AAIB Bulletin 8/2024

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(ALL TIMES IN THIS BULLETIN ARE UTC)

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:	Grumman FM2, Wildcat, G-KINL
No & Type of Engines:	1 Wright Aeronautical Corp CT7-9B piston engine
Year of Manufacture:	1942 (Serial no: 5744)
Date & Time (UTC):	6 July 2023 at 1615 hrs
Location:	Heveningham Hall, Suffolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Windscreen and canopy broken, propeller, fin and rudder disrupted
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	4,238 hours (of which 2 were on type) Last 90 days - 28 hours Last 28 days - 17 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was attending an annual public event at a private estate. During the landing on a grass runway, at an unlicensed private airstrip, the aircraft nosed over and came to rest inverted. The pilot was seriously injured. It is believed the surface of the runway had a solid crust on top of a softer sub-soil that the aircraft dug into which caused it to nose over.

The event organisers are planning to implement additional operational coordination and risk management measures for future events.

History of the flight

Background information

G-KINL, a Grumman FM2 (also known as a Wildcat), was one of 13 historic aircraft that were part of a fly-in and static display at a concours[1] of aircraft, which was part of the annual Heveningham Country Fair (HCF), held at Heveningham Hall (HH) Estate, near Walpole, Suffolk. This was the twenty fifth fair held at HH and was attended by about 35,000 members of the public over two days.

Footnote

[1] An exhibition of vintage or classic aircraft in which prizes may be awarded for those in the best or most original condition.

There were three grass runways at HH, orientated 03/21, 06/24 and 15/33 (Figure 1). Runway 03/21 was for the sole use of visitors to the fair that were flying in. In previous years there have been about 70 visiting aircraft. Runway 06/24 was for the sole use of the aircraft taking part in the concours fly-in and a flying display. Those that used Runway 06/24 were generally vintage aircraft. Runway 15/33 was not routinely used during the HCF.

The pilot had operated G-KINL from a grass runway at Duxford Airfield[2], Cambridgeshire, where it was based, after its restoration. Prior to departing for the HCF he flew it from a grass runway, on a local flight, as a refamiliarisation and to confirm it was serviceable.

To assist the pilot of G-KINL in manoeuvring the aircraft to its parking position at HH, and to take the pilot back to Duxford, a Rallye Minerva[3], with two ground crew, flew to HH ahead of G-KINL.

The accident flight

The pilot stated that the aircraft left Duxford at about 1530 hrs, with 102 US gallons of fuel. After an uneventful transit to HH, at about 1,500 ft amsl, G-KINL arrived in the area at about 1600 hrs; as did the Minerva. Prior to the arrival of G-KINL and the Minerva, a Waco UPF7[4] and a Focke Wulf FW44J[5] landed on Runway 24 without incident.

The pilot of G-KINL advised the pilot of the Minerva that he would let him land first. The Minerva pilot made an uneventful landing on Runway 24 and reported that the runway was fine.

The pilot of G-KINL then flew down Runway 24, to orientate himself to the runway direction, assess the approach over some trees in the undershoot and the proximity of trees on the sides of the runway, before positioning downwind to land. On the downwind leg he completed the landing checks and left the canopy closed. At this point there was about 80 US gallons of fuel remaining.

The pilot then positioned the aircraft on the final approach at a V_{APP} of 85 kt. The aircraft landed in a 3-point attitude, with the tail wheel about one foot off the ground, just before the runway threshold. The pilot added that, during the initial part of the landing roll, the aircraft was going straight and in full control, with the throttle closed. As he could see the ground crew at the end of the runway, he started thinking ahead about taxiing off the runway to the parking position. At this point he became aware of the aircraft's tail coming up. To counter this, he immediately applied full back stick, but the tail continued to rise. He then put both hands on the control column and looked inside to check the position of his feet, which were on the floor, so was not applying braking. Not understanding what was going on, he knew he could not stop the tail from rising, as it was happening so quickly, and that the aircraft would go on its nose as the aircraft was still doing a reasonable speed. As a result, he braced for the impact.

Footnote

2 Duxford Airfield is licensed by the UK Civil Aviation Authority (CAA).
3 The Minerva had a maximum landing weight of 2,425 lb.
4 The MTOW of the UPF-7 was about 2,550 lb.
5 The MTOW of the FW44J was about 1,985 lb.

The aircraft went onto its nose, but immediately went further over and came to rest inverted about 96 m from the point of touchdown. As it did so, the pilot leaned his head forward and braced himself as low as possible in the cockpit. The impact crushed the cockpit into him and forced his head and shoulders to the right of the cockpit.

Once the aircraft had come to rest, the pilot found himself suspended in the straps, with his helmet and left shoulder in contact with the ground, and with his head pushed onto his right shoulder. He noticed a small gap in the Perspex canopy between the ground and the cockpit's left side and realised that would be the only place to exit the aircraft. Fuel then started leaking down into the cockpit. Realising there was no point in turning the fuel cock off as the fuel would have been coming out of the filler caps and knowing that the electrical relays were in the rear of the fuselage, he knew it would be safe to turn the electrics off, which he did. He then removed his protective helmet and used it to break through some of the canopy's Perspex to make the hole larger.

By this time, the ground crew from the Minerva had arrived at the aircraft. The pilot of G-KINL was still in the aircraft so the ground crew helped remove the pilot's helmet and clear away broken canopy parts, and other debris, away from the aircraft. The pilot then released his parachute harness before carefully releasing his aircraft four-point harness. Once he was able to stretch both his arms out of the hole he was pulled out of the aircraft before being taken a distance away from the aircraft, where some additional people gave him first aid.

At about this time paramedics arrived as did the local Rescue and Fire Fighting Services (RFFS) and an air ambulance. The pilot was subsequently taken to hospital by the air ambulance. The pilot stated that he remained conscious throughout the event.

Landings on other runways

The following day, two Spitfires landed uneventfully on Runway 15, in preparation for a flying display over the weekend. This other runway was used because Runway 03/21 was too short, and Runway 06/24 was not available as a result of the accident. One was flown by the Airborne Flying Display Director (AFDD). The Spitfires weighed about 2,990 kg with main gear tyre pressures of about 55 psi.

The AFDD had also landed in a Minerva, on the same runway, the previous day, after the Wildcat's accident, leaving no indentations in the grass. The surface appeared to be solid and would not leave any indentations when the heel of a shoe was dug into the surface.

Pilot's comments

The pilot was a very experienced pilot of vintage aircraft; he held a Display Authorisation and was a Display Authorisation Evaluator. He had flown over 110 different types and, of his 4,238 total flying hours, had over 1,800 hours on Spitfires and similar aircraft types.

