

Accident

Aircraft Type and Registration:	Jodel DR1050-M1, G-BAEE	
No & Type of Engines:	1 Continental Motors Corp O-200-A piston engine	
Year of Manufacture:	1964 (Serial no: 579)	
Date & Time (UTC):	6 October 2022 at approximately 1135 hrs	
Location:	Near Jackrell's Farm airstrip, Horsham, West Sussex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Serious)	Passengers - 1 (Serious)
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	85 years	
Commander's Flying Experience:	2,004 hours (of which at least 700 were on type) Last 90 days - 12 hours Last 28 days - 4 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft was being flown for the renewal of its Permit to Fly. Having completed most of the required items, the pilot flew the aircraft back to Jackrell's Farm airstrip to land. The approach to the airstrip resulted in a go-around during which the aircraft struck the tops of tall trees beyond the end of the runway. The aircraft then struck the ground in the field beyond the trees in an upright attitude. Both the pilot and the aircraft owner suffered serious injuries in the accident. Although the aircraft owner recalled that the aircraft was high and fast on the approach and that a go-around was commenced from close to the end of the runway, this could not be verified as the pilot had no recollection of the flight. The investigation found no mechanical or technical cause for the accident.

History of the flight

The aircraft had not been flown for over two years due to a combination of the owner's health and the Covid-19 pandemic, and both the aircraft Permit to Fly and the owner's class rating had expired. The owner decided that he wanted to sell the aircraft as he was no longer using it, and as part of the sale arranged for the Permit to Fly to be renewed. The aircraft owner ran the engine of G-BAEE occasionally over the period it had not flown and a long layup inspection was also completed before the aircraft was approved to fly for the permit renewal flight. Since the owner was not able to do the flight himself, he arranged

with a friend who also operated an aircraft from Jackrell's Farm airstrip to fly the aircraft, with the owner acting as observer.

Having fuelled the aircraft and ground run the engine, both the pilot and aircraft owner were seen in the aircraft as it taxied out for a takeoff on Runway 21. The pilot sat in the left seat, and the owner in the right seat. Witnesses reported watching the aircraft takeoff at around 1115 hrs. Radar detected the aircraft at 1124:50 hrs as it climbed out from Jackrell's Farm. Having conducted the planned items for the permit renewal, the aircraft returned to land. Its last recorded radar position was south of the airstrip at 1134:44 hrs. A few minutes later the aircraft struck tall trees beyond the end of Runway 03 having gone around from an approach to land. This impact substantially reduced the aircraft's forward speed and as a result it came down into the field just beyond the trees. Both the pilot and aircraft owner were seriously injured.

There were no witnesses to the approach or the accident. Having regained consciousness sometime after the accident, the aircraft owner was able to find the pilot's mobile phone to make an emergency call. This call was made at 1318 hrs, over 1.5 hours after the accident. The air ambulance was the first to arrive at the site at 1341 hrs, approximately two hours after the accident.

Accident site

The accident site was located in a field just beyond and to the right of the departure end of grass Runway 03 at Jackrell's Farm airstrip. The aircraft was upright and all the aircraft structure was present except for the outer two thirds of the right wing. Damage to trees on the adjacent field boundary and tree debris on the accident site indicated that the aircraft had struck the trees, which were approximately 15 m tall. The outer portion of the right wing was found on the opposite side of the tree line, with some small items of aircraft skin found in the trees. A single impact mark on the right wing leading edge close to the wing tip was consistent with the wing having struck a tree. The force of the right wing impact with the tree caused the aircraft to yaw to the right, pivoting around the impact point before continuing to the ground.

There were no appreciable ground marks other than in the immediate impact area, which indicated a predominantly vertical descent in a level attitude.

