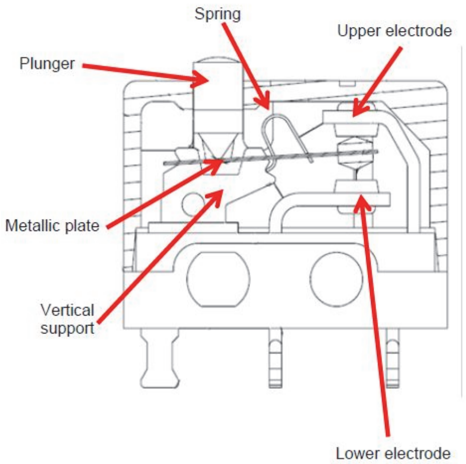
Downlock microswitch and connector after removal from the aircraft

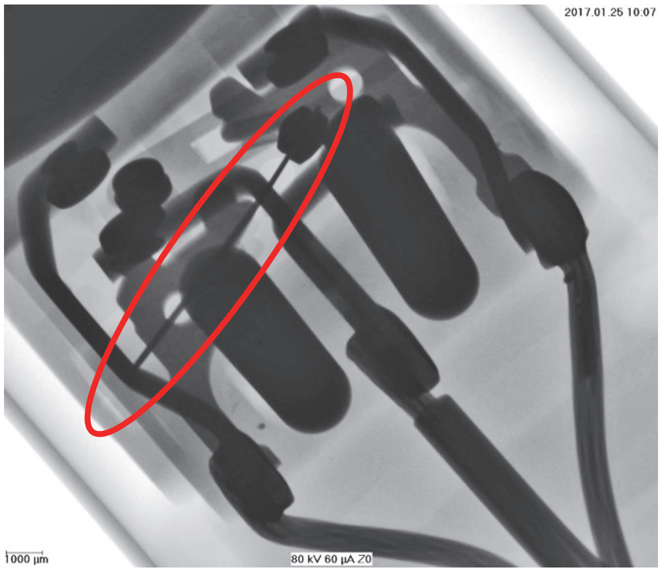
The component was initially tested by assessing the continuity between the pins on the connecting plug, with and without the switch plunger being pressed. The results were inconsistent and it was decided to send the switch for testing at the aircraft manufacturer's facility in France. This was supervised by the Bureau d'Enquêtes et d'Analyses (BEA), who are the French air safety investigation authority.

The test confirmed the AAIB results and additionally confirmed that the state of the microswitch changed randomly when lightly tapped with a finger. The unit was then X-rayed and subsequently disassembled by the BEA.

The switch assembly comprised a spring-loaded plunger acting on two (for redundancy) integral microswitches. These in turn contained a metal plate with a rounded contact, or electrode, at the end. Figure 2 shows a sketch of the cross section and one of the X-ray images.

It was found that moving or tapping the switch would cause the metal plates to move relative to the surrounding components. Cutting the switch assembly open confirmed that the components of one of the microswitches were loose. In the other, the spring had become jammed under the plate. The aircraft manufacturer stated that they had not received any reports of similar failures and, having checked their stock of switch assemblies, confirmed that all of them functioned correctly. The manufacturer additionally stated that they considered that a possible reason for the internal components being found in this condition was the switch may have been subjected to a severe impact.





Courtesy BEA

Figure 2

Cross section of assembly and (right) a sample X-Ray image.
The metal plate was loose

Conclusion

Despite some similarities to the January 2016 accident, it was concluded that they occurred as a result of different causes. In the earlier accident, which remains unresolved, the pilot stated that he was aware that the hydraulic pump was operating despite the intermediate position of the nose landing gear. In the latter case, the failure of the switch mechanism resulted in the random illumination of the green indicator light, together with the associated cessation of hydraulic pump operation, regardless of the nose gear position.

The aircraft manufacturer was unaware of any similar occurrences regarding the switch assembly and considered that the extent of disruption of the internal components may have been the result of a severe impact. It is possible that such an impact occurred in the earlier accident, although the switch had operated normally during the 25 flight hours leading up to this accident on 19 July 2016.

ACCIDENT

Aircraft Type and Registration:	Ikarus C42 FB100, G-CDNR
No & Type of Engines:	1 Rotax 912 ULS piston engine
Year of Manufacture:	2005 (Serial no: 0507-6696)
Date & Time (UTC):	20 March 2016 at 1600 hrs
Location:	Stoke Airfield, near Burrows Lane, Middle Stoke, Kent
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 (Aeroplanes)
Commander's Age:	61
Commander's Flying Experience:	117 hours (of which 17 were on type) Last 90 days - 2.5 hours Last 28 days - 1.5 hours
Information Source:	AAIB Field Investigation

Synopsis

The pilot, who was converting to three-axis microlights, was flying solo following three training flights that morning. The aircraft was seen to become airborne and then climb very steeply, achieving an extreme nose-up attitude. The left wing dropped and the aircraft descended, colliding with high tension power cables adjacent to the runway. It then struck the ground and an intense post-crash fire broke out. The pilot was fatally injured.

History of the flight

The pilot had qualified as a weight shift microlight pilot in August 2013 and decided to convert to three-axis microlights in 2015. His first solo flight in a three-axis aircraft was in the Ikarus on 12 February 2015, after 13.75 hours of training. He had made an appointment to take up three-axis flying again on 20 March 2016.

The instructor arrived at the airfield at approximately 1000 hrs and checked the weather. The forecast was for a 1,400 ft cloud base with a light wind down Runway 06, which was suitable for training and solo flights. He moved the aircraft out of the hangar, carried out the daily inspection and then washed it.

The pilot arrived at about 1130 hrs and discussed with the instructor the plan for the day, which was to make a number of 30-minute flights to continue his three-axis training. They conducted two training flights in the morning, covering takeoffs, climbing, emergencies in the circuit and use of flaps. As expected, after a year since his last three-axis flight, the pilot was a "little rusty" on the first couple of landings. Following a demonstration by the instructor and some further practice, the pilot improved measurably to a competent solo standard.

Following a debrief in the cockpit, the instructor took the pilot into the training room and gave him a presentation on the use and effects of different flap settings. He also talked about the importance of aircraft attitude during a go-around.

They carried out a third dual flight during which the instructor simulated an engine failure after takeoff, followed by a simulated engine failure downwind, from which the pilot landed. He flew competently on his second circuit and seemed calm and ready to go solo. The engine was shut down and the instructor briefed the pilot to fly out to the Isle of Sheppy, an area that he was familiar with, and practise some climbing and descending turns. The pilot seemed happy to be flying solo again and, after restarting the engine, taxied back to the threshold of Runway 06. The instructor observed the takeoff. He heard the pilot apply full power and saw the aircraft become airborne. It climbed very quickly and reached a very high nose-up attitude, which the instructor described as the aircraft "hanging on its prop".

The aircraft drifted left over the railway line that runs alongside the runway before dropping the left wing, descending and striking a set of high tension power cables. There was a bright flash and the aircraft fell to the ground. The instructor and club members ran to the accident site and attempted to extinguish the post-crash fire with handheld fire extinguishers. The pilot had sustained fatal injuries.

Accident site

The aircraft had come to rest in a field adjacent to the northern edge of the airfield, beneath power cables carried on pylons running in a southwest-northeast direction (Figure 1).

The airstrip is slightly curved and is bordered by marshy ground to the south and a railway line to the north. A line of pylons runs north of and roughly parallel to the railway and carries 400kV electricity cables. Each pylon has three arms, with the power supply cables attached to the end of each arm. A separate phase is carried on each arm, with four cables in each phase. The aircraft had struck the southern array of cables (ie the ones on the airfield side of the pylons), causing an electrical discharge across two phases.

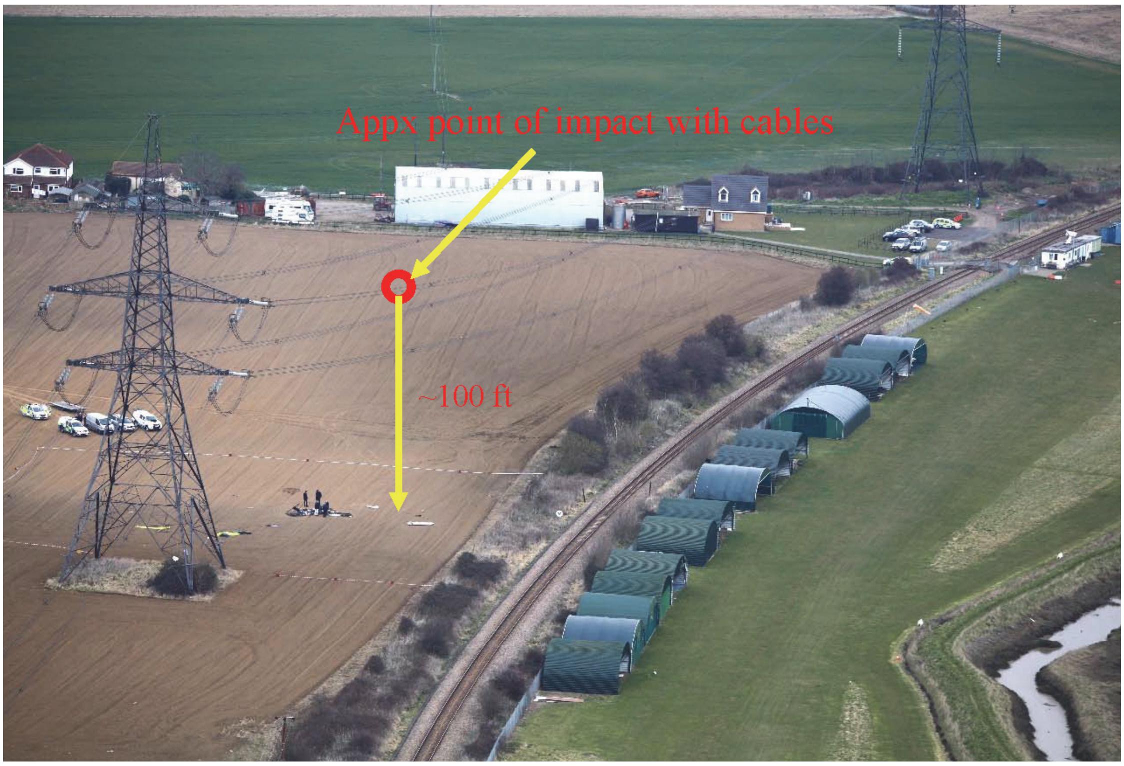


Figure 1

View of accident site, looking along Runway 06

The aircraft had come to rest in an inverted attitude, with the nose pointing roughly parallel to the runway heading, ie 060°. The wreckage had burnt out, with the fire in the forward fuselage having been particularly intense. It was apparent that the right wing had separated close to the root as a result of striking the cable group mounted on the centre arm on the south side, approximately 100 ft above the ground. The right wing was found approximately 13 m from the main wreckage. The cables had not been severed, but had sustained damage in the form of broken cable strands (Figure 2).