The pilot commented that this was the first time he had landed at the HCF in a Wildcat but, having landed there before in other vintage aircraft in preceding years, he was familiar with the general layout of Runway 06/24. The other aircraft included a ME 109 (Buchon), which had 13 cm wide tyres, with a pressure of 66 psi and a Maximum Takeoff Weight (MTOW) of 2,850 kg.

He added that he had landed various marks of Spitfires at the HCF before. These had either 10½ inch (26.7 cm) or 12-inch (30.5 cm) radius main wheels, which had tyre pressures of 55 psi and 62 psi respectively. The pilot commented that the 12-inch wheels were more likely to penetrate the top surface of a grass runway compared to the 10½ inch ones. The Wildcat's mainwheel tyres are "not very wide" and were inflated to about 100 psi. However, having landed without event in a ME 109, he did not consider the Wildcat's narrow tyres to be a problem on the HCF runway. The pilot stated that, had the runway been described to him as being potentially soft, then he would have considered this factor. However, there was no mention of the runway being potentially soft when, prior to departing, he spoke to a representative from HH who informed him that the runway had been driven and was serviceable.

Witnesses

One witness landed on Runway 24 in a Waco UPF-7 about 10 minutes before the Wildcat and watched it land. He stated that its touchdown was a "lovely 3-pointer". However, after a ground roll of about 75-100 m, the tail of the aircraft lifted, and the aircraft continued to pitch over quickly before coming to rest inverted.

The AFDD commented that he thought it was noteworthy that the first relatively heavy aircraft to land on Runway 24 for the 2023 concours fly-in, was the Wildcat, with its relatively higher Centre of Gravity (CG) and firmer tyres when compared to a Spitfire. He felt that had a Spitfire been the first heavy aircraft to land, it would have done so without any problems, but the pilot would have noticed the softer ground.

Meteorology

An aftercast obtained from the Met Office showed the rainfall recorded in the local area in the previous four weeks. Whilst the exact rainfall was not recorded at HH, rainfall totals recorded within a 30 nm radius throughout June ranged between 16.6 mm and 35.4 mm. The first week of July showed an increased rainfall rate, with 34.4 mm recorded at Tibenham, Norfolk, 15 nm north-west, of which 30.0 mm fell between 1800 hrs on 4 July 2023 to 0800 hrs on 5 July 2023. No further rainfall was recorded on 6 July 2023.

The weather conditions on the day of the accident were generally fine with mainly light winds from the southwest at 5 to 10 kt and a daytime temperature of 21°C. No precipitation was recorded locally, and both cloud bases and visibilities remained good.

Local people also commented that Suffolk had significant rainfall two days prior to the accident with the following days being dry and sunny. The Wildcat pilot commented that at Duxford (50 nm west-south-west of HH), there was no rain in the week prior to the accident, giving him the impression that the locality, including HH, had not had any rain either. At Wattisham Airfield, 21 nm southwest of HH, temperatures were recorded up to 21°C and 26°C the day before and the day of the accident respectively.

Airstrip information

The field within the HH estate, where Runway 06/24 was located, is about 115 ft amsl. The runway orientation, and general layout of all three runways on the estate, is shown in Figure 1.

Figure 1

Approximate runway positions and orientation on the HH estate
© 2020 Google, Image © Landsat / Copernicus

The field in which Runway 06/24 was situated was normally used for pastoral farming, had about 6 inches of topsoil and a subsoil of heavy brown clay. Runway 06/24 was prepared every year for the sole use of the aircraft flying in for the concours. On around 8 June 2023, the grass was cut with a flail topper, with the cuttings being collected a couple of days later. It was then rolled with a 13-tonne vibrating roller, six times, at 1.2 km/hr to 1.5 km/hr. This is the same process as was used in preceding years. Thereafter, there was no activity on the runway until the aircraft arrived on 6 July 2023; the day of the accident. At the time of the accident the grass was approximately 3 to 4 inches (about 7.5 cm to 10 cm) long[6]. Whilst Runway 06/24 had been inspected each year by some of the pilots before an aircraft landed on it, the HCF had no evidence to suggest anyone had requested to do an in-person

Footnote

6 CAP 793 stated that '*It is recommended that grass be kept to a maximum of 10 cm*'. See below for more information.

inspection before the event in 2023. However, several pilots, who were familiar with that runway, are believed to have been in contact with the HCF to check on the condition of the runway and to confirm that there were no significant changes to previous years.

Having been advised that the visiting aircraft would be landing at about 70 mph (60 kt), a 1,200 kg off-road buggy, with 20 psi tyres, was driven down the edge of the runway at about 50 to 60 mph in the days before the accident. This was to see if there were any uneven areas that caused the vehicle to bounce and could potentially do the same for aircraft if they were operating on it. However, none were identified. Additionally, prior to the first aircraft landing, a 2,675 kg road vehicle, with 38 psi tyres, was driven at various speeds up to 60 mph on multiple occasions by a representative from the HCF. No surface indentations were noticed after these. The organiser of the visitors' fly-in also drove along the runway in a 1,700 kg road vehicle, with 32 psi tyres, at speed of up to 70 mph. He commented that wheel marks were only made in the grass, not into the surface soil.

To coordinate aircraft movements to both runways, pilots communicated with an Air Ground Communications Service (AGCS) operator at the HCF via the 'SAFETYCOM' frequency, 135.480 MHz[7], using the callsign 'Heveningham Radio'. The use of SAFETYCOM is discussed later in this report.

As the airstrips were not licensed, pilots only needed the landowner's permission and were landing at their own risk. There was no firefighting equipment or aircraft recovery provisions at the airstrip for the arrival of the concours aircraft, nor was there a requirement for there to be any. During the days the fair was open, there was firefighting equipment present for the visiting aircraft landing on Runway 03/21 and for the flying display. This comprised of five vehicles, including two fire tenders.

A representative from the HCF commented that whilst, during the preceding years, they had sought advice from the AFDD on operating from Runway 06/24, they had not sought any advice from the CAA to help prepare the runways, nor was there a requirement to do so. However, they had followed the advice in the CAA's Safety Sense 12 – Strip Flying[8] which contains the following information of relevance.

> ***'Assessing the site***
>
> …
>
> *Conditions on the ground*
>
> ***A ground visit is recommended****…*[9]
>
> …

Footnote

[7] SAFETYCOM is a common traffic advisory frequency for use at aerodromes that do not have an assigned frequency. Aircraft should announce their position and intentions at the normal points in the circuit.

[8] The full version of the Safety Sense 12 can be found at https://www.caa.co.uk/media/cwjom2ph/safetysense_12-strip-flying.pdf [accessed 6 June 2024].

[9] The CAA commented that a ground visit would be appropriate to assess the ground conditions if there had been infrequent flying activity.