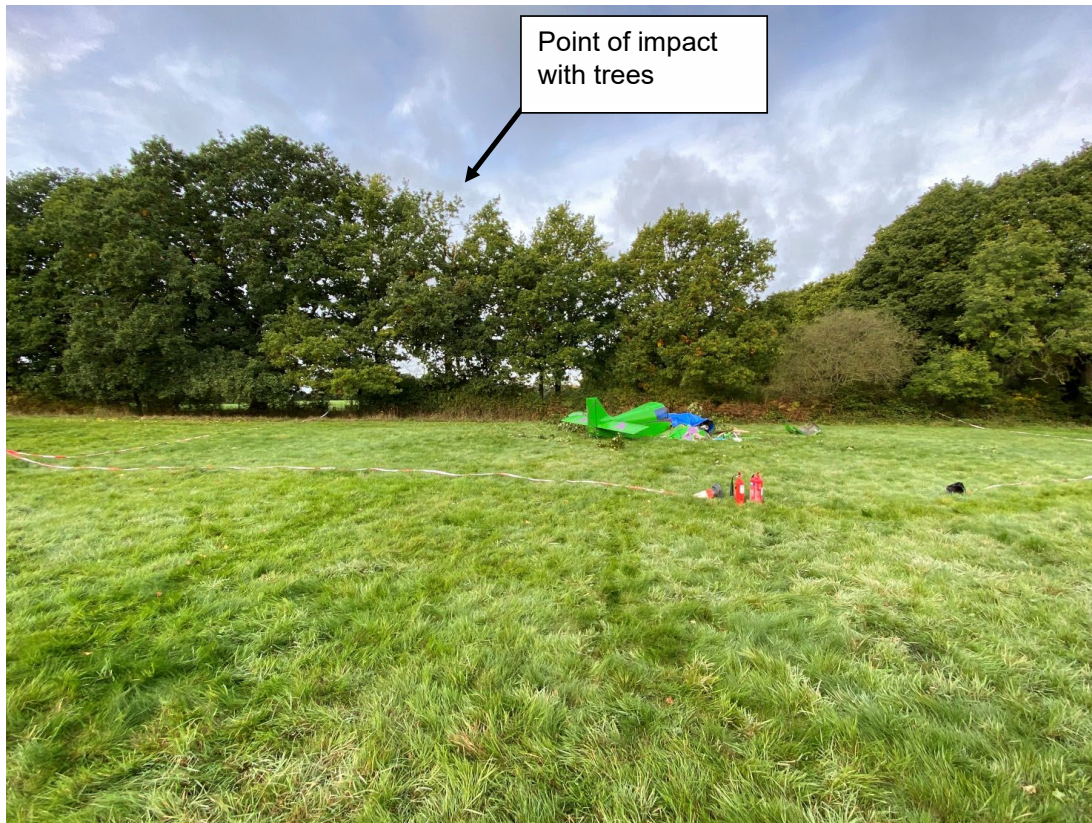


Figure 1
Accident site

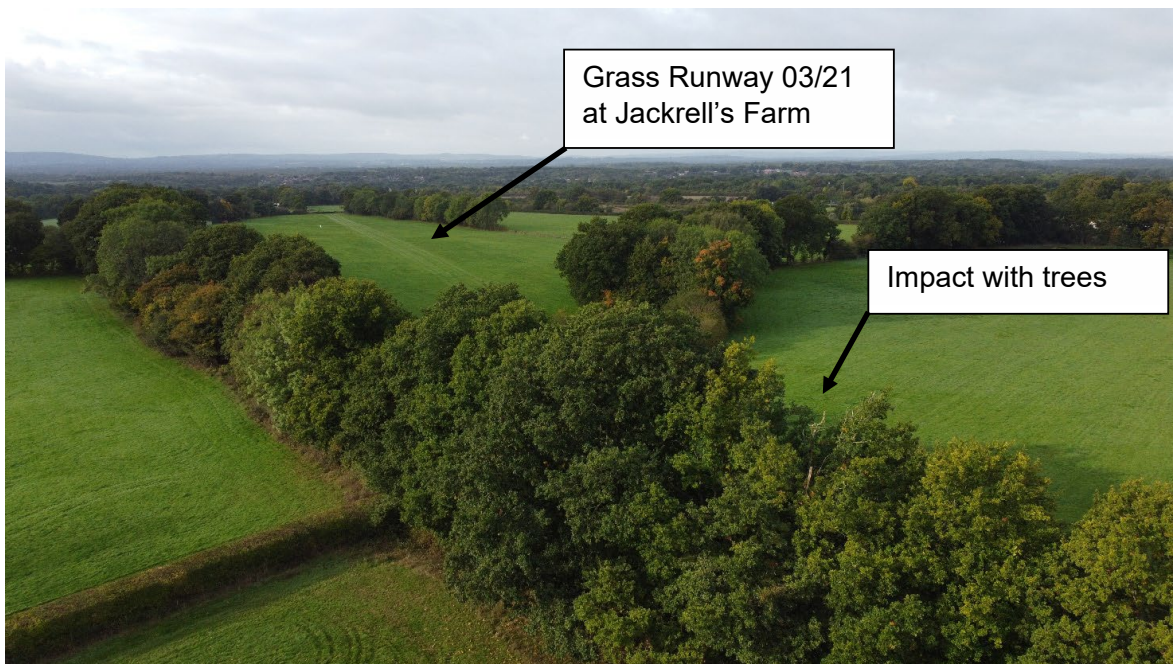


Figure 2
Aerial view toward Jackrell's Farm airstrip from the accident site



Figure 3

Tree line viewed from direction of aircraft travel

Recorded information

The radar stations at Gatwick and Pease Pottage detected the aircraft for parts of the accident flight south of the airstrip. The aircraft was equipped with a Mode S transponder but only primary radar returns were detected, indicating that the transponder was turned off and therefore no altitude information was recorded. Some altitudes can be inferred when the aircraft transitions in and out of the minimum height for radar coverage in the area based on the viewshed¹ from the Gatwick radar head, but not when in radar coverage with the transponder turned off. The first detection was at 1124:50 hrs as the aircraft climbed into line of sight of the Gatwick radar, implying the aircraft was at a height of about 800 ft agl. The last detection was about 10 minutes later at 1134:56 hrs, 1 nm south of the airstrip, at a height less than 890 ft agl.

Footnote

¹ A viewshed is the geographical area that is visible from a location. It includes all surrounding points that are in line-of-sight with that location and excludes points that are beyond the horizon or obstructed by terrain and other features such as buildings and trees.