Photo: National Grid

Figure 2

Damage to power cables

The cable group below the damaged ones exhibited some slight scuffing, possibly as a result of a brushing contact with the underside of the left wing; this showed evidence of light scuff marks on the wing struts, with several holes resulting from severe electrical discharges that had caused localised vaporising of the aluminium alloy. Similar features were observed on the structural members of both wings and on flying control components, with some of the flying control tubes having melted. The positions of the discharge damage on the wing struts was consistent with the spacing of the cables within the group (Figure 3).

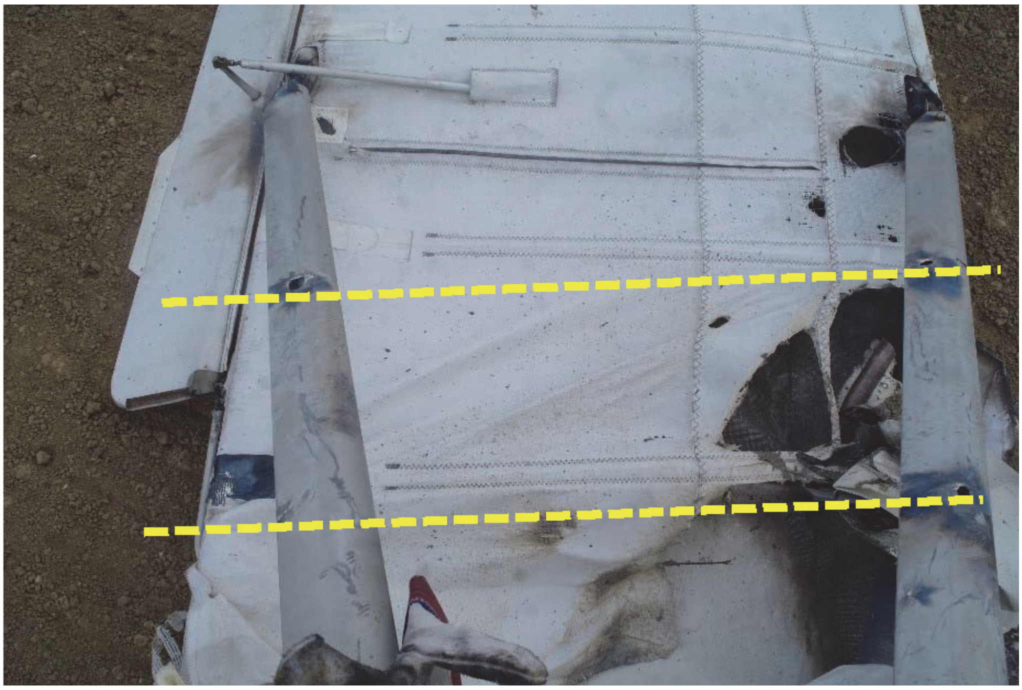


Figure 3

Underside of right wing showing electrical discharge damage and possible cable contact positions

The fabric covering of the left wing, which had remained attached to the fuselage, had burnt away, although there was little evidence of significant heat on the ground, leading to the conclusion that the fabric may have been ignited by the electrical discharge. The fuel tank, located behind the cockpit, had burst on impact and the burning fuel had consumed most of the forward fuselage. There was a shallow crater beneath the engine, but no other ground marks. The propeller blades had all broken at the approximately mid-span point, suggesting power at impact, although it was not possible to quantify this.

The right wing leading edge spar had been broken just inboard of its mid-span point, as a result of contacting the cables. A foam fillet had been bonded to the front face of the tube, giving an aerodynamic shape to the leading edge. An indentation was apparent in the foam, close to the spar fracture, which was consistent with being made by one of the cables (Figure 4). As can be seen, the cable would have been approximately vertical relative to the wing leading edge, suggesting the aircraft was in a near vertical nose-down attitude at the time.

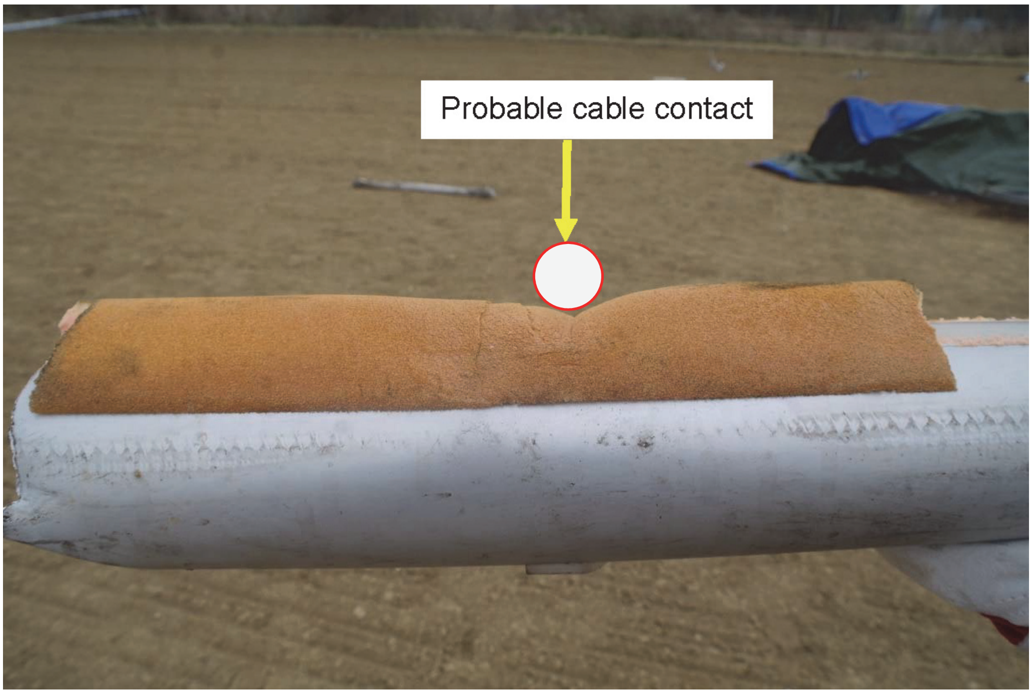


Figure 4

Likely cable contact on the right wing leading edge spar

It was concluded, from the available evidence, that the right wing had struck the middle set of cables on the south side of the pylons whilst the aircraft was in a steep, probably vertical, nose-down attitude. It is likely that this caused a yaw to the right, bringing the left wing into light contact with the lowest set of cables, resulting in the phase-to-phase discharge that in turn produced the bright flash and explosion reported by witnesses.

Following an inspection of the site, the wreckage was recovered to the AAIB's facility for a detailed examination.

Aircraft information

General

The Ikarus C42 is a two-seat high-wing aircraft with a tricycle landing gear. It is manufactured in kit form or as a complete aircraft. Factory-built examples are dealt with by the British Microlight Aircraft Association (BMAA), and are approved as microlights. The Light Aircraft Association (LAA) deals with the kit versions, which can be either a microlight or Group A aircraft. G-CDNR was a factory-built aircraft and was classed as a microlight.

The airframe primary structure is of bolted and riveted aluminium tube construction, the main structural member being a tubular boom that carries the empennage at the rear and the engine and nose landing gear at the front. The fuselage is given a conventional external shape by virtue of non-structural composite mouldings. The flying surfaces are covered with pre-stitched reinforced polyester envelopes. The engines approved for use in the Ikarus are the Rotax 912 UL (80 hp) and 912 ULS (100 hp).

The flight controls are operated by a 'side stick' mounted on a console between the front seats. The top of the stick incorporates two buttons that respectively apply nose-up and nose-down elevator trim, the electric trim actuator being mounted within the left tailplane and operating a trim tab attached to the trailing edge. The flaps are operated by control rods, with the position being controlled by a lever in centre of the cockpit roof; squeezing a calliper attached to the lever allows the flaps to be placed in one of three detented positions. Engine power is controlled by means of a throttle lever mounted between the pilot's legs.

Additional information

In-service structural problems

Two structural issues with the aircraft type were identified by the manufacturer subsequent to the accident; one related to cracking of the fuselage tube and the other to cracking of the A-strut, which links the fuselage tube to the wing leading edge.

The cracking of the fuselage tube resulted in an Owner's Service Bulletin (OSB) 29, which was issued on 16 June 2016. The Bulletin became the subject of a Civil Aviation Authority (CAA) Emergency Mandatory Permit Directive (MPD), issued on 28 June 2016. It required an inspection for cracking of the front of the fuselage tube; the affected area is shown in Figure 5a. The engine is supported, via a pylon, on the front of the tube. In addition, there are two square cut-outs in the tube; the front one carries the nose landing gear and the rear forms the attachment of the A-strut.

Cracks have been found emanating from the corners of the upper cut-outs which, if allowed to propagate, would compromise the structural integrity of the engine mountings, the nose landing gear leg and the A-strut. An extreme example is shown in Figure 5b. As far as is known, no crack has progressed to complete failure. The LAA covered the topic in an article in the August 2016 issue of their '*Light Aviation*' magazine.

The fuselage cracking appeared to primarily affect high flight hour, early examples of the aircraft, although the MPD applied to all C42 models, with inspections being required prior to the next flight on aircraft with over 2,000 hours of operation.

G-CDNR had achieved over 2,420 flight hours at the time of the accident but had never been inspected in accordance with the MPD, as the accident occurred prior to the discovery of the fuselage tube cracking problem. Two other C42 aircraft based at the same airfield, with slightly fewer flight hours, were inspected and found to have no cracks.