*One way of assessing the **general condition of the surface** is to drive a car at approximately 30 mph and note the ride quality, if it is reasonably smooth, it should be suitable. Grass height should be not more than 30% of the diameter of the aircraft's main wheels[10] and ideally shorter.'*

Aircraft performance

Runway 06/24 had a landing distance available of about 850 m and the Wildcat, from the aircraft's performance data, required a factored landing distance of about 680 m.

Weight and balance

During the aircraft restoration a check weigh was carried out. The aircraft basic weight was found to be 5,396 lbs (2,538.3 kg) with its CG within limits. The aircraft contained 756 lbs of fuel at takeoff on the day of the accident and used approximately 233 lbs during the flight from Duxford to HH. The aircraft basic weight, fuel, pilot and his flying kit meant the aircraft's landing weight was approximately 5,999 lbs (about 2,720 kg). The weight on each mainwheel was therefore 2,999.5 lbs (1,360 kg) per wheel by calculation this results in a ground pressure of 100 psi on the soil.

The thrust line, and therefore vertical centre of mass of the Wildcat, acts approximately 2.0 m above the centre of the mainwheels when the aircraft is in a horizontal attitude. The Spitfire that landed the following day weighed about 6,585 lb (2,987 kg) and had a thrust line of approximately 1.5 m above the centre of the mainwheels when in a horizontal attitude.

Recorded information

The aircraft was fitted with a transponder and the pilot stated that he had switched it on for the flight to the HCF. However, no secondary radar was able to be recovered by NATS.

Accident site

The aircraft touched down at approximately 85 kt on the grass runway and evidence on both tyres show an initial wheel run up slippage but also show the tyres penetrated the ground to a depth of 3.3 cm. Marks made by both tyres were pronounced over most of the 96 m landing run until the aircraft nosed over (Figure 2). Deepening propeller blade slash marks had been made at the end of the landing run followed by a deep hole made by the propeller boss.

Footnote

[10] 30% of the diameter of the Wildcat's mainwheels is 13.5 cm.

Figure 2
Accident site with ground marks

The aircraft had nosed over on to its back and come to rest in line with its landing run. Fuel had spilt from wing tanks through the filler caps. The rudder was heavily distorted and had detached, and the fin was buckled and had been compressed. The windscreen, canopy transparency and frame parts had detached and were lying beneath the cockpit area. The left wingtip had also struck the ground and was distorted. The right mainwheel could be turned by hand with a small amount of binding. The left mainwheel was stiff to turn by hand. Although one witness described a '3-point' touchdown, no tailwheel marks were found on the runway.

The first responders had turned the fuel cock off and disconnected the battery to make the aircraft safe as far as possible.

Apart from the marks left by this aircraft, there were no other identifiable marks on the runway surface. A subjective test the day after the accident was carried out using a steel spike (part of an electric fence pole) to penetrate the runway surface and found it had a hard turf surface crust approximately 2 cm thick on top of a softer substrate. It was noted that when the test was done, the daytime temperature reached 28°C by midday[11], which was much warmer and sunnier than the day of the accident. This would have had the effect of drying the crust and making it slightly harder when this test was carried out.

Aircraft description

The aircraft was a World War Two carrier-borne fighter. It is an all-metal midwing monoplane powered by a nine-cylinder, single row supercharged radial engine. Its airframe, landing gear and braking systems are designed for all weather aircraft carrier deck operations. The main landing gear is a parallelogram frame assembly which retracts into the undersides of the fuselage giving it a narrow track when compared to other carrier aircraft of the era. To fit neatly into the fuselage, it was fitted with relatively narrow wheels and tyres. The wheel and tyres were approximately 45 cm in diameter and 13 cm wide. This size of tyre was required to support an aircraft which had a maximum weight of approximately 7,400 lb (3,356 kg) and required a pressure of 103 psi (7.1 bar) which would give a tyre contact surface area of approximately 180 cm^2.

Both mainwheels are fitted with drum brakes with an upper and lower lined brake shoe. The drum is an integral part of the inner half hub. Both rudder pedals are fitted with an articulated foot pad which acts on a sealed master cylinder and fluid reservoir on each pedal. When the brakes are applied, hydraulic pressure is felt on a double acting slave cylinder which pushes the shoes outwards against the drum to achieve the desired braking effect. When the pedals are released the brake shoe are pulled away from the drums by a spring. To ensure that the brake shoes require the minimum slave cylinder piston travel and to allow for friction material wear, they are fitted with threaded adjusters. The brakes are adjusted to achieve maximum clearance[12] between the friction material and drum. A correctly adjusted brake will exhibit a small amount of drag when the wheel is rotated by hand. Figure 3 shows the brake assembly.

Footnote

[11] As shown on the outside air temperature monitor of one of the AAIB vehicles at the accident site.

[12] As this was an aircraft designed and built in the USA, all the settings are in imperial measurements. Of note, this aircraft had a comprehensive and detailed operation and maintenance manual which was adhered to during its restoration. Both brakes were adjusted using this manual to the required maximum clearance of 0.007 inch (‘7 thou’).

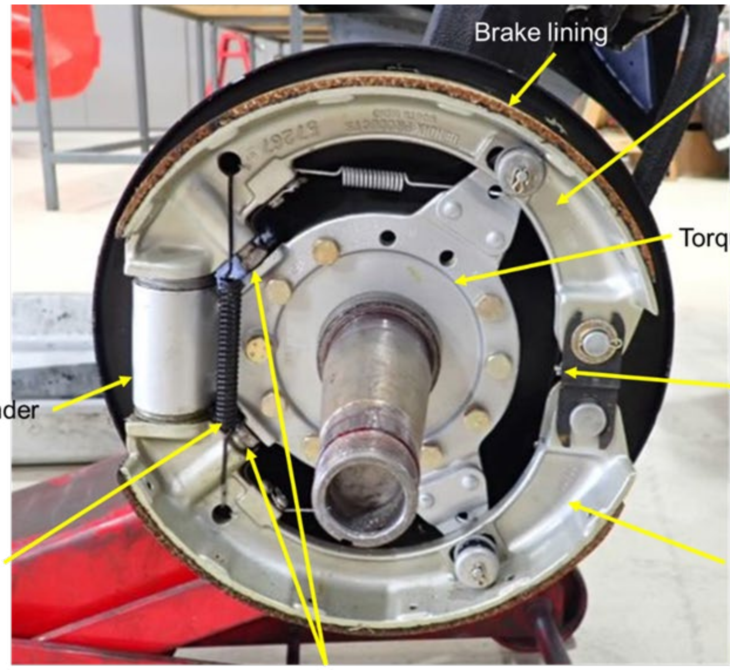


Figure 3
Wheel brake assembly (left side, drum removed)

Aircraft maintenance history

This aircraft had undergone a full restoration which had brought it back to the factory standard as far as possible. The brakes had been restored with new brake linings. The left wheel hub with integral drum was new 'old stock' whilst the right wheel was more original to the aircraft. Both had been repainted externally to leave a smooth bare metal running surface for the brake shoes. The aircraft was fitted with a modern but unobtrusive radio and transponder so as not to detract from the original cockpit layout. Post-restoration test flying had been carried out at Duxford and the first flight took place in October 2022. Since then, there had been seven flights/landings with a total of 5 hours and 40 minutes flying time. This included a short flight in the morning of 6 July 2023 before the accident. This flight and three other previous flights had taken off and landed on the grass runway at Duxford.