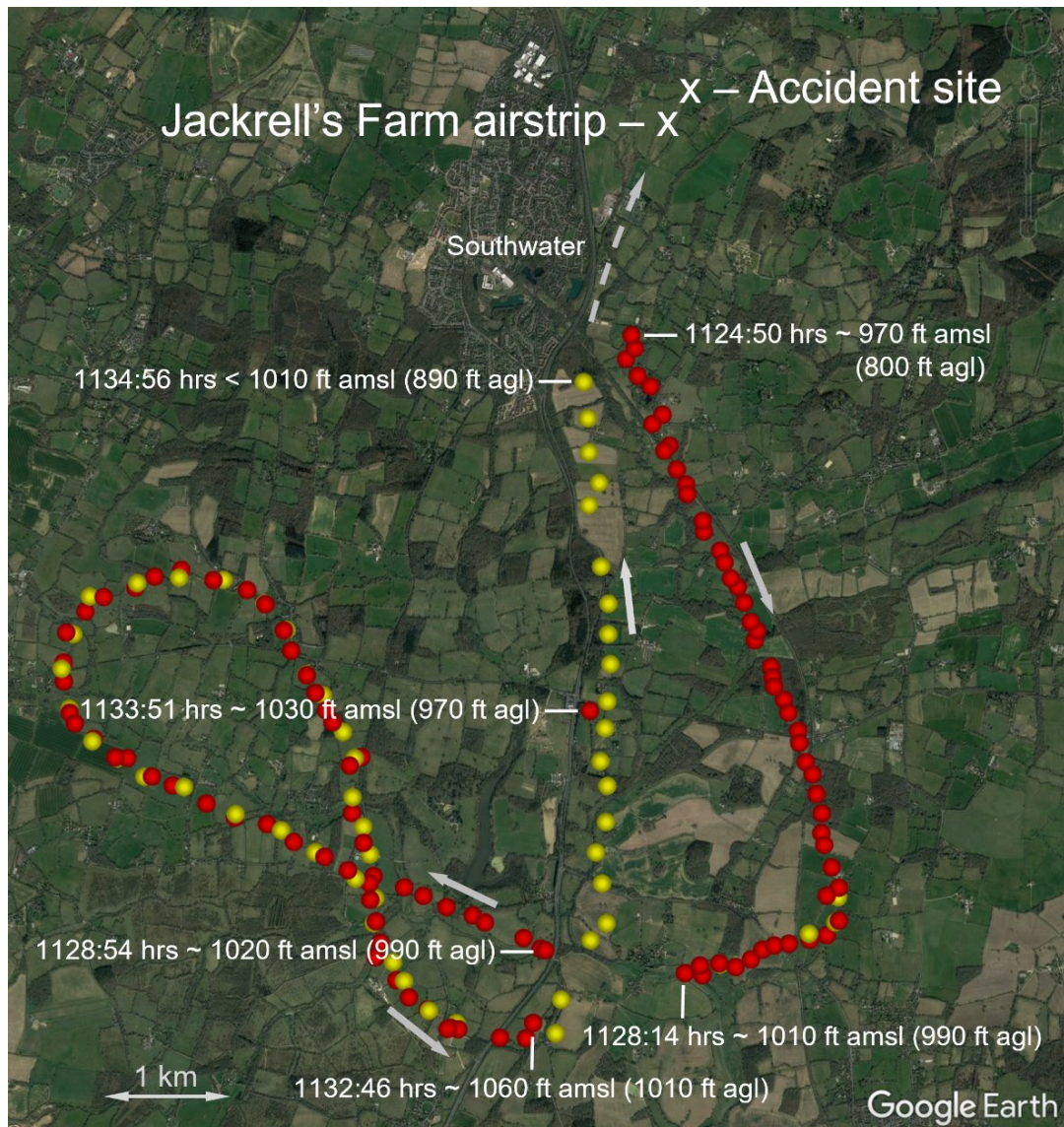


Figure 4

Gatwick (red) and Pease Pottage (yellow) primary radar track of aircraft

Aircraft information

The Jodel D1050-M1 is a four-seat, low-wing, tailwheel aircraft of fabric-covered wooden construction. G-BAEE was factory built in 1964 and was fitted with a Continental O-200-A horizontally opposed piston engine and two-bladed fixed pitch metal propeller. The owner purchased G-BAEE in 1991.

The aircraft's most recent Permit to Fly had been issued on 16 July 2018, when the aircraft had accrued 2,440 flying hours. It flew a further two hours before its Permit to Fly expired on 15 July 2019 and was not flown again until the accident flight.

Aircraft maintenance

The owner had decided to sell the aircraft and consulted his LAA inspector with a view to revalidating the lapsed Permit to Fly. The inspector advised the owner that the inspection would need to take account of the fact that the aircraft had not flown for several years, including looking for any evidence of corrosion, wood rot, rubber degradation, rodent or environmental damage. This inspection revealed no damage.