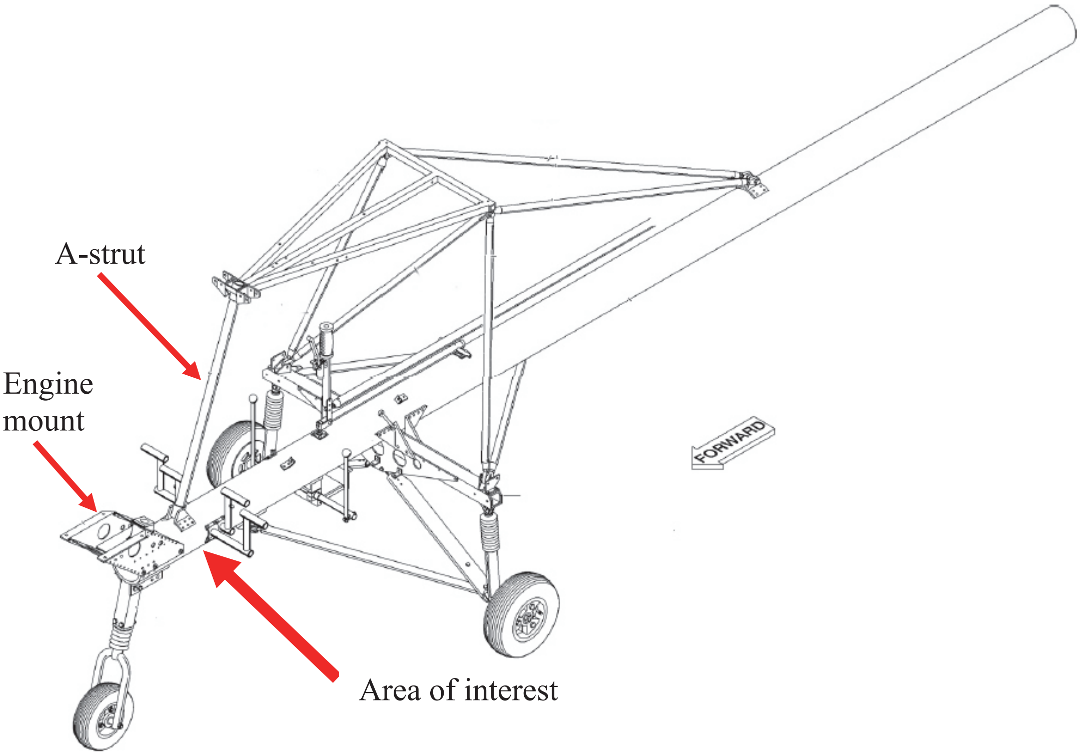


Figure 5a

View of fuselage structure

Figure 5b

Example of crack emanating from rear cut-out, as shown in OSB 29

In November 2016, cracking of the A-strut was identified on the same airframe that had suffered the fuselage tube cracking that led to the issue of OSB 29 and the subsequent MPD. It was found that the A-strut was cracked around its entire circumference within the outer collar at the connection between the strut and the upper surface of the main fuselage tube (Figures 6a and 6b). The failure was concealed by the collar and the upper part of the strut had been retained in position only by a single locating rivet (ie a manufacturing aid) that located the collar on the strut. The crack had emanated from the bolt hole in the strut.

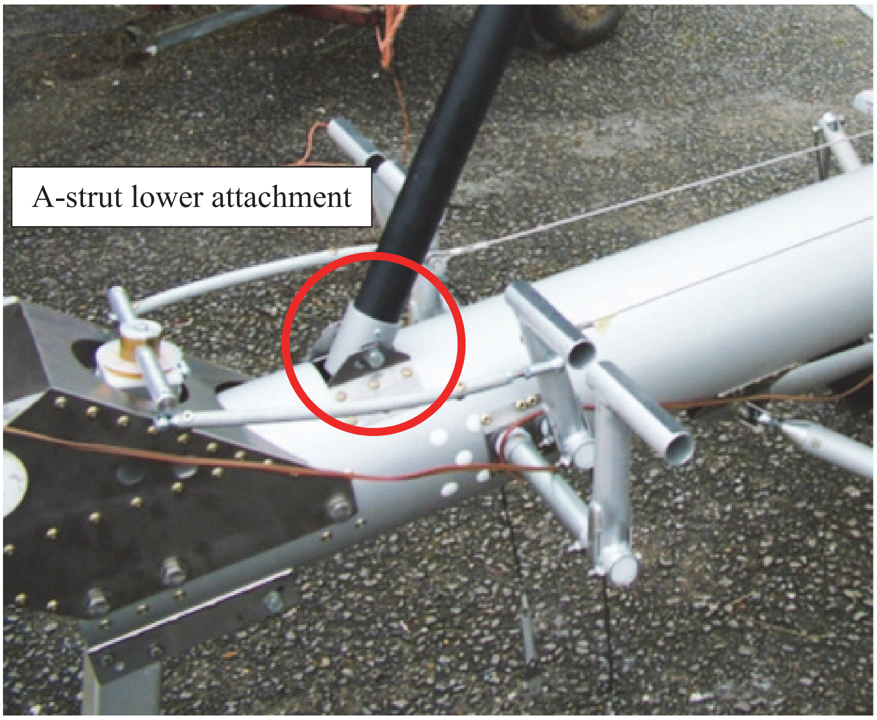


Photo: Red Aviation

Figure 6a

A-strut attachment to forward fuselage tube

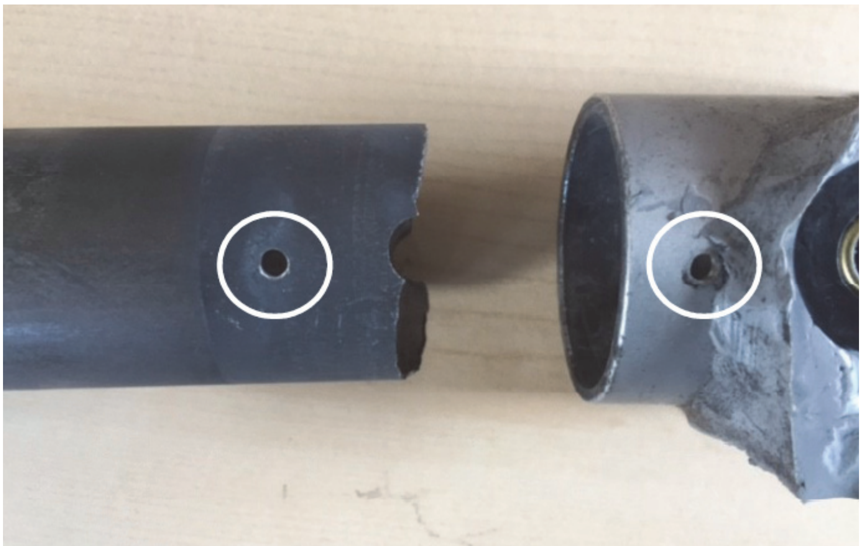


Photo: Red Aviation

Figure 6b

Failed A-strut after removal of collar, showing rivet hole

The UK agent for the aircraft, in conjunction with the German manufacturer, issued OSB 31 on 30 November 2016, applicable to all C42 A and B model aircraft, although later B models featuring a different design were exempted. The Bulletin stated that it was believed that the failure was the result of excessive loads placed on the A-strut due to near failure of the main fuselage tube. One other similar case was known to have occurred on an aircraft known to have sustained landing gear damage. However, it was also considered that the failure may have been related to fatigue due to flexing of the A-strut, thus introducing the requirement for an inspection of potentially vulnerable aircraft.

The OSB requires any aircraft which have previously suffered damage that could have affected the A-strut, such as nose gear or accident damage, to be inspected by means of a borescope inserted into the strut from its lower end. However there was no requirement to inspect aircraft with no history of damage and which had flown less than 2,000 hours. Aircraft with more than 2,000 flying hours were recommended to be inspected at the next Annual or 100-hour Inspection, whichever occurred first.

Subsequent to the accident, the manufacturer's design/certification engineer stated that his calculations indicated that, in the event of an A-strut failure, the rivet would withstand flight loads of 2 to 3g before failing. It was pointed out that the A-strut is also attached to the engine firewall structure, thus providing some additional strength.

Aircraft examination

The intense fire that developed after the aircraft came to rest had resulted in much of the structure being reduced to ash or solidified molten alloy. It was thus not possible to conduct a complete continuity check on some of the flying controls in the cockpit area. However, those parts of the system that remained bore no evidence of disconnect or failure prior to striking the ground. A bell crank assembly, in the right wing aileron circuit, had become disconnected as a result of being melted in the electrical discharge after the aircraft struck the power cables.

It was established that the flap operating lever, in the roof of the cockpit, had been in the flaps retracted detent and that the elevator trim electrical actuator was in the middle of its operating range, thus indicating that the elevator trim was approximately neutral.

The engine was dismantled and no evidence of failure or malfunction was found, with all the internal components being in good condition. However the carburettors, together with most other engine accessories, were burnt and could not be tested.

The fuselage boom was examined with particular regard to OSB 29. However, very little of the front end had survived the fire. An exception was the nose landing gear leg, which had remained attached to the lower half of a short length of the fuselage tube, including the cut-outs for the leg and the A-strut. The latter was severely fire affected, but contained a few centimetres of the lower end of the A-strut. It was not possible to draw any conclusions from the fracture surfaces due to the fire damage.

The A-strut upper and lower attachments to the fuselage tube were made with steel brackets. These had survived the post-impact fire, whereas much of the surrounding aluminium material had not. Figures 7 and 8 show the remains of the lower and upper attachments. The lower attachment was similar to the upper in that both used collars and locating rivets (the rivet is not visible in the image of the lower attachment).