Aircraft examination

The aircraft was righted and placed on its undamaged landing gear. Engine lubricating oil started to leak from the underside of the engine cowling. This was found to be because of a slight distortion on the engine mounting frame which led to an oil pipe fracture. To minimise the environmental impact the oil reservoir was drained into a suitable container. The propeller blades were also damaged when they struck the ground.

The aircraft braking system was examined and there were no obvious signs of damage or malfunction. However, the left brake pedal was firmer when compared to the right. The double acting slave cylinders and shoes can be seen with the wheel hub cover removed. The left and right wheel brake shoes could be seen moving on and off although the left set appear to move to a lesser extent than the right.

Despite this the aircraft could be rolled backwards and forwards with ease. It was observed that whilst doing this the aircraft left distinct wheel tracks in the runway surface. The aircraft was then moved to an unprepared safe area at the side of the runway for later recovery to a maintenance facility.

After recovery, the aircraft braking system was examined. The left brake drum and shoe linings had started to bed in with evidence of high spots[13] on the surfaces. Experience has found that the combination of a new drum and linings bed in slightly more slowly than an older, used drum with new linings. The right brake drum and shoe linings had bedded in commensurate with the number of aircraft landings since restoration. The resultant level of binding on each wheel was considered normal by the experienced aircraft restoration engineers present during the examination.

Organisational information

Anyone organising or participating in an event should take certain precautions to plan for unexpected circumstances. These could be in the form of risk assessments (RAs) and, although there is no requirement to follow it, the CAA provides a lot of guidance information and recommendations in various publications. Those of relevance to this event are discussed further in this report.

The HCF was open to the public on the Saturday and Sunday for which there was an *Event Management Plan* (EMP) and an *Emergency Plan*. The EMP covered the fair, the visitors' fly-in, concours fly-in and flying display, for the two days, and included a generic section about RA for the HCF. It stated that '*Risk Assessments relating to the content of specific attractions at the event are covered both by generic risk assessments and specific assessments by the providers of the attraction*.'

The flying display, that took place during the HCF and had planned to use Runway 06/24, had a RA that was produced by the AFDD and was signed by him and the HCF Event Organiser. The CAA permission (ADOC-2182) issued for the flying display was for an off-airfield display on the two public days.

The visitors' fly-in, that used Runway 03/21, was organised by the AGCS operator. The organiser stated that there was a RA for the visitors' fly-in. The HCF had requested a copy of the RA, prior to the 2023 fly-in, but they commented that the document "never materialised". The AGCS operator commented that this was an oversight on his part. However, they did have some documentation pertaining to the 2018 fly-in. The 2023 RA for the visitors' fly-in was made available to the AAIB during the course of this investigation.

The provider of the fire cover for the visitors' fly-in had a RA.

There was no RA for operations of concours aircraft to and from Runway 06/24, nor was there required to be one.

Footnote

[13] The new linings were of a uniform thickness at manufacture, but when they were bonded to the shoe, high spots of a few thousandths of an inch can develop. These can manifest themselves as slightly darker areas early in the bedding in process but eventually disappear.

Issue 1 of Civil Aviation Publication (CAP) 793 – *Safe Operating Practices at Unlicensed Aerodromes*[14] stated in Chapter 1, that the contents of this CAP '*are not mandatory.*' It also states the following:

> *'Whether an unlicensed aerodrome is a "farm strip", a helicopter landing site or a hard runway equipped airfield, the physical characteristics and operating standards should provide a safe operational environment. This publication provides guidance to the owners of, and those who operate or fly from, unlicensed aerodromes to enable safe operating practices to be met.*
>
> *Chapter 4 Aerodrome Physical Characteristics*
>
> *3.4 …It is recommended that grass be kept to a maximum of 10 cm (4 in.) high.*
>
> *Chapter 5 Flying Operations*
>
> *…*
>
> *3. A visual inspection of the airfield including checking the runway…should be conducted each day before the start of flying...*
>
> *5. …The surface of a grass runway can be considered smooth enough if a car can be driven over it at 30 mph without undue discomfort…*
>
> *Chapter 8 Emergency Services*
>
> *1 ...At larger unlicensed aerodromes greater provision would be prudent,…*
>
> *2 In developing emergency procedures the following should be considered:*
>
> - A competent person should conduct an assessment of the hazards and risks.
>
> *…*
>
> - Ensuring suitable first aid and fire-fighting equipment is available and can be transported to an accident or incident which occurs up to the aerodrome boundary.'

Consultant's review of HH runways

In March 2019, a consultant met with representatives from the HCF and drove/walked Runways 03/21 and 06/24. He did not look at Runway 15/33 as it was not routinely used during the HCF. In his report he mentioned CAP 793 and CAP 403 – *Flying Displays and Special Events: Safety and Administrative Requirements and Guidance*[15]. He commented that '*a Duty of Care is placed upon an Event Organiser to ensure that any event which is open to the public (including fly-ins) shall be risk assessed and managed to ensure that*

Footnote

[14] CAP 793 can be found here: https://www.caa.co.uk/publication/download/13965 [accessed 6 June 2024].
[15] CAP 403 can be found here: https://www.caa.co.uk/publication/download/12154 [accessed 6 June 2024].

any risk is as low as reasonably practicable (ALARP).[16]' He also mentioned Appendix A to CAP 403, *Risk Assessment* which, whilst it is principally for flying displays and special events, he stated it '*is equally applicable to fly-ins.*'

SAFETYCOM

The UK Aeronautical Information Publication states the following in *Communication and Navigation Services*:

'3.2.4 ***Common VHF Channel for Use at Aerodromes having no notified Ground Radio Channel***

a. At aerodromes having no notified ground radio facilities a VHF channel is available to assist pilots to avoid potential collisions between arriving and departing aircraft. Pilots may use this channel to broadcast their intentions for safety purposes.

b. The channel assigned is 135.480 and is known as 'SAFETYCOM'.

c. The conditions of use are:

…

iii. SAFETYCOM shall only be used to transmit information regarding the pilot's intentions, and there should be no response, except where the pilot of another aircraft also needs to transmit his intentions or, exceptionally, has information critical to the safety of an aircraft in a condition of distress or urgency.