Other maintenance conducted by the owner included draining and refilling the fuel tanks with fresh fuel, cleaning the fuel filter and gascolator, draining and refilling the engine oil and replacing the oil and air filters. Engine ground runs were carried out and the static rpm was noted as 2,350 rpm at full throttle. The magneto timing was checked, and a cylinder compression test conducted when the engine was hot revealed good compression on all cylinders. The tubular frames of the front seats were inspected for cracking in accordance with a mandatory LAA Airworthiness Information Leaflet², no cracks were found. The functioning of the airspeed indicator was also checked and confirmed to be satisfactory. The maintenance was documented on worksheets.

The inspector was satisfied with the condition of the aircraft and engine and certified the work by signing the aircraft and engine logbooks and the Permit Maintenance Release on the worksheets. These were dated 14 July 2022. As the previous permit had lapsed by more than 12 months, the LAA required that a Permit Flight Release Certificate (PFRC) was issued by LAA Engineering rather than by an inspector in the field.

An '*Application for renewal (revalidation) of Permit to Fly*' form was completed jointly by the owner and inspector and submitted by the owner to LAA Engineering. The form included the inspector's recommendation that the Permit to Fly be revalidated, subject to the completion of a check flight.

Having reviewed the application, LAA Engineering issued a PFRC on 4 August 2022, valid for one month. The check flight did not take place during this period as the owner had been overseas and a second PFRC was issued on 16 September, again valid for one month.

Aerodrome information

Jackrell's Farm airstrip is a grass strip just to the south of Horsham, West Sussex. It has a single glass runway orientated 03/21 which is 550 m long. There are tall trees around the airfield including some oak trees which are 100 m from the end of Runway 03 on the extended centreline, although there are gaps in the trees at the thresholds at each end of the runway. Guidance for the airstrip states that takeoffs are to be on Runway 21 with landings on Runway 03, in part because of the tall trees. The exception to this is for microlights and very light two seaters, neither of which describes G-BAEE.

Footnote

² LAA MOD/845/001 dated 27 November 2019, applicable to all factory-built Jodel DR100 series aircraft operating under an LAA administer Permit to Fly.

Preliminary aircraft examination

Damage to the aircraft was consistent with a vertical descent in a level attitude, with the impact loads having been absorbed predominantly by the undercarriage, engine and cockpit structure. The engine mounts and firewall had failed. The carburettor, mounted underneath the engine, had separated from the induction manifold. One of the metal propeller blades was largely undamaged and the other exhibited damage to the tip consistent with the propeller having been turning at the time of the accident.

The forward fuel tank was empty, having ruptured, and a strong smell of fuel was apparent. The rear fuel tank located in the fuselage was intact and approximately 11 litres of motor gasoline were retrieved from it.

Examination of the flight control runs showed that some had experienced distortion as a result of the impact, but integrity of the control runs was established.

The front seats were mounted on supporting structure above the main spar. Forward of this the cockpit was extensively disrupted. Although it remained in position, the right seat had completely separated from the aircraft structure. Both front seats were fitted with a combined lap strap and shoulder harness. The lap straps were mounted on the seats and the inertial reels for shoulder harnesses were mounted on a bulkhead underneath the rear seats. The harness fabric and attachments were intact and functional and there was evidence that they were being worn by the occupants at impact.

Detailed aircraft examination

General

Damage to the aircraft was consistent with striking trees and the subsequent impact with the ground. The underlying wooden structure and fabric covering was in good condition, with no evidence of moisture ingress, rot or other environmental damage.

Airbrakes

The airbrake lever was found in the locked closed position and could not be moved due to distortion. Together with the absence of damage to the airbrake panels themselves, this indicated that the airbrakes were closed at impact.

Seats

The front right seat had failed where the vertical portion of the frame joined the horizontal portion of the frame. This was consistent with the vertical loading sustained by the aircraft during impact with the ground and the failure was outside the area covered by the mandatory LAA inspection of the seat frame.

Engine and fuel controls

The engine controls were mostly cable-operated and, due to substantial disruption forward of the firewall, it was not possible to verify their pre-impact positions. The No 1 magneto was ON and the No 2 magneto was OFF. The battery and alternator master switches were ON.