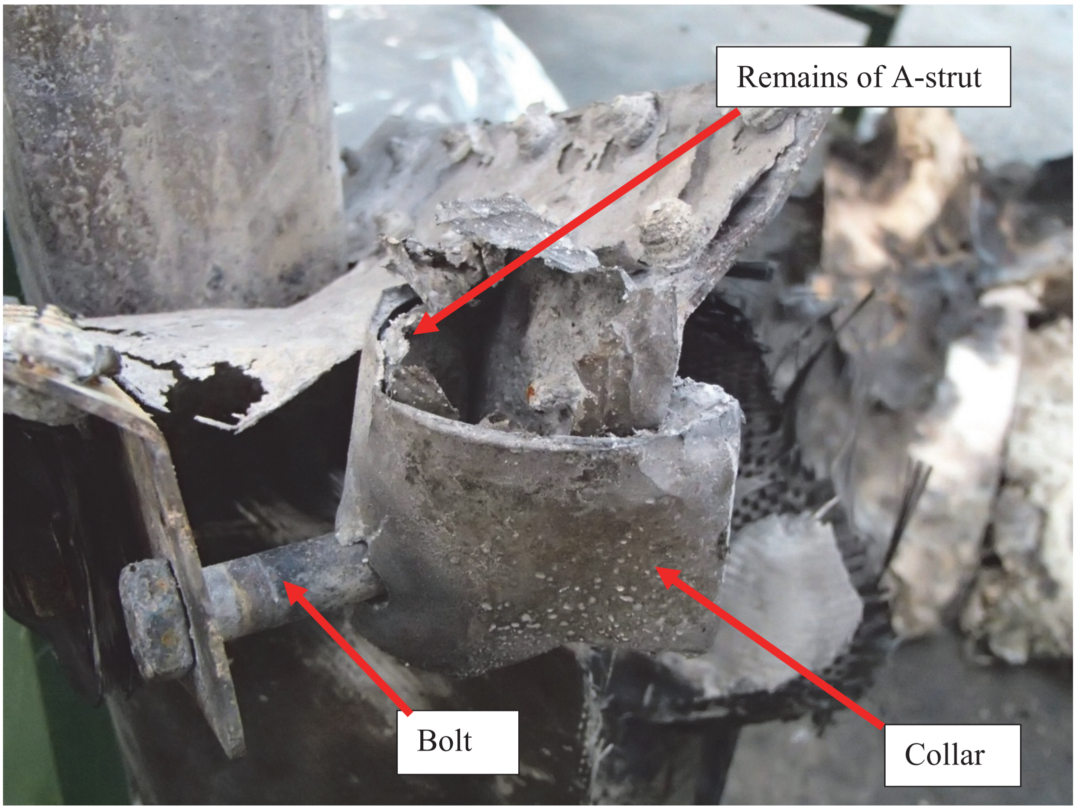


Figure 7
Lower attachment

The remains of the collar on the upper attachment were fragile and part of it was peeled aside to reveal the locating rivet; this appeared intact. However there was no evidence of any part of the A-strut, unlike the lower attachment, where a section of the strut, together with the rivet was found positioned concentrically within the collar.

Figure 8

Remains of A-strut upper attachment and (lower view) rivet

Recorded information

Security video recording

A video camera located on the clubhouse recorded both the takeoff with the instructor and the takeoff for the accident flight. Figure 9 shows three snapshots from each takeoff which illustrate differences in the respective flightpaths. The takeoff with the instructor was at a higher weight, but the aircraft tracked along the runway in a normal climb. On the accident takeoff the aircraft became airborne and climbed steeply, whilst drifting to the left (prior to dropping the left wing, descending and contacting the power lines).

Previous take off with the instructor Solo accident take off

Figure 9

Comparison of normal and accident takeoffs

Weight and balance

The instructor estimated that the fuel on board at the commencement of the accident flight was 30 litres and the pilot's weight was 75 kg. Total weight at takeoff was calculated as 362 kg, with a maximum permitted takeoff weight of 450 kg. The Centre of Gravity (CG) range for the aircraft was 350 mm to 560 mm aft of the zero datum, which is defined as the wing leading edge root. The calculated CG at the time of the accident was 397.8 mm aft of the CG datum. The aircraft was therefore being operated within the maximum permitted takeoff weight and CG envelope.

Airfield information

Stoke Airfield has a single grass runway orientated 06/24, 400 m long by 20 m wide. Running along the west side of the runway is a railway line and to the west of that are a set of 200 ft high power cables. The active runway at the time of the accident was Runway 06, with a right hand circuit.

Personnel

Pilot's background and experience

The pilot had commenced his microlight flying on 28 March 2012, although his instructor thought he had undertaken some light aircraft training previously. He successfully passed his weight shift microlight General Skills Test (GST) on 2 August 2013. Thereafter, he mainly flew his Blade 912, which is a weight shift microlight, but also carried out three-axis microlight training on the Ikarus C42. His first three-axis solo flight was in G-CDNR on 12 February 2015. He continued to fly his Blade 912. On 20 February 2016, he recommenced his three-axis conversion.

Tests and research

Flight test

On 7 September 2016 flight testing, commissioned by the AAIB, was carried out at Old Sarum Airfield using an Ikarus C42 aircraft (registration G-CDOK) which closely matched the accident aircraft. The purpose of the flight test was to assess the aircraft's handling qualities, particularly with respect to takeoff profiles with full power applied. The weather conditions were good, with a surface wind of 160° at 8 kt, visibility in excess of 20 km, OAT +24° and light turbulence. The instructor from Stoke Airfield who had witnessed the accident was present for the test and was able to compare the accident flight profile with that of the test aircraft.

The testing was carried out by a qualified Experimental Test Pilot using standard CS-23[1] test techniques. The test aircraft was configured with the same weight, CG and elevator trim position as the accident aircraft. Flights were carried out with the test pilot flying the aircraft 'hands-on' (Closed Loop) and then 'hands-off' (Open Loop), to establish the forces needed to control the aircraft and its behaviour if not controlled, as would have been the case had the pilot become incapacitated.

The circuits were flown to Runway 06 at Old Sarum which has an 800 m grass (over chalk) runway. The following is quoted from the Flight Test Report:

> *'Take-off: "Closed Loop" and "Open Loop" take-offs were conducted with take-off flap. Closed Loop the stick was held aft to reduce loads on the nose-wheel. The aircraft flew itself off in this attitude and was allowed to accelerate to 60 KIAS to climb away. Directional control was easy with full power applied indicating an effective rudder. Open Loop the aircraft was trimmed as above and full power applied smoothly with subtle inputs to the rudder to ensure it ran straight along the ground. Without any joystick input the aircraft lifted off to approx. 5 ft, sank slightly as it continued to accelerate then pitched smartly nose up to approx. 30° at 55 KIAS before pitching back down to a stable climb attitude of approx. 25° nose-up. Without rudder input there was a subtle tendency for the aircraft to yaw and then roll to the left.*

Footnote

1 EASA Certification Specification 23.

Full Power caused the nose to pitch up – idle power caused it to pitch down. Application of full power caused the aircraft to yaw very slightly left which created sufficient sideslip to cause the aircraft to subsequently roll left.

With full power applied during the take-off condition assessments the aircraft had a subtle tendency to yaw to the left followed by a roll to the left. If the yaw was not prevented the aircraft continued to roll with the nose starting to drop as the AOB [angle of bank] exceeded 30°. If not corrected the AOB increased and the nose dropped below the horizon with the aircraft entering into a spiral dive.

Conclusions and Recommendations

The 100 hp C42 aircraft was a very benign aircraft with good handling qualities and stall characteristics. Take-offs and landings were easy to perform. The application of full power with neutral pitch trim created a nose up pitching moment but in all tested cases the aircraft eventually stabilised into a climb. The more flap that was applied the greater the nose up pitch (initial and stable) attitude and the slower the subsequent airspeed but even with full flap the aircraft did not slow down to the stall speed. It was possible to conduct Open Loop take-offs with one stage of flap with the aircraft eventually ending up in a 55 KIAS climb. Without small rudder inputs to prevent yaw to the left the aircraft with full power applied would roll to the left and subsequently enter a spiral dive.'

The instructor who had witnessed the accident observed the test flight takeoffs, but none had the extreme climb rate and nose-up attitude of the accident flight.

Medical and pathology

A post-mortem examination did not reveal the presence of any pre-existing disease or medical condition which might have contributed to the accident. The pilot was reported to have been in good health and toxicology showed no presence of drugs or alcohol.

Analysis

General

The investigation concluded that the accident resulted from an in-flight loss of control followed by a collision with the high tension power cables adjacent to the airstrip. The instructor described the aircraft as "hanging on the prop", which suggests a high angle of attack. It is probable that the aircraft entered a stall, with the left wing dropping such that the aircraft was pointing at the ground. This is supported by the angle of the cable impact mark on the right wing leading edge. None of the cables broke, although it is probable that they had the effect of reducing the aircraft's vertical speed. The shallow crater made by the engine and the lack of significant compression foreshortening of the fuselage suggested a relatively low ground impact speed.

Engineering aspects

While it was not possible to conduct a complete check of the flying controls due to the fire having consumed some components, there was limited scope for a disconnect or a malfunction in such a simple system. Regarding the secondary flying controls, the flaps were found to be retracted. The elevator trim, being in a central position, is unlikely to have resulted in control forces that were higher than the pilot was used to.

The engine components were found to be in good condition, although some of the accessories had been severely damaged by the fire. The aircraft had been climbing prior to the loss of control and the damage to the propeller blades indicated that at least a degree of power was applied at the time of the ground impact.

The witness and video evidence additionally indicated that the aircraft had climbed more steeply after takeoff than on the previous flight. Whilst this could be expected due to the reduced all-up weight of the aircraft after the instructor had disembarked, it appeared to happen immediately after the aircraft became airborne.

The possibility of cracking of the fuselage tube and A-strut was identified on C42 aircraft subsequent to the accident to G-CDNR. Neither had previously resulted in an accident but, of the two, the A-strut issue is considered more relevant to this accident, as the likely consequences of a failure would allow the wing leading edge to lift, thus increasing the angle of attack. This in turn would cause an uncommanded climb, which accords with the observed behaviour of the aircraft after takeoff.

Had a failure of the A-strut occurred, the upper section would have been held mostly by the locating rivet, which could have failed in shear under the action of flight loads. The rivet was found to be intact and undistorted, similar in appearance to the rivet in the lower attachment, which still retained the bottom of the A-strut. This suggested that there had not been an airborne failure, and this is supported by the statement from the manufacturer's design/certification engineer that the rivet would withstand flight loads of 2 to 3g. However, given the degree of damage sustained by the aircraft in the post-crash fire, the possibility of some other failure could not be discounted.

Operational aspects

The pilot was properly licensed to conduct the flight and had carried out three flights with the instructor that day to prepare him for the solo flight. During those flights he had demonstrated a satisfactory standard of ability in the operation of three-axis aircraft, sufficient to be allowed to fly solo. It appeared that either no attempt was made to correct the aircraft's extreme nose-up attitude or drift to the left prior to the accident, or the pilot had been unable to take corrective action. The post-mortem examination did not identify any medical reason for a lack of intervention by the pilot.