…

vii. No air traffic service is associated with SAFETYCOM…'

SAFETYCOM was used at the HCF to provide an AGCS. This is contrary to the conditions of use stated in the Aeronautical Information Publication (AIP). If an AGCS is required, organisers are to initially apply to Ofcom[17], who would share the application with the CAA.

Analysis

G-KINL examination

On initial examination, with the aircraft on its back, the left wheel was very stiff to turn. The right wheel was free to rotate, albeit with slight brake shoe drag. After the aircraft had been righted with its full weight on the wheels, the left and right wheels rotated normally. Later examination of the brakes showed that the lining condition was as would be expected.

Footnote

[16] CAP 760 defines a risk as being ALARP when it is low enough that attempting to make it lower, or the cost of assessing the improvement gained in an attempted risk reduction, would actually be more costly than any cost likely to come from the risk itself. CAP 760 can be accessed here: https://www.caa.co.uk/publication/download/13108 [accessed 6 June 2024].

[17] Applications to Ofcom are to be made via this form: https://www.ofcom.org.uk/__data/assets/pdf_file/0026/125369/OfW586a-Aeronautical-radio-ground-station-licence-application-form.pdf [accessed 6 June 2024].

The right brake had bedded in more than the left brake with its newer drum, but this was considered unremarkable by experienced engineers. This explains why there appeared to be slightly less movement of the left brake shoes when observed at the accident site. The operation of the braking system was not a factor in this accident.

Effect of the runway surface

A closer examination of the marks made by both mainwheels, their effect on the blades of grass and soil in the tyre tracks, show that compression of the surface was the prominent factor rather than skidding. Calculations show the static ground pressure from each wheel to be 1,360 kg over an area of 180 cm^2 and that the tyre pressure of 103 psi presents a stiff running face of the tyre. In practice, this loading would be less at initial touchdown but would rise to this magnitude as the wing lift reduces. No marks attributable to the tailwheel were found on the runway.

Met Office aftercast showed significant rainfall in the eastern counties in the preceding days which gave way to warm sunshine on the day of the accident. The day after the accident was hot and sunny. The penetrative examination of the runway showed that a hard surface crust had formed on top of a softer layer. It is likely that this surface had been softer on the day of the accident and that the crust was thicker and slightly harder as a result of the much warmer conditions on the following day and at the time the penetrative examination was carried out.

As the aircraft touched down, the hardness of the tyres and the weight of the aircraft compressed the surface crust. The leading rolling faces of the tyres continued to compress the surface as they rolled along which created a considerable drag effect. This was very similar to the effect of landing in soft sand or icy slush. This rapidly decelerated the aircraft from approximately 85 kt (43.72 m/s) to a stop over a distance of about 96 m. As this was happening, the mass of the engine, which was no longer producing thrust, as the throttle was closed, created a 2.0 m moment arm couple rotating the CG about the axis of the mainwheels. This tipped the aircraft forward and caused the propeller to strike the ground leaving deepening cut marks. Eventually the aircraft nosed completely over and came to rest on its back. This was despite the pilot's attempts to lower the tail by pulling back on the control stick.

Airstrip preparation

The preparations for Runway 06/24 seemed appropriate and were no different to previous years during which there were no known incidents. The grass was at an appropriate length and several different vehicles were driven along on Runway 06/24, prior to the first movements, as suggested by the CAA's Safety Sense 12 and CAP 793. However, the tyre footprints, and hence ground pressures, were lower than those of the Wildcat.

CAP 793 stated that the runway should be visually inspected each day before flying started and the runway was assessed for uneven areas using road vehicles by HCF. Safety Sense 12 also recommended that a ground visit be conducted. However, it seems reasonable to assume the recommendation to conduct a ground visit is directed towards pilots who have not flown into a particular airstrip before or whose condition is unknown due to the absence of personnel on the ground to inspect it prior to a pilot's arrival.

Conduct of the flight

The pilot had flown the Wildcat from a grass runway at Duxford, several times before, including prior to departing for the HCF, with Duxford being a licensed airfield that had runways that were in regular use. Whilst he had landed at HH in previous years in different aircraft types, he did not consider the Wildcat's narrow tyres to be a problem on the HCF runway but, had he been informed that the runway was potentially soft, he would have taken this into account.

Even though some other aircraft did land before the Wildcat, they were lighter aircraft with a weight of about a third of the Wildcat and had softer tyres. The AFDD believed that had a Spitfire landed before the Wildcat, it would have done so without event. However, the soft sub-soil may have been noticed and this could then have been passed on to the Wildcat pilot.

It appears that, given the Wildcat's relatively high CG, once the narrow, high-pressure tyres broke through the surface crust and started to dig into the softer sub-soil, the tail started to lift and there was not much the pilot could have done to stop it from pitching forward onto its nose before coming to rest inverted. This was despite him applying full back stick to try to counteract this.

Once the aircraft came to rest, the trapped pilot was then exposed to leaking fuel. He was subsequently extracted, with assistance, through a small hole, as attempts to lift the tail of the aircraft were unsuccessful given its weight and the lack of aircraft recovery equipment close to hand.

There was also no firefighting equipment in the vicinity of the runway. Whilst neither of these were a requirement for an unlicensed airstrip, given the number of aircraft movements expected, it may have been prudent to have fire and rescue facilities available during all flying activities.

Risk Assessments

The HCF, flying display, visitors' fly-in and the associated firefighting provider each had an RA. However, there was no RA for operations using Runway 06/24 which was used by the aircraft involved in the concours and the display aircraft. This is despite the consultant highlighting some relevant parts of CAP 403 that could be equally applicable to the fly-ins, and that any event, including all fly-ins, should be risk assessed and managed to ensure that any risk is as ALARP.

Whilst the guidance in the CAPs was not mandatory, had an RA been conducted it is likely that more consideration would have been given to what may occur during aircraft operations and any potential risk, like an aircraft accident, reduced to ALARP by having appropriate provisions to cater for such an event, as suggested in CAP 793.

The RA for the visitors' fly-in for 2023 was not made available by the organiser of the fly-in to the HCF before or after the event and was only passed to the AAIB towards the end of the AAIB investigation. HCF only had a copy of the RA from 2018. This did not give the HCF the opportunity to review any changes made to the RA to ensure that the provisions put in place prior to the 2023 event were adequate, and thus ensure that risks were ALARP.

Survivability

The correctly adjusted and worn harness and protective helmet afforded protection to the pilot. This, along with his ability to anticipate what was about to happen and crouch down as far as possible, prevented a more serious outcome.

Conclusion

The aircraft systems and controls were functioning normally during the accident. The weight of the aircraft caused its narrow, high-pressure mainwheel tyres to sink into the soft runway surface and created a rolling resistance which rapidly decelerated the aircraft. The high CG resulted in large rotating moment about the axis of the mainwheels which led to the aircraft toppling forwards, the propeller blades striking the ground, and the aircraft then tipping over on to its back.