The fuel selector valve, mounted on the aft face of the engine firewall, had three positions: POSITION 1 (off), POSITION 2 (rear tank selected) and POSITION 3 (front tank selected). The valve was found in an intermediate position between POSITION 1 AND POSITION 3. The valve operating linkage and the fuel selector handle mounted on the instrument panel were substantially disrupted, which may have caused the valve to move during the impact. By blowing compressed air through the valve it was determined that if it had been in the as-found position prior to the accident, fuel from the front tank would still have been able to flow through the valve to supply the engine, but likely at a reduced flow rate.

The aircraft owner recalled that the fuel selector handle had been selected to the front tank (clockwise) prior to the accident. No markings or decals were present to indicate the tank positions on the fuel selector handle, but the owner stated that labels had been present prior to the accident flight. It was not determined whether the engine or fuel controls were disturbed by the first responders, but it is unlikely in the case of the fuel selector due to the absence of labelling and the disruption it had suffered.

Engine

Apart from impact damage to the underside, the engine was relatively intact and rotated freely when turned. When tested, the cylinder compression ratios were lower than those noted in the maintenance worksheets, substantially so in the case of cylinder No 1. Air could be heard leaking past the piston rings and/or the exhaust valves. The compression test was performed when the engine was cold and at a reduced air pressure, so may not have been fully representative.

Partial disassembly of the engine revealed that it was generally in good condition although some minor anomalies were noted. The piston rings on all cylinders were intact and correctly seated. The inlet valves from each of the four cylinders had an encrusted burnt deposit on the seat face of the valve. This could indicate that the engine had been running hot at some point or that the mixture was too rich, but the valve seats were clean and free from debris.

Survivability

Both occupants of the aircraft sustained serious injuries in the accident including spinal damage. The aircraft deceleration was largely vertical because the aircraft had little forward speed as it fell to the ground. The right seat of the aircraft was detached from its mountings and the left seat remained in place. Neither seat was designed to mitigate the loads associated with large vertical decelerations. Both occupants were over the age of 75 and at increased risk of fracture.

The seriousness of the injuries may have been compounded by the delay in alerting rescue services. There were no witnesses to the accident, and neither occupant was able to raise the alarm for some time. Having regained consciousness and managed to reach the pilot's mobile phone, the aircraft owner was able to call the emergency services. The air ambulance and other services arrived at the scene around two hours after the accident.

As the aircraft was operated under a Permit to Fly it was not required to be fitted with an Emergency Locator Transmitter (ELT) or for a personal locator beacon to be carried. These radio devices are activated manually or automatically in the event of an emergency and must be carried in aircraft with a Certificate of Airworthiness. ELTs that operate automatically in an accident (without the need for any action by the aircraft occupants), provide a means of alerting emergency services even if those in need of assistance are incapacitated.

Whilst a witness did see G-BAEE takeoff, neither occupant of the aircraft had informed anyone when they were about to depart and what time they were expected back. Whilst there was no requirement to provide this information to anyone, giving a friend or relative an expected time to call after the flight might provide an alert if things should not go to plan.

Weight and balance

G-BAEE had 106 litres of fuel on board for the permit renewal flight, with 52 litres in the front tank and 54 litres in the rear tank. The pilot and aircraft owner recorded the actual loaded weight for the flight as 705 kg, with the centre of gravity position recorded as 0.47 m aft of datum. Both these figures are inside the approved envelope. Whilst the weight may have changed during the flight as the fuel was consumed, it would have made no appreciable difference to the centre of gravity position, which would have remained inside the approved envelope.

Aircraft performance

The Jodel Flight Manual indicates that the maximum rate of climb at sea level is 650 fpm at maximum takeoff weight (780 kg), 709 fpm at maximum landing weight (740 kg) and 945 fpm at 600 kg. The aircraft weight at the beginning of the flight was noted on the Flight Test Schedule paperwork as 705 kg, at which the expected climb rate would be approximately 770 fpm.