The flight testing demonstrated that:

> *'with full power applied during the take-off condition assessments, the aircraft had a subtle tendency to yaw to the left followed by a roll to the left. If the yaw was not prevented the aircraft continued to roll with the nose starting to drop as the AOB exceeded 30°. If not corrected the AOB increased and the nose dropped below the horizon with the aircraft entering into a spiral dive.'*

The witnesses' description of the final manoeuvre was more indicative of a wing drop at the stall resulting from the excessively nose-high pitch attitude.

The instructor had observed the flight tests at Old Sarum and in none of those takeoffs did the test aircraft climb as steeply as the accident aircraft. This suggests that either the pilot had applied an aft side stick control input, or the aircraft suffered a failure leading to a loss of control. If the pilot did not correct the yaw to the left, his ground track would have taken him towards the power cables, the location and height of which were known to him. With the high nose-up pitch attitude, the visibility forward would have been restricted by the nose of the aircraft. It is possible that, in trying to achieve the maximum angle of climb to avoid the power cables, the pilot may have made a large aft side stick control input and, with limited forward visibility, may not have been fully aware of his extreme nose-up pitch attitude.

Conclusion

The pilot had demonstrated that he was competent to fly the aircraft before undertaking the solo flight and yet the aircraft was seen to climb very steeply before control was lost.

The extreme angle of climb and wing drop were not reproduced in the 'Open Loop' (hands-off) takeoffs during flight testing and this suggests that either the accident pilot had made a deliberate and sustained aft side stick control input, or a failure of the aircraft occurred, resulting in the steep climb and a reduction in airspeed. The continued reduction in airspeed led to a stall, left wing drop and departure from controlled flight, with insufficient height to recover before striking the cables.

There was insufficient evidence available to determine which possibility was more likely.

AAIB Correspondence Reports

These are reports on accidents and incidents which were not subject to a Field Investigation.

They are wholly, or largely, based on information provided by the aircraft commander in an Aircraft Accident Report Form (AARF) and in some cases additional information from other sources.

The accuracy of the information provided cannot be assured.

ACCIDENT

Aircraft Type and Registration:	Alpi Aviation Pioneer 400, G-CPPG
No & Type of Engines:	1 Rotax 912 ULS piston engine
Year of Manufacture:	2013 (Serial no: LAA 364-15117)
Date & Time (UTC):	23 August 2016 at 1730 hrs
Location:	Thruxton Aerodrome, Hampshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to aircraft underside
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	81 years
Commander's Flying Experience:	16,776 hours (of which 14 were on type) Last 90 days - 73 hours Last 28 days - 20 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

On returning to the airfield the landing gear was selected down but did not lock down. The landing gear was recycled but would still not lock down. After touchdown, the landing gear legs collapsed. The failure of the gear to lock down was attributed to a bent nose gear screwjack extension rod.

Description of the aircraft

The Alpi Aviation Pioneer 400 is a four-seat development of the Pioneer 300 light aircraft, which has two seats. G-CPPG was home-built and was undergoing flight tests for the issue of a Permit to Fly.

The aircraft is of primarily wooden construction and has a retractable tricycle landing gear. Retraction and extension is by an electric motor which drives three screwjacks (one for each landing gear). When the legs are fully extended, the jacks operate overcentre mechanisms which lock the landing gear down. If the electric motor fails, for any reason, a hand crank can be used to drive the mechanism manually.

The indications for the landing gear are conventional. Three green lights illuminate when the landing gear is down and locked and a landing gear unsafe amber light indicates that it is in transit or unsafe.

History of the flight

On returning to the airfield the landing gear was selected down, but its circuit breaker tripped and the gear unsafe light remained on. The circuit breaker was reset and the gear recycled but again the circuit breaker tripped. The manual landing gear extension crank handle was operated but could only be moved half a turn. The air/ground radio operator advised that the landing gear appeared to be down and the pilot could see through the transparent panel in the footwell that the nosewheel was no longer in its bay. A flaps-up landing was made on the grass strip parallel to the main Runway 25. During the round-out the right-seat observer switched off the magnetos and fuel, and the aircraft settled gently onto its belly, pitching nose-down at the end of the ground run.

When the aircraft was subsequently raised the landing gear dropped down under gravity.

Aircraft examination

The aircraft was examined by a maintenance organisation that carried out the repairs. All the screwjacks had fractured as a result of the collapse, but the nose gear screwjack extension rod (which is 470 mm long) had also bent. The engineer believed that this extension rod was probably bent during takeoff when the aircraft hit a bump in the runway. A bent rod would also explain a slight sticking of the throttle lever that had been experienced, because this rod runs underneath the throttle quadrant. The bent rod could have prevented all three landing gear legs from reaching their overcentre positions.

The Pioneer 400 has suffered previous landing gear extension issues and the manufacturer is developing modifications. One of the modifications has been to change the nose gear screwjack extension rod from a hollow steel tube to a solid steel tube.

ACCIDENT

Aircraft Type and Registration:	Pioneer 300 Hawk, G-CFUE
No & Type of Engines:	1 Rotax 912 ULS piston engine
Year of Manufacture:	2009 (Serial no: LAA 330A-14867)
Date & Time (UTC):	8 January 2017 at 1300 hrs
Location:	Westonzoyland Airfield, Somerset
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Nosewheel detached, damage to propeller and aircraft structure
Commander's Licence:	Private Pilot's Licence
Commander's Age:	51 years
Commander's Flying Experience:	568 hours (of which 156 were on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot and information from the Light Aircraft Association

On returning to the airfield after a short local flight, the aircraft floated before settling onto the main landing gear. Upon lowering the nose, the pilot reported that there was a "bang and the aircraft felt unstable". The aircraft dropped onto its nose and the propeller broke when it struck the ground. The aircraft slid to a halt and the pilot, who was uninjured, exited normally.

Examination by the Light Aircraft Association (LAA) established that the nosewheel and fork assembly had separated due to overload. The nose landing gear overcentre mechanism was found to be locked and the firewall had been distorted rearwards by the forces imparted during the accident. The nature of the damage indicated that the nose gear had experienced heavy loads during the landing, possibly associated with 'wheelbarrowing'.

The LAA have undertaken a review of recent Pioneer 300 landing gear incidents and a precis of their findings is presented in a *'Safety Spot'* article within their March 2017 *'Light Aviation'* publication.

ACCIDENT

Aircraft Type and Registration:	Europa XS, G-BYSA	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2000 (Serial no: PFA 247-13199)	
Date & Time (UTC):	10 August 2016 at 1015 hrs	
Location:	Hollym Airfield, East Riding of Yorkshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Minor)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	60 years	
Commander's Flying Experience:	918 hours (of which 438 were on type) Last 90 days - 49 hours Last 28 days - 11 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

While landing on a clifftop runway, the landing gear's right outrigger failed and the aircraft ran off the edge of the runway, over the cliff and into the sea. The pilot evacuated the aircraft and activated his Personal Locator Beacon (PLB) but had reached safety before help arrived. Coastal erosion had noticeably reduced the runway's surroundings since the pilot had last used it four years before.

History of the flight

Hollym Airfield is an unlicensed grass airfield near the village of Withernsea, Yorkshire. The airfield is Prior Permission Required (PPR), so the pilot had telephoned the airfield operator for permission to land. He had previously landed at Hollym on four occasions, therefore the owner granted permission without a detailed briefing.

When the aircraft arrived overhead the airfield, the windsock showed the surface wind to be from about 310° at less than 10 kt. Therefore, the pilot decided to land on Runway 32, which he had last used four years before. The first approximately 150 m of Runway 32 is bounded by a fence on its left side and a cliff, down to the sea, on its right. The fence then stops and the area to the left of the runway opens out onto the main grass airfield, with Runway 32 continuing to parallel the cliff.

The pilot reported that he flew a normal approach and landing to Runway 32, although he was aware that both the fence and the cliff edge were unexpectedly close. During the landing roll he heard a noise, possibly from the right side of the aircraft, and it slewed to the right. He attempted to control the aircraft and apply braking, resulting in the aircraft rolling out on the extreme right side of the runway. As the aircraft slowed, the tailwheel went over the edge of the cliff and, at low speed, the aircraft fell tail-first off the cliff into the sea.

The accident was not witnessed by anyone else, so the emergency services were not initially alerted. The pilot escaped from the aircraft and after a few minutes was able to retrieve and activate his 406 MHz PLB. After another approximately thirty minutes, he was able to make his way up the cliff to a nearby house. Help then arrived and he was transferred to hospital for treatment to minor injuries sustained after he had exited the aircraft.

Airfield information

The pilot commented that the last time he had landed on Runway 32, the mown runway strip was bounded on both sides by significant fallow ground, providing some margin for error. Reviewing the airfield entry in commercially available flight guides had appeared to confirm to him that this remained the case. At the time of the accident the runway was reported as being 15 m in width, with a sketch diagram showing a clear area on each side. However, coastal erosion in the area is an average of two metres per year, with the cliff on the right of the runway being undermined by the sea and then collapsing in stages. This had resulted in the runway being moved to the left, until it abutted the fence, while the sea continued to erode the ground to the right of the runway, to its current width.

The pilot reported that, following the accident, he determined that the runway was approximately 14 m wide for this initial portion.

CAA Guidance

The CAA issues guidance for the operation of unlicensed aerodromes. *CAP 793 'Safe Operating Practices at Unlicensed Aerodromes'* states:

> *'The contents of this CAP are not mandatory, nor do they purport to be exhaustive. However, they do provide what can be considered as sound practice that has been developed in consultation with industry representative bodies.'*

In Appendix B *'Deciding Minimum Runway Dimensions'* it recommends that, for light aircraft of less than 2730 KG Maximum Take-Off Mass, the minimum runway width is 18 m.

Aircraft information

G-BYSA was the monowheel variant of the Europa, with a wingspan of 8.27 m and retractable outrigger wheels mounted on each wing. The outriggers are described in the aircraft owner's manual as:

> *'exceedingly strong and pliable so there is no need to be overly concerned about turning sharply or rough field operation. The outriggers will, if necessary, bend through 90 degrees.'*

However, they are not designed to take significant vertical loads and, on rare occasions, do fail. Following the accident, the right outrigger was located on the runway near the cliff edge. It had failed in the plastic section below its attachment to the wing. Why this occurred was not explained.