The crusty surface of the runway, on top of the soft sub-surface, was probably a result of the wet weather conditions in the weeks prior to the event, followed by warm dry weather in the days prior to the accident. This was undetected, despite the runway being checked in accordance with the guidance available.

The event organisers are planning to implement the following additional measures for future events:

- An RA for the visitors fly-in will be obtained and reviewed in advance of the HCF.
- A risk assessment will be conducted for the operation of Runway 06/24, that is used for the concours and flying display aircraft.
- There will be a nominated suitably qualified and experienced person to coordinate all the aviation operations.
- Firefighting and lifting equipment will be available at Runway 06/24 for movements in the days prior to the country fair.

Published: 27 June 2024.

Accident

Aircraft Type and Registration:	Piper PA-28-180, G-AYUH
No & Type of Engines:	1 Lycoming O-360-A4A piston engine
Year of Manufacture:	1970 (Serial no: 28-7105042)
Date & Time (UTC):	21 August 2023 at 0820 hrs
Location:	Near Stanley Hall, Halstead Hall, Essex
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:	Private Pilot's Licence
Commander's Age:	72 years
Commander's Flying Experience:	407 hours Last 90 days - 7 hours Last 28 days - 1 hour
Information Source:	AAIB Field Investigation

Synopsis

Whilst approaching Earls Colne Airfield, the pilot of G-AYUH encountered weather that was not compatible with flight under VFR. The airfield was in fog, but this was not relayed to the pilot when he requested airfield details. Following an attempted track reversal manoeuvre and climb, the aircraft departed from controlled flight and struck trees and terrain, fatally injuring the pilot.

Safety action has been taken by the Civil Aviation Authority (CAA) and the operator of Earls Colne Airfield. The CAA Published a Safety Notice and a Supplementary Amendment to CAP 452 to highlight those occasions when radio operators should provide pilots with additional information for the purpose of alerting them to hazards and avoiding immediate danger. The airfield operator introduced additional processes to provide guidance to radio operators on reporting of weather conditions at the airfield to pilots.

History of the flight

G-AYUH was based at Old Buckenham Airfield in Norfolk and was owned by a syndicate. The pilot, who was a member of the syndicate, was due to fly to Earls Colne Airfield in Essex to complete training that had been directed by the CAA. On the evening before the day of the accident flight, the pilot telephoned Earls Colne to request a PPR[1]. A radio operator at

Footnote

[1] Prior Permission Required (PPR): is a requirement at many airfields where visiting pilots give notice of their intention to arrive and land on a specific day and time. This is commonly achieved by a telephone call, email or notification on the airfield's website.

Earls Colne acknowledged the PPR and suggested that the pilot call again before departure the following morning to confirm the airfield conditions. He informed the pilot that the airfield opened for flights at 0800 hrs (0900 hrs local) and that he would be available to receive a call from 0700 hrs (0800 hrs local). However, no telephone call was received from the pilot on the morning of the accident.

G-AYUH departed Old Buckenham at 0753 hrs on 21 August 2023, with the pilot as the sole occupant. CCTV at Old Buckenham captured the aircraft's departure and showed clear skies with good visibility. The pilot had previously flown the route on 17 August 2023.

After departure, the aircraft flew south as planned towards Earls Colne, at an altitude of about 2,100 ft amsl. The planned flight distance was approximately 40 nm and the estimated flight time around 25 minutes.

Figure 1 shows the aircraft's planned route and its actual track flown. A visible satellite image provided from the Met Office, showing the approximate location of low cloud and/or fog at 0745 hrs, is overlaid.

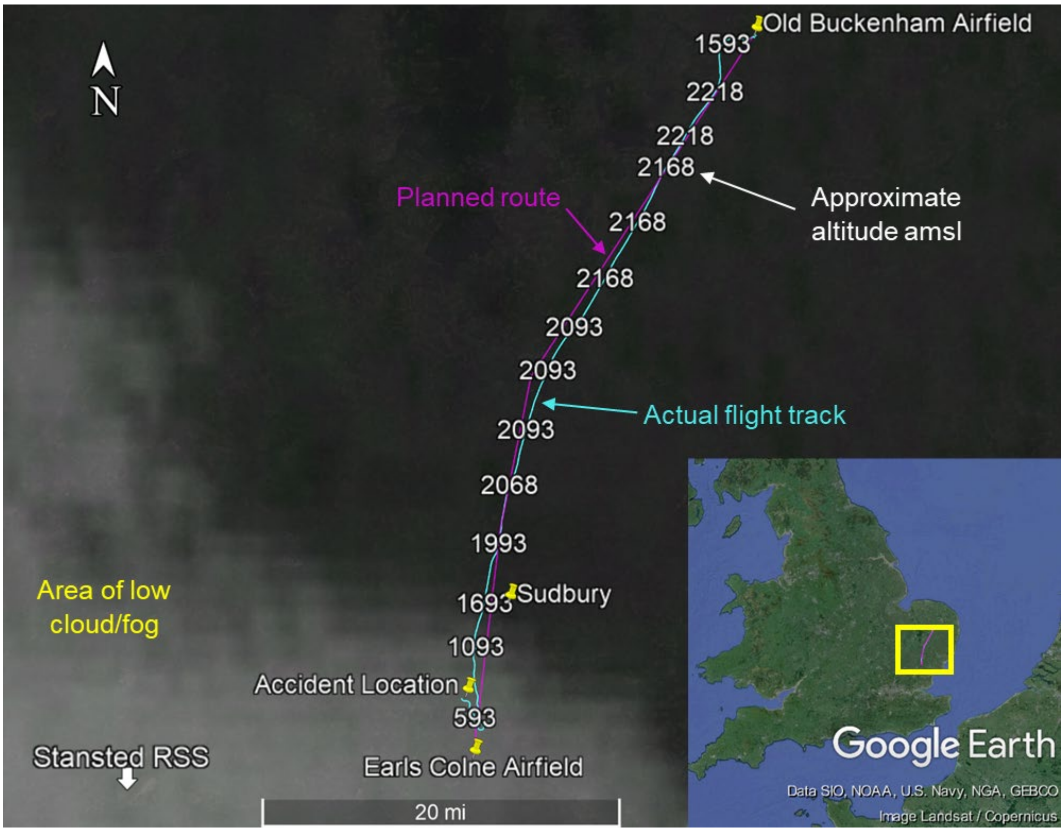


Figure 1

Planned route and actual flight track, with fog/cloud overlaid.
© 2023 Google, Image © Landsat / Copernicus

At approximately 0805 hrs and 8 nm north of his destination, the pilot called Earls Colne Radio stating that he was "abeam Sudbury, inbound at 1,500 ft" and requested the airfield details. The radio operator responded by passing details of the runway in use, the QNH/QFE and the wind speed and direction. Earls Colne had been in fog from earlier in the morning and conditions were reported as being "very bad". The resident air ambulance unit declared its helicopter 'off-line' at 0630 hrs due to the weather. The radio operator did not report the reduced visibility and low cloud to the pilot of G-AYUH on the radio. The radio exchanges between the pilot and the Air Ground Communication Service (AGCS) at Earls Colne were not recorded and were not required to be.