During the flight the pilot performed a timed climb from 1,000 ft to 2,000 ft with normal best climb speed, maximum throttle and the airbrakes retracted. The Flight Test Schedule paperwork found in the wreckage indicated this climb took 90 seconds, which gives a rate of climb of 666 fpm. This figure is around 15% less than the performance expected from the flight manual. Whilst the test was not conducted at sea level, the recorded QNH was 1033 hPa and the outside air temperature 15°C, giving a density altitude of approximately 330 ft at 1,000 ft QNH. These atmospheric conditions alone would not account for a significant performance reduction.

When the aircraft last underwent a permit renewal in 2018, the recorded climb rate of 770 fpm at 680 kg was only 5% less than the book figure of 810 fpm. The test in 2018 was carried out in similar weather conditions (pressure and temperature) to that on the accident flight.

The aircraft owner did not recall the details of the timed climb but was able to state that the engine sounded normal during the final stages of the flight.

Meteorology

The southern part of the country was affected by a high-pressure system centred over northern France causing mild weather with a south-westerly airflow. Conditions were fine with good visibility. The cloud base was observed at between 2,500 ft and 4,500 ft. The London Gatwick Airport METAR at 1120 hrs gave a surface temperature of 16°C with a dewpoint of 8°C with wind observed at 240° at 11 kt. If the wind was similar at the airstrip this would have given a 10 kt tailwind on the landing runway. A pilot who was at the strip observed that the windsock suggested there was an 8 kt tailwind on Runway 03. The landing distance for G-BAEE was calculated from the performance information for the aircraft type.

Using the factors contained in the CAA Safety Sense Leaflet - '*Strip Flying*'³, the runway at Jackrell's Farm was sufficient for the planned landing in the conditions reported.

Using the chart provided in the Skyway Code⁴ the combination of temperature and dew point would put the aircraft at risk of moderate carburettor icing⁵ at cruise power settings and severe icing at descent power settings.

Personnel

The pilot had significant experience in light aircraft including in aircraft similar to G-BAEE. This included at least 700 hours experience of the same model of Jodel but with a different engine fitted. He had also flown G-BAEE on several occasions previously, although not recently. All his most recent flying had been exclusively on a three-axis microlight aircraft. The pilot was very familiar with Jackrell's Farm as his own aircraft was also based there.

The pilot has no memory of the accident flight and was unable to provide the investigation with any information. The aircraft owner stated that the permit renewal flight was complete with the exception of the baulked landing and the landing. The pilot had begun an approach to land on Runway 03. During this approach the aircraft owner felt that the pilot was flying too high and fast. The aircraft owner recalls that at some point the pilot decided to abandon the approach, but the aircraft was at a low height and close to the tall trees beyond the end of the runway.

Footnote

³ Civil Aviation Safety Sense Leaflet '*Strip Flying* (SS12), https://www.caa.co.uk/media/zrwcxv0/caa8230_safetysense_12-strip-flying_v12.pdf [accessed June 2023]

⁴ Civil Aviation Publication CAP 1535, <https://www.caa.co.uk/general-aviation/safety-publications-and-information/the-skyway-code/> [accessed April 2023].

⁵ Ice formation in a carburettor caused by the reduction in air pressure and air temperature in the carburettor venturi under certain atmospheric conditions.

Other information

All pilots adapt to the aircraft they fly, becoming familiar with the sights, sounds and performance. The three-axis microlight that the pilot flew regularly was lighter and able to slow down for landing more rapidly than G-BAEE. This would mean that if the pilot flew an approach using the technique and visual picture he was familiar with, this might have led to G-BAEE being too high and fast for the landing, the aircraft being harder to slow down than he was used to. Humans tend to revert to mental models they are familiar with such as when a driver changes from a manual to automatic car yet still seeks to push the clutch pedal down. These 'reversions' are often unconscious, and the driver or pilot may only realise once the action has been taken and the results are clear.