Personal locator beacon

The pilot's PLB was equipped with a 406 MHz transmitter, which is detectable by satellites of the Cospas-Sarsat Programme. In order to determine an approximate position of the activated beacon, more than one satellite pass was required.

At 1036 hrs, a downlink from a satellite pass alerted the UK Aeronautical Rescue Co-ordination Centre (ARCC) to the activation of the beacon. A further satellite pass at 1056 hrs was required to resolve the beacon's location in the approximate area of the accident. The ARCC attempted to contact the beacon's registered owner (the pilot) and made further enquiries, to determine the nature of the incident and decide on the appropriate response[1]. At 1108 hrs, a land-based Coastguard rescue team was tasked to the area of the accident. This was followed later by the deployment of RNLI lifeboats and a SAR helicopter.

The ARCC commented that GPS-enabled PLB's will generally allow much quicker location of the transmitter than those without this capability. Additionally, the more information and, in particular, contact details that owners include when registering a PLB, the quicker the ARCC can respond and the higher the probability of them deploying the correct rescue assets.

Additional information on what happens when a PLB is activated can be found at www.cospas-sarsat.int/en/

Flight guides

Various commercially available flight guides contain information on unlicensed airfields. These publications generally advise that the information they contain should be considered as guidance and may be inaccurate. This may apply particularly where the landscape, airfield and runway dimensions are constantly changing.

Footnote

1 PLBs are registered to an individual and can be used during a range of activities, onshore, at sea and in the air.

Safety action

> The airfield operator has informed the publishers of various flight guides that the runway width is now 10 m and requested that they include a warning to '*Beware cliffs on the east side of the airfield*'.
>
> The Light Aircraft Association included this accident in their October 2016 *'Safety Spot'* feature to advise their members of the circumstances.

Conclusion

While landing on a clifftop runway, the landing gear's right outrigger failed and the aircraft ran off the edge of the runway, over the cliff and into the sea. The failure of the aircraft's right outrigger was not explained. However, there was little margin for variation in landing track when using Runway 32, which was narrower than recommended by the CAA in CAP 793 because of coastal erosion (Figure 1).

The airfield operator has informed publishers of various flight guides of the revised width of Runway 32 and warned about the cliffs on the east side of the airfield, for inclusion in their publications.

Figure 1

Coastal erosion at Hollym Airfield

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-181 Cherokee Archer II, G-BPAY
No & Type of Engines:	1 Lycoming O-360-A4M piston engine
Year of Manufacture:	1980 (Serial no: 28-8090191)
Date & Time (UTC):	29 December 2016 at 1450 hrs
Location:	White Waltham Airfield, Berkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to the wingtip fairing, leading edge of the left wing and to the propeller spinner of a parked aircraft
Commander's Licence:	Private Pilot's Licence
Commander's Age:	28 years
Commander's Flying Experience:	68 hours (of which 63 were on type) Last 90 days - 1 hour Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

After landing and while taxiing between two rows of parked aircraft, the aircraft's left wingtip struck the propeller spinner of another, unoccupied PA-28. The pilot believed glare from the low sun contributed towards his misjudgement of the clearance between his wingtip and the other aircraft. He also noted that, although the lines of aircraft were far enough apart for his aircraft to pass, they were closer together than was usual at this airfield.

The airfield operator reported that the distance between the rows of aircraft was varied, when the ground was soft, to prevent some surface areas becoming more worn than others.

Safety action

> Since the accident the airfield operator has changed its procedures to reduce the need for parallel rows of parked aircraft and therefore lessen the risk of ground collisions.

ACCIDENT

Aircraft Type and Registration:	Reims Cessna F172N Skyhawk, G-DUVL
No & Type of Engines:	1 Lycoming O-320-H2AD piston engine
Year of Manufacture:	1978 (Serial no: 1723)
Date & Time (UTC):	20 December 2016 at 16:04 hrs
Location:	White Waltham Airfield, Berkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	Right main landing gear failed, minor damage to the tailplane and elevator
Commander's Licence:	Private Pilot's Licence
Commander's Age:	61 years
Commander's Flying Experience:	15,600 hours (of which 230 were on type) Last 90 days - 3 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB enquires and examination of failed components

Synopsis

Shortly after landing, the right mainwheel assembly detached from the landing gear leg. The failure occurred as a result of a fatigue crack in the landing gear leg that initiated at the position where a screw in the wheel fairing had made contact with the leg.

History of the flight

The pilot reported that the touchdown on the grass runway at White Waltham was smooth with little impact; however as the aircraft slowed to approximately 35 kt, there was a loud bang and the right side of the aircraft dropped. The aircraft turned to the right by approximately 120° before it came to a halt. On vacating the aircraft, the pilot noticed that the right main wheel assembly had detached from the landing gear leg (Figure 1).

Figure 1

Right main wheel assembly detached from its leg

Aircraft examination

The right main landing gear leg failed adjacent to the top fastener in the aerodynamic fairing, which covers the lower part of the leg and is attached to the wheel spat (Figure 2). The screws in the fairing should all be identical; however the top two screws were found to be magnetic and heavily corroded, whereas the bottom two screws were non-magnetic and were bright in appearance. The screws were therefore made from different materials and varied in length by between 9 and 11 mm.

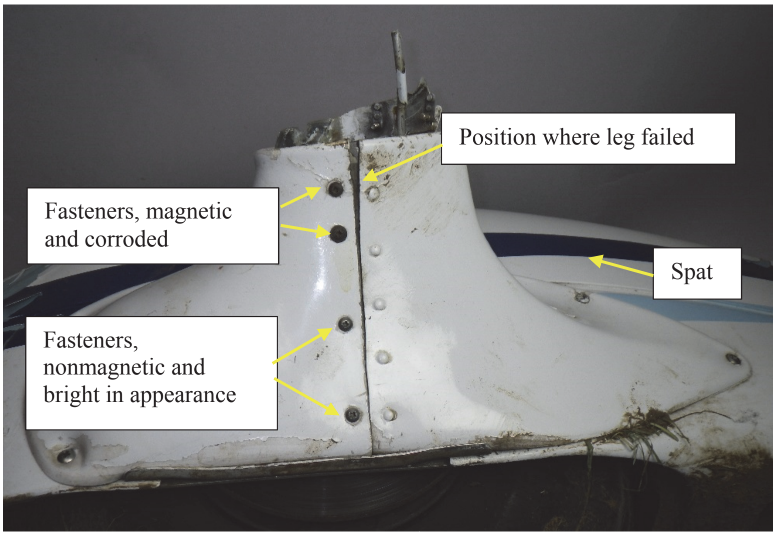


Figure 2

Fairing attached to right wheel spat

The top fastener had made contact with the leg and formed a dent approximately 6.8 mm in diameter and 1.6 mm deep (Figure 3). Spots of discoloration and surface damage indicated that the other three screws had also been in contact with the leg.

Figure 3

Top fastener in contact with the landing gear leg

Examination of the fracture surface

Examination of the fracture surface under a microscope revealed multiple cracks emanating from the dent, which had been caused by contact with the screw. The surface in the area of the dent was discoloured and corroded, and beachmarks extended from the centre of the dent to approximately 0.5 mm from the inner surface of the landing gear leg (Figure 4). The beachmarks were evidence of fatigue cracking and the corrosion and discolouration showed that the crack had grown over a period of time before it failed in overload. Due to the nature of the failure it was not possible to estimate the time period over which this occurred.

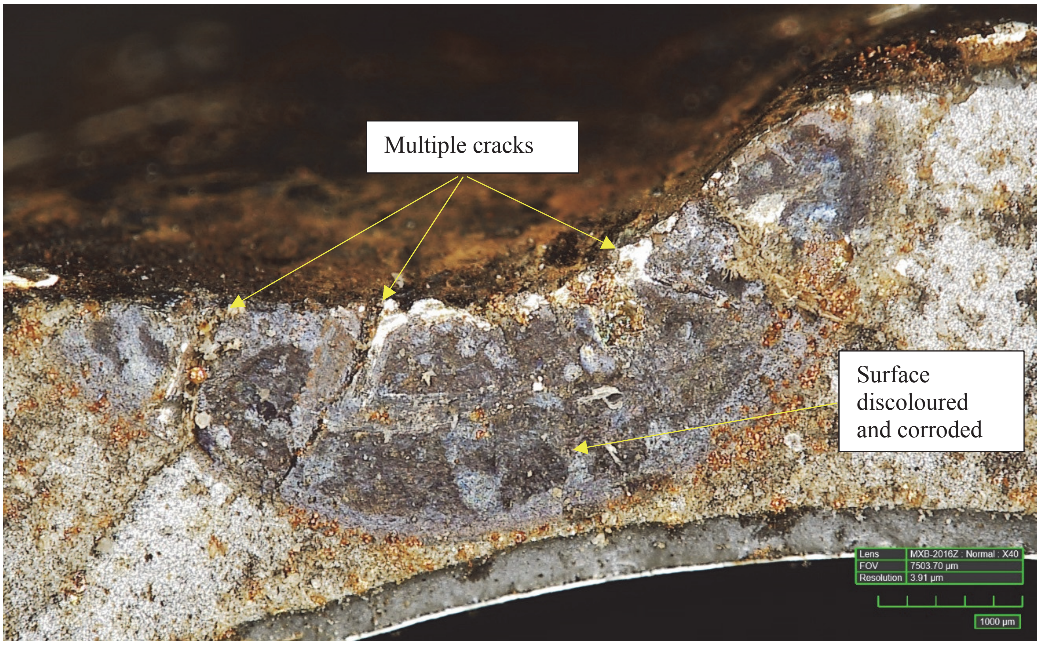


Figure 4
Multiple cracks and corroded surface

Clearance between the screws and landing gear leg

Contact between the landing gear leg and the end of the screws might have been a result of the screws being too long, the fairing being too close to the leg, or a combination of both.

The four screws that secured the right fairing were compared with the correct screw (S1021Z6-6) identified in the parts catalogue, which was 9 mm long, made of steel and therefore magnetic. Only two of the four screws, including the one involved in the fatigue crack, were magnetic and of the correct length. The insurance loss adjuster provided the AAIB with the four screws from the left main wheel fairing and reported that there were witness marks indicating that these screws had also made contact with the leg. Only one of these screws was magnetic, three were of the correct length and one was 2 mm longer.