As G-AYUH approached Earls Colne, it began to descend at a location consistent with the edge of the band of low cloud / fog captured by the Met Office satellite image. The aircraft continued at an altitude of around 500 ft amsl (approximately 250 ft aal for Earls Colne).

At approximately 0815 hrs the radio operator, now joined by a colleague in the radio room, noted that G-AYUH had disappeared from the screen of an electronic conspicuity tracking website which was used by the radio operators to aid the monitoring of aircraft in the vicinity. The pilot then transmitted that he was at 500 ft, entering '*thick cloud or fog*' and was returning to Old Buckenham. A witness working on a roof in the area, who is a private pilot, reported seeing an aircraft approaching from the north, "trying to stay below the cloud", which was "low at around 500 ft above the ground". The witness lost sight of the aircraft as it passed between Colne Engaine and Halstead (2 km to the west), but a short time later saw it again briefly heading in a northerly direction having apparently turned around. The witness reported that the sound of the aircraft's engine appeared constant and normal. Recorded data shows the aircraft making a 270° left turn over the village of Colne Engaine (Figure 2) then continuing in a north-westerly direction and climbing to approximately 1,100 ft amsl (860 ft agl), before continuing to the west.

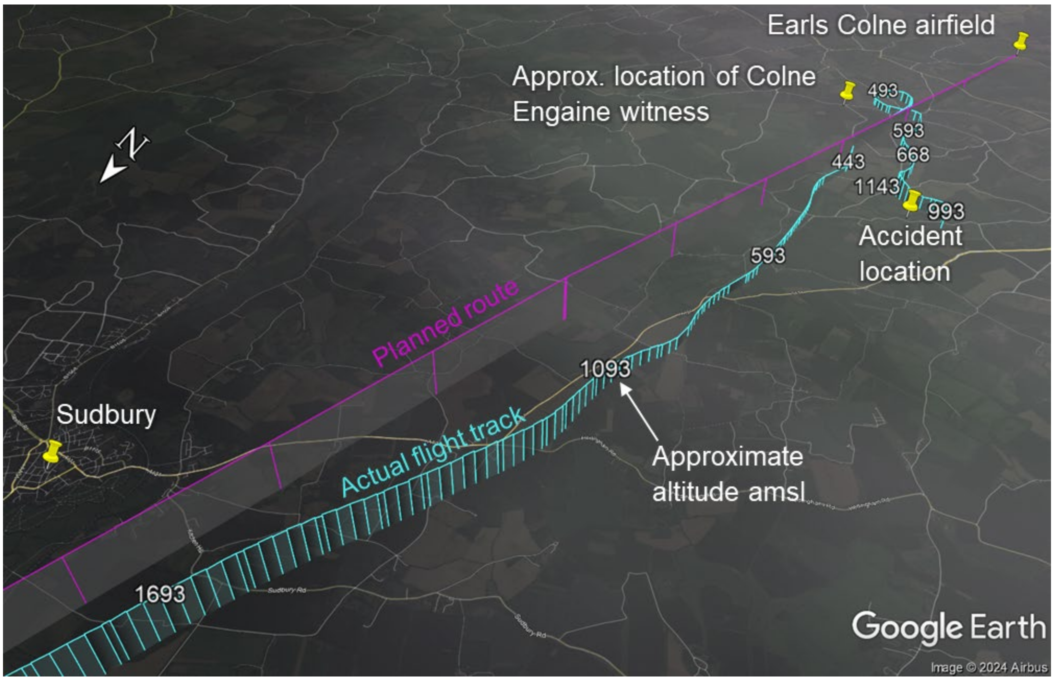


Figure 2

View from the north-west showing the planned route and actual flight track for the final part of the flight, with fog/cloud overlaid.
© 2024 Google

A witness at Stanley Hall (3 km north-west of Colne Engaine) heard an aircraft approaching from the south-east but could not see it due to the “very low cloud”. He reported hearing the sound of an engine revving up and down, and then the sound passing overhead in a northerly direction and apparently “quite low”. Recorded data shows G-AYUH descending to approximately 800 ft amsl (560 ft agl) near Stanley Hall and then resuming a climb.

The same witness then saw the aircraft emerge from the cloud about 100 m away, in a 45° nose-down attitude with the right wing oriented towards the ground such that the top surface of the wings was visible. The aircraft dropped out of sight behind a barn. The witness described hearing an “explosion” and then seeing black smoke rising behind the barn. The witness at Colne Engaine reported that shortly after losing sight of the aircraft they heard an engine sound as if full power was being applied, followed by a “sickening crash, like a crunching of metal”.

The aircraft came to rest in an inverted attitude in a field adjacent to an area of woodland, and there was a significant post-accident fire. Emergency services arrived on scene approximately 25 minutes later. The pilot was fatally injured in the impact.

Accident site

The accident site was approximately 3 nm north of Earls Colne Airfield at an elevation of 240 ft amsl. An aerial view of the site is shown in Figure 3.