Analysis

During a go-around the aircraft collided with trees which arrested the aircraft's energy, causing it to pivot around the tree and land almost vertically and upright on its undercarriage. The absence of ground marks and the damage to the aircraft indicate predominantly vertical impact forces, which could account for the nature of the injuries sustained by the occupants.

The pilot had completed all his recent flying on a three-axis microlight aircraft which had significantly different performance to G-BAEE. As the pilot does not recall the flight, it is not possible to confirm his intentions or the techniques he was using. Given the recollection of the aircraft owner, it is possible that in making the approach into Jackrell's Farm the pilot had adopted the technique and visual picture he was used to from his regular flying in his own aircraft. This may have placed G-BAEE in a position where a landing was not possible. The position of the accident site and the account of the aircraft owner would indicate that a go-around was attempted but the aircraft performance was not sufficient to allow it to climb above the top of the tall trees.

Examination of the aircraft did not reveal any defects which could have affected its controllability. Evidence from the accident site indicated that the engine had been operating until the point of impact and this was consistent with the aircraft owner's account. Although examination and partial disassembly of the engine revealed several minor anomalies, it did not reveal any gross defects which could cause a substantial reduction in engine performance nor account for the reduced cylinder compression ratios. However, the satisfactory results of the compression test noted during maintenance, which was conducted when the engine was hot, indicate that this was probably not a factor that contributed to the accident.

Although the aircraft owner recalled that the fuel selector handle had been selected to the front tank prior to the accident, the fuel selector valve was found in an intermediate position. Possible explanations include that the fuel selector handle had not been rotated fully clockwise to the front tank position or that the disruption to the linkage caused the valve to move during the impact. However, if reduced fuel flow or reduced engine performance contributed to the accident in any way, it was in a subtle manner which was not detected by the aircraft owner.

The timed climb test performed during the flight for the permit renewal showed that the aircraft performance was around 15% below that in the performance tables provided by the manufacturer. The same climb test for the 2018 permit renewal flight, which was carried out in similar temperature and pressure conditions, saw only a 5% reduction from the book figures. It is possible that the aircraft performance was below that expected for reasons that could not be identified. It is also possible that the pilot's unfamiliarity with the type meant that the test was not performed exactly as required and this was the cause of the poorer climb performance recorded in the Flight Test Schedule paperwork. The investigation did not establish what contribution engine performance or pilot technique may have made to the aircraft's climb performance during the flight.

The occupants of G-BAEE were both rendered unconscious or unable to raise the alarm after the accident for a significant period. The accident was not witnessed nor was the site directly visible to anyone around the area. It was around 90 minutes before the alarm was raised and over two hours before the first emergency responders arrived at the scene and were able to render assistance to the seriously injured occupants. The lack of an automatically activating ELT meant that the pilot and aircraft owner were reliant on one of them being able to manually alert the emergency services. With the injuries suffered by both occupants, their ability to search for, reach and use a mobile phone were extremely limited. Fortunately, the aircraft owner was able to locate and use the pilot's mobile phone. Whilst it is not possible to speculate on what effect the delay might have had in the seriousness of the occupants' condition, such delays increase the risk of serious complication or fatality.

Conclusion

During an attempted go-around from an approach into Jackrell's Farm airstrip with a tailwind, the aircraft was unable to clear tall trees beyond the end of the runway. Although the aircraft owner recalled that the aircraft was high and fast on the approach, the pilot was unable to recall any of the flight.

There were no witnesses to the accident, the occupants were incapacitated, and an ELT was not fitted the aircraft. Consequently, no person or organisation was alerted to the accident for a significant period. Letting someone know a time to expect you to call after a flight is complete may enable appropriate assistance to be provided if things don't go to plan.

The investigation did not find any technical anomalies that could have substantially contributed to the accident.

Published: 24 August 2023.