It was not possible to determine if the wheel spats had the correct profile and clearance from the landing gear leg.

Maintenance

A 150-hour check was carried out in accordance with Issue 1 of the CAA Light Aircraft Maintenance Programme (LAMP) and completed on the 10 October 2016, which was 34 flying hours and two months prior to the accident.

The LAMP required the landing gear structural members, the brakes, and the wheel fairings to be examined during the 150-hour check. The maintenance records show that during this check the brake pads were replaced, which would have required the spats to have been removed.

Comment

The right landing gear leg failed as a result of a fatigue crack that initiated from damage caused by the end of a screw in contact with the leg. The condition of the fracture surface indicated that the fatigue crack was present for a period of time. The cyclic loads in the leg during the landing and taxiing would have caused the fatigue crack to grow until the leg eventually failed in overload during a ground roll.

Witness marks show that the screws securing the fairings on both main wheel spats had been in contact with their respective landing gear legs. While some of the eight screws were longer than the correct screw identified in the parts catalogue, the screw where the fatigue crack initiated was of the correct length. This indicates that it was probably some aspect of the fitting or profile of the wheel spat and fairing that had resulted in insufficient clearance between the screws and the landing gear leg.

ACCIDENT

Aircraft Type and Registration:	Pegasus Quik, G-CDMU	
No & Type of Engines:	1 Rotax 912ULS piston engine	
Year of Manufacture:	2005 (Serial no: 8121)	
Date & Time (UTC):	30 July 2016 at 1715 hrs	
Location:	Private strip, Hawksview, Cheshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Serious)	Passengers - N/A
Nature of Damage:	Disruption to the cockpit structure and flex wing	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	58 years	
Commander's Flying Experience:	76 hours (of which all were on type) Last 90 days - 30 hours Last 28 days - 8 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft was landing on a runway with a crosswind. Just prior to touchdown the aircraft weathercocked to the right. The pilot initiated a go-around but realised that there was insufficient clearance from a fence along the side of the runway. She immediately closed the throttle but was unable to avoid a collision with the fence. The aircraft was severely damaged and the pilot sustained serious, but not life-threatening, injuries.

History of the flight

The pilot was landing the aircraft on a grass runway heading 260°. The estimated wind was 8 kt at 300° (40° to the runway heading) with gusts. Just prior to touching down the aircraft weathercocked to the right. The pilot immediately attempted a go-around but realised that there was now insufficient clearance from a barbed wire and chain-link fence running along the right side of the runway. She reduced power but was unable to avoid a collision with the fence. The aircraft was severely damaged and the pilot sustained serious, but not life-threatening, injuries.

Discussion

With the crosswind any gusting would have an instant effect on this very lightweight aircraft. In the pilot's own assessment, the cause of the accident was inexperience in gusty conditions. However, in this case it would have been difficult to react to check the weathercocking and then regain the runway heading in the narrow confines of the runway and fence. Therefore the go-around was the best option but the aircraft did not have enough height to clear the fence.

ACCIDENT

Aircraft Type and Registration:	Rotorsport UK Cavalon, G-EVAA
No & Type of Engines:	1 Rotax 914-UL piston engine
Year of Manufacture:	2015 (Serial no: RSUK/CVLN/014)
Date & Time (UTC):	11 December 2016 at 1308 hrs
Location:	Wolverhampton Halfpenny Green Airport, Staffordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Engine cowling and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	183 hours (of which 46 were on type) Last 90 days - 13 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

During takeoff from Runway 28 at Wolverhampton Halfpenny Green Airport, the pilot observed that the autogyro took longer than normal to gain speed and he described hearing a noise from the right side of the aircraft. Shortly after takeoff ATC reported that there was debris on the runway. Once this had been removed from the runway, the pilot conducted a flypast of the tower to enable an inspection of the autogyro. Nothing unusual was reported and the autogyro made a normal landing, whereupon it became apparent that the right side of the engine cowling was missing.

The pre-flight inspection checklist for the Rotorsport Cavalon requires removal of the single-piece engine cowling, which is secured by 16 fasteners, 8 on each side. Replacement of the cowling requires all the fasteners to be properly located before any are locked. The pilot reported that after locking the fasteners on the left side of the cowling, he became distracted by a person who had stopped to talk.

Upon resuming the pre-flight inspection, he continued with the remaining items on the checklist, but forgot to lock the right side of the cowling, which subsequently detached from the aircraft during takeoff.

ACCIDENT

Aircraft Type and Registration:	Tango 2, RA-0542A
No & Type of Engines:	1 Yamaha Genesis
Year of Manufacture:	2016
Date & Time (UTC):	25 August 2016 at 1345 hrs
Location:	Popham Airfield, Hampshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Rotor, propeller and left side of the open canopy
Commander's Licence:	No details provided
Commander's Age:	47 years
Commander's Flying Experience:	450 hours (of which 35 were on type) Last 90 days - 60 hours Last 28 days - 25 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and video clip

The pilot was taking part in the FAI World Paramotor and Microlight Championship in the Autogyro Tandem class and lost control of the gyrocopter during takeoff. Video footage of the takeoff shows the gyrocopter rotating steeply with the rotor blade hitting the ground behind the gyrocopter. It then rolled to the left before coming to a stop on its side. The pilot and crew were unharmed.

Bulletin Correction

There was an error in the report header information when this report was sent to press. The text should read:

Persons on Board: Crew - **2** Passengers - None

The online version of this report was corrected when published on 11 May 2017.

ACCIDENT

Aircraft Type and Registration:	Thruster T600N 450, G-OASJ
No & Type of Engines:	1 Jabiru 2200A piston engine
Year of Manufacture:	2003 (Serial no: 0037-T600N-090)
Date & Time (UTC):	14 September 2016 at 1105 hrs
Location:	Bradley's Lawn Airfield, Heathfield, East Sussex
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Extensive damage, beyond economic repair
Commander's Licence:	Student
Commander's Age:	41 years
Commander's Flying Experience:	61 hours (of which 55 were on type) Last 90 days - 10 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

A student pilot was carrying out his second solo flight and was on finals to land at Bradley's Lawn Airfield in East Sussex. The pilot was unable to establish a stable approach and bounced heavily on touchdown. He applied power to go around and the aircraft yawed, rolled to the left and before he could take corrective action the aircraft lodged in nearby trees. The pilot was uninjured but the aircraft was damaged beyond economic repair.

History of the flight

The pilot had carried out his first solo flight approximately three weeks before at Headcorn Airfield. The pilot and his instructor had returned to Headcorn to conduct circuit practices in crosswind conditions. After the circuit practice they flew back to Bradley's Lawn Airfield where the aircraft and instructor were based.

The pilot's performance during the circuits earlier in the day had been good, so it was decided that he should make a short local solo flight to land back at Bradleys Lawn Airfield. After an uneventful flight he joined the circuit. During his final approach he became concerned that he was going to undershoot and modified his flight path accordingly. However, a stable approach was not established and as he flared the aircraft, it rolled left to right, contacted the ground and bounced heavily. His instructor advised a go-around over the radio and the pilot applied full power. The aircraft immediately yawed and rolled to the left and headed towards nearby trees. Before the pilot could react, the aircraft lodged in the trees approximately 15 metres from the ground. The aircraft was badly damaged and the pilot, although uninjured, had to be rescued by the emergency services.

Instructor's comment

The instructor had been satisfied with the student's flying skills on the day of the accident and commented on his student's proficiency in all aspects of the circuit practice and the return flight to the home airfield. He was therefore "very content" to allow the pilot to carry out his second solo flight.

Pilot's assessment

In the pilot's own analysis after the accident, he considered there to be a number of contributory factors. With hindsight he felt that he had not been fully comfortable with his first solo landing at Headcorn Airfield three weeks before. He also felt that it might have been unwise to attempt a solo landing at Bradley's Lawn, which he considered to be more challenging than Headcorn. However, he took off and re-joined the circuit without any problems but became uneasy during the latter part of his final approach and did not feel in control of the aircraft. The wing rock and bounce further unsettled him. When he applied full power to go around, he did not react quickly enough to counter the torque reaction of the aircraft and this he attributed to inexperience in a stressful situation.

ACCIDENT

Aircraft Type and Registration:	Zenair CH 601 XL (P) Zodiac, 54-ASJ
No & Type of Engines:	One Rotax 912 ULSFR piston engine
Year of Manufacture:	2014 (Serial no 6-6702)
Date & Time (UTC):	22 August 2015 at 0820 hrs
Location:	Near Sandown Airport, Isle of Wight
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	ULM Pilot Certificate (France)
Commander's Age:	60 years
Commander's Flying Experience:	670 hours (of which 64 were on type) Last 90 days - 40 hours Last 28 days - 15 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot took off from Sandown Airport and the aircraft immediately started an unintended turn to the left. The pilot applied right rudder and right aileron in an effort to counter the turn, but the inputs appeared ineffective. A shallow climbing left turn continued until the aircraft stalled and entered an incipient spin to the left. The aircraft crashed into a grass field and caught fire but the pilot survived, sustaining serious injuries.

History of the flight

On 19 August 2015, the pilot contacted Sandown Airport by e-mail and advised that he would like to fly in on Friday, 21 August, with a planned departure on Sunday, 23 August. That weekend, 22 to 23 August 2015, Sandown Airport was holding an *'End of the War 70th Celebration Weekend'* event.

Having arrived at Sandown on 21 August, the pilot's plans then appeared to change, as he departed the next morning, 22 August, for a return flight to France. Grass Runway 05 was in use and the weather conditions were good, with the airfield windsock indicating that the surface wind was from a north-easterly direction at 5 kt to 10 kt. The 0820 hrs METAR at Southampton Airport, 19 nm north-west, reported a surface wind from 060° at 5 kt, CAVOK and a temperature of 18°C.

The pilot performed his pre-flight inspection and started the engine. Once the pre-departure checks were complete, he taxied to Runway 05 and commenced a rolling takeoff, with approximately half flap set, as estimated from a photograph taken by a witness. After a ground roll of about 350 m, the aircraft (using the callsign F-JVVV) lifted into the air and immediately started to turn left. It also pitched up and momentarily reached a steep nose-high attitude, before adjusting to a more normal climb attitude. The pilot, who had not intended to turn left, reported that he reduced power at a height of about 30 ft to try and keep the aircraft tracking straight ahead. Once the track appeared to straighten, he reapplied power. The flight continued with the aircraft in a nose-up attitude and in a banked skidding turn to the left. It then straightened momentarily, lost height, and appeared to enter a stall and incipient spin to the left.

The aircraft, which was airborne for a total of 20 seconds, crashed into a grass field 300 m to the north of the Runway 05 threshold and there was a post-crash fire. The pilot did not remember the accident but recalled hearing the voices of the air traffic controller, presumably on the radio, and of people approaching the aircraft after the impact. He was helped out of the aircraft and given emergency medical assistance before being transferred to a local hospital.

Witness information

There were a number of eyewitnesses to the accident and there was also a video recording of the entire flight, together with still photographs taken from alongside the runway. The displacement of the flight control surfaces could be seen in both the photographs and the video footage.

At the start of the takeoff roll, the ailerons were in the neutral position and approximately half flap was deployed. The aircraft appeared to accelerate normally along the runway and directional control was maintained. It bounced into the air briefly once or twice, before lifting off after a ground roll of approximately 350 m. As it lifted off, it immediately started to bank left. Right aileron and right rudder control deflections could be seen, but the left turn continued. The initial climb to a height of about 80 ft was steep, then the climb rate reduced somewhat, although a nose-up pitch attitude was maintained throughout the flight. Right rudder and right aileron inputs were apparent throughout the remainder of the flight but the aircraft continued turning to the left, apparently flying slowly. As the heading reached almost the reciprocal of the original runway heading, there was a marked loss of height, the left wing dropped and the aircraft entered an incipient spin.

Pilot information

The pilot had flown ultralight aircraft for more than 20 years. His recollection of the accident was incomplete but he considered that the cause of the accident may have been a jammed aileron control.

Aircraft information

The pilot had built the aircraft himself from a partial kit supplied by the manufacturer. It was completed and first flown in July 2014 and, at the time of the accident, had flown

64 hours. The documentation for the aircraft indicated that the maximum engine power was 59 kW (80 hp). However, the engine's ULSFR designation suggests that it was a 75 kW (100 hp) engine. Manufacturer's data indicates that, at maximum takeoff weight and standard atmospheric conditions, the ground roll during takeoff would be 168 m with a Rotax 100 hp engine installed.

The aircraft has nosewheel steering, an all flying vertical tail (rudder) and conventional ailerons which are attached to the wing with a 'hingeless' system. The flaps are electrically operated and their extension is judged visually from their position relative to the ailerons. A camera was mounted on the left wing.

Aerodrome information

Sandown Airport is unlicensed. The runway, which has a grass surface and is orientated 05/23, is 884 m in length and 40 m wide. Runway 05 has a slight downslope. There are hangars located to the left of the runway and beyond them a line of trees.

Noise abatement procedures require departing traffic to climb straight ahead for at least 1 nm, before commencing a turn.

Analysis

There was nothing unusual observed about the takeoff ground roll and, as the aircraft lifted off, it immediately banked left and started turning to the left. This turn was not intended and the pilot attempted to correct with right rudder and aileron control inputs. However, these were not effective, so, at a height of about 30 ft, he reduced power in an effort to regain directional control. This appeared to be partially effective as the bank angle was reduced. However, there were trees ahead, so he reapplied full power.

There could be a number of possible reasons why the aircraft made an unintended turn to the left, as it lifted off the ground. However, there was insufficient evidence to identify any particular factor. Once the aircraft had turned away from the runway track, the pilot's options were limited by the obstacles in his path. The nose-high attitude probably led to a reduction in airspeed, thereby reducing the effectiveness of the flight controls and ultimately leading to a stall.

Conclusion

During departure, the aircraft immediately started an unintended turn to the left after it had lifted off. The pilot applied right rudder and right aileron in an effort to counter the turn but the inputs appeared ineffective. A shallow climbing left turn continued towards a downwind direction until the aircraft stalled and entered an incipient spin to the left. The aircraft crashed into a grass field and caught fire but the pilot survived, sustaining serious injuries.

There was insufficient evidence to establish why the aircraft had behaved as it did and why the accident occurred.

Miscellaneous

This section contains Addenda, Corrections and a list of the ten most recent Aircraft Accident ('Formal') Reports published by the AAIB.

The complete reports can be downloaded from the AAIB website (www.aaib.gov.uk).

BULLETIN CORRECTION

Aircraft Type and Registration:	Quik GTR, G-CIDG
Date & Time (UTC):	11 November 2016 at 1600 hrs
Location:	Headcorn Aerodrome, Kent
Information Source:	Aircraft Accident Report Form submitted by the pilot

AAIB Bulletin No 2/2017, page 60 refers

The first sentence of the report on page 60 of the Bulletin incorrectly referred to a ‘twin-engine aircraft used by the airfield’s skydiving centre’. The full text of the first sentence should read:

> The pilot was about to turn the microlight onto finals just as a Cessna 208 (**single**-engined turbine aircraft) descended ahead onto finals.

The online version of this report was corrected on 23 March 2017.

TEN MOST RECENTLY PUBLISHED FORMAL REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

2/2011 Aerospatiale (Eurocopter) AS332 L2 Super Puma, G-REDL
11 nm NE of Peterhead, Scotland
on 1 April 2009.

Published November 2011.

1/2014 Airbus A330-343, G-VSXY
at London Gatwick Airport
on 16 April 2012.

Published February 2014.

2/2014 Eurocopter EC225 LP Super Puma
G-REDW, 34 nm east of Aberdeen, Scotland on 10 May 2012
and
G-CHCN, 32 nm south-west of Sumburgh, Shetland Islands
on 22 October 2012.

Published June 2014.

3/2014 Agusta A109E, G-CRST
Near Vauxhall Bridge,
Central London
on 16 January 2013.

Published September 2014.

1/2015 Airbus A319-131, G-EUOE
London Heathrow Airport
on 24 May 2013.

Published July 2015.

2/2015 Boeing B787-8, ET-AOP
London Heathrow Airport
on 12 July 2013.

Published August 2015.

3/2015 Eurocopter (Deutschland) EC135 T2+, G-SPAO
Glasgow City Centre, Scotland
on 29 November 2013.

Published October 2015.

1/2016 AS332 L2 Super Puma, G-WNSB
on approach to Sumburgh Airport
on 23 August 2013.

Published March 2016.

2/2016 Saab 2000, G-LGNO
approximately 7 nm east of Sumburgh Airport, Shetland
on 15 December 2014.

Published September 2016.

1/2017 Hawker Hunter T7, G-BXFI
near Shoreham Airport
on 22 August 2015.

Published March 2017.

Unabridged versions of all AAIB Formal Reports, published back to and including 1971, are available in full on the AAIB Website

http://www.aaib.gov.uk

GLOSSARY OF ABBREVIATIONS

aal	above airfield level
ACAS	Airborne Collision Avoidance System
ACARS	Automatic Communications And Reporting System
ADF	Automatic Direction Finding equipment
AFIS(O)	Aerodrome Flight Information Service (Officer)
agl	above ground level
AIC	Aeronautical Information Circular
amsl	above mean sea level
AOM	Aerodrome Operating Minima
APU	Auxiliary Power Unit
ASI	airspeed indicator
ATC(C)(O)	Air Traffic Control (Centre)(Officer)
ATIS	Automatic Terminal Information System
ATPL	Airline Transport Pilot's Licence
BMAA	British Microlight Aircraft Association
BGA	British Gliding Association
BBAC	British Balloon and Airship Club
BHPA	British Hang Gliding & Paragliding Association
CAA	Civil Aviation Authority
CAVOK	Ceiling And Visibility OK (for VFR flight)
CAS	calibrated airspeed
cc	cubic centimetres
CG	Centre of Gravity
cm	centimetre(s)
CPL	Commercial Pilot's Licence
°C,F,M,T	Celsius, Fahrenheit, magnetic, true
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European Aviation Safety Agency
ECAM	Electronic Centralised Aircraft Monitoring
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration (USA)
FDR	Flight Data Recorder
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth's gravity
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hrs	hours (clock time as in 1200 hrs)
HP	high pressure
hPa	hectopascal (equivalent unit to mb)
IAS	indicated airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IP	Intermediate Pressure
IR	Instrument Rating
ISA	International Standard Atmosphere
kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	knots indicated airspeed
KTAS	knots true airspeed
km	kilometre(s)
kt	knot(s)
lb	pound(s)
LP	low pressure
LAA	Light Aircraft Association
LDA	Landing Distance Available
LPC	Licence Proficiency Check
m	metre(s)
mb	millibar(s)
MDA	Minimum Descent Altitude
METAR	a timed aerodrome meteorological report
min	minutes
mm	millimetre(s)
mph	miles per hour
MTWA	Maximum Total Weight Authorised
N	Newtons
N_R	Main rotor rotation speed (rotorcraft)
N_g	Gas generator rotation speed (rotorcraft)
N_1	engine fan or LP compressor speed
NDB	Non-Directional radio Beacon
nm	nautical mile(s)
NOTAM	Notice to Airmen
OAT	Outside Air Temperature
OPC	Operator Proficiency Check
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot in Command
PNF	Pilot Not Flying
POH	Pilot's Operating Handbook
PPL	Private Pilot's Licence
psi	pounds per square inch
QFE	altimeter pressure setting to indicate height above aerodrome
QNH	altimeter pressure setting to indicate elevation amsl
RA	Resolution Advisory
RFFS	Rescue and Fire Fighting Service
rpm	revolutions per minute
RTF	radiotelephony
RVR	Runway Visual Range
SAR	Search and Rescue
SB	Service Bulletin
SSR	Secondary Surveillance Radar
TA	Traffic Advisory
TAF	Terminal Aerodrome Forecast
TAS	true airspeed
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Collision Avoidance System
TGT	Turbine Gas Temperature
TODA	Takeoff Distance Available
UHF	Ultra High Frequency
USG	US gallons
UTC	Co-ordinated Universal Time (GMT)
V	Volt(s)
V_1	Takeoff decision speed
V_2	Takeoff safety speed
V_R	Rotation speed
V_{REF}	Reference airspeed (approach)
V_{NE}	Never Exceed airspeed
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional radio Range

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