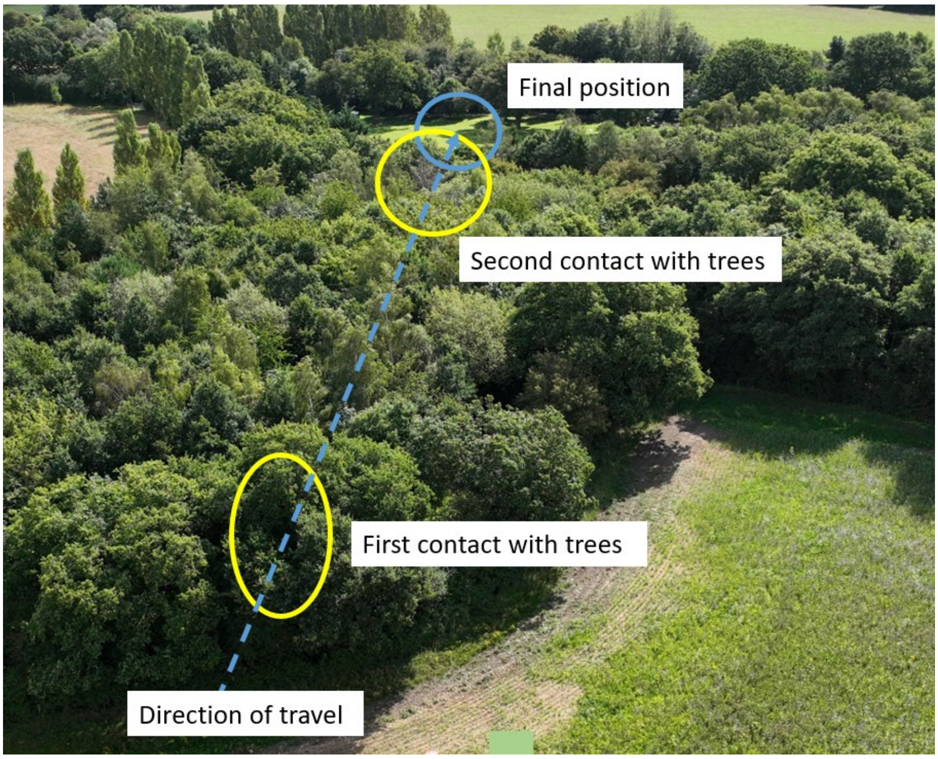


Figure 3
Aerial view of accident site

Inspection of the accident site and wreckage indicated that the aircraft first contacted the top of trees approximately 200 m before its final resting place. The initial contact was made by the right wingtip, evidenced by remains of the right wingtip green navigation light found on the ground underneath these trees. The second contact with the trees occurred approximately 75 m further along the path of travel. On the ground in this area were the remains of the left wingtip, red navigation light, and the beacon light mounted on top of the fin, along with pieces of clear plastic from the windows. This indicated that the aircraft was in a right-wing low attitude when it first contacted the trees and, by the time of the second contact, the aircraft was inverted with the left wing low. The aircraft continued in an inverted attitude until it came to rest in the grass field where the central part of the fuselage was consumed by the post-accident fire (Figure 4).

Figure 4
Final part of flight path through trees, looking along direction of travel

Preliminary examination of the wreckage, and in particular damage to the detached propeller and its attachment, indicated that the engine was producing power at the time of the impact. Both fuel tanks had been ruptured and no fuel remained but there was evidence of a significant post-accident fire. No pre-accident defects were identified.

Recorded information

The aircraft's avionics did not have any recording capability and were extensively damaged by the post-accident fire.

A significantly fire-damaged tablet was recovered from inside the aircraft, and a fire-damaged mobile phone was also retrieved from the accident site. The batteries of the tablet exhibited evidence of having combusted in the post-accident fire, exposing the internal circuitry to high temperatures. Some components on the circuit board had been displaced due to the high temperatures melting the solder joints. Some of the damage is shown in Figure 5.

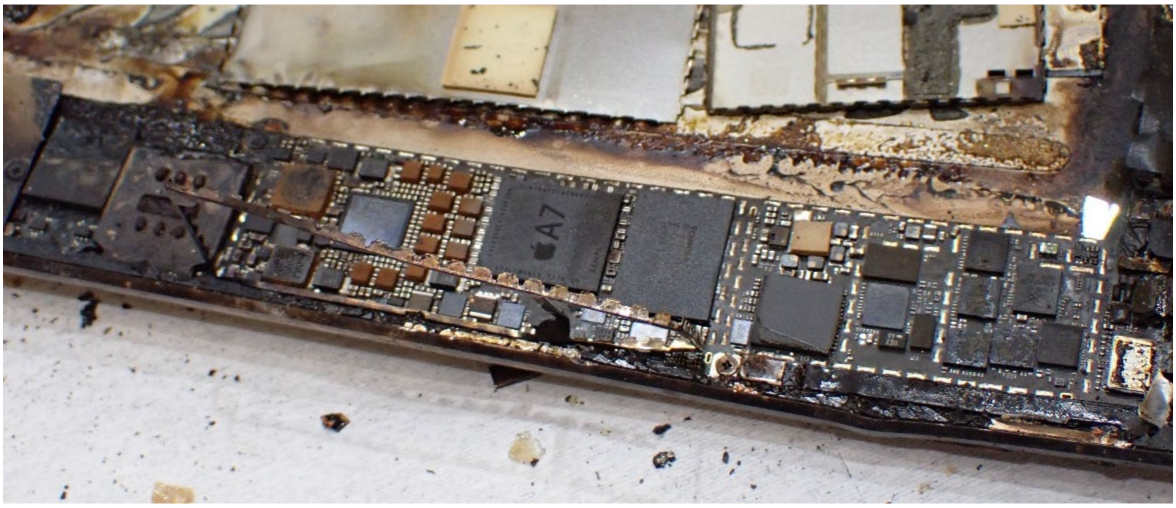


Figure 5
Circuit board from the fire-damaged tablet.

The AAIB did not recover any data from either the tablet or mobile phone.

Other data sources

G-AYUH was detected by both the primary surveillance radar (PSR) and secondary surveillance radar (SSR) at Stansted Airport until it reached the vicinity of the accident location. Detection by SSR indicates that G-AYUH's transponder was turned on and functional. Stansted's radar antenna is a combined PSR and SSR which sweeps the area every 4 seconds. Historic radar recordings showed that aircraft in the vicinity of the accident site are detectable by Stansted's radar as low as 400 ft amsl[2] in most summertime conditions. This was also the case for G-AYUH shortly before the accident.

Footnote

2 Mode-S radar altitude resolution is accurate to ± 25 ft.

G-AYUH was last detected by Stansted radar close to the accident site at about 1,000 ft amsl. The next radar sweep did not detect the aircraft, either because the transponder antenna was obscured by an unusual aircraft attitude which also presented insufficient surface area to be detected by primary radar, or because it had rapidly descended below the radar's lower limit of coverage.

The AAIB obtained the pilot's SkyDemon data, which included a flight plan for the accident flight and two additional flight plans for the training routes intended to be flown later that morning. All three flight plans had a date stamp indicating they were last modified on 20 August 2023.

The AAIB obtained the ground-recorded position, speed and altitude data transmitted from G-AYUH by a PilotAware Rosetta unit, which corroborated the Stansted radar data.

Interpretation of available data

The Mode-S groundspeed and track information for the final four minutes of the flight from the radar returns and PilotAware are shown in Figure 6. Weather reports at Wattisham and Stansted around the time of the accident indicated light winds from the south-west, with a windspeed of about 6 kt. Therefore, calculated airspeeds may differ by up to ±6 kt from the groundspeeds shown.

The start of G-AYUH's left turn over Colne Engaine is indicated by point A. G-AYUH then exited the turn flying west, later turning right to fly north in the direction it arrived from (point B). G-AYUH continued in this general direction and climbed to reach about 1,100 ft amsl, approximately 20 seconds before the last recorded position.

At point C, the calculated groundspeed from online tracking data was 52 kt and from radar it was 60 kt. The latter value is considered to be an overestimate due to errors which are normally expected in radar position measurements. The data indicates the aircraft then commenced a left turn and its altitude started to decrease, whilst groundspeed increased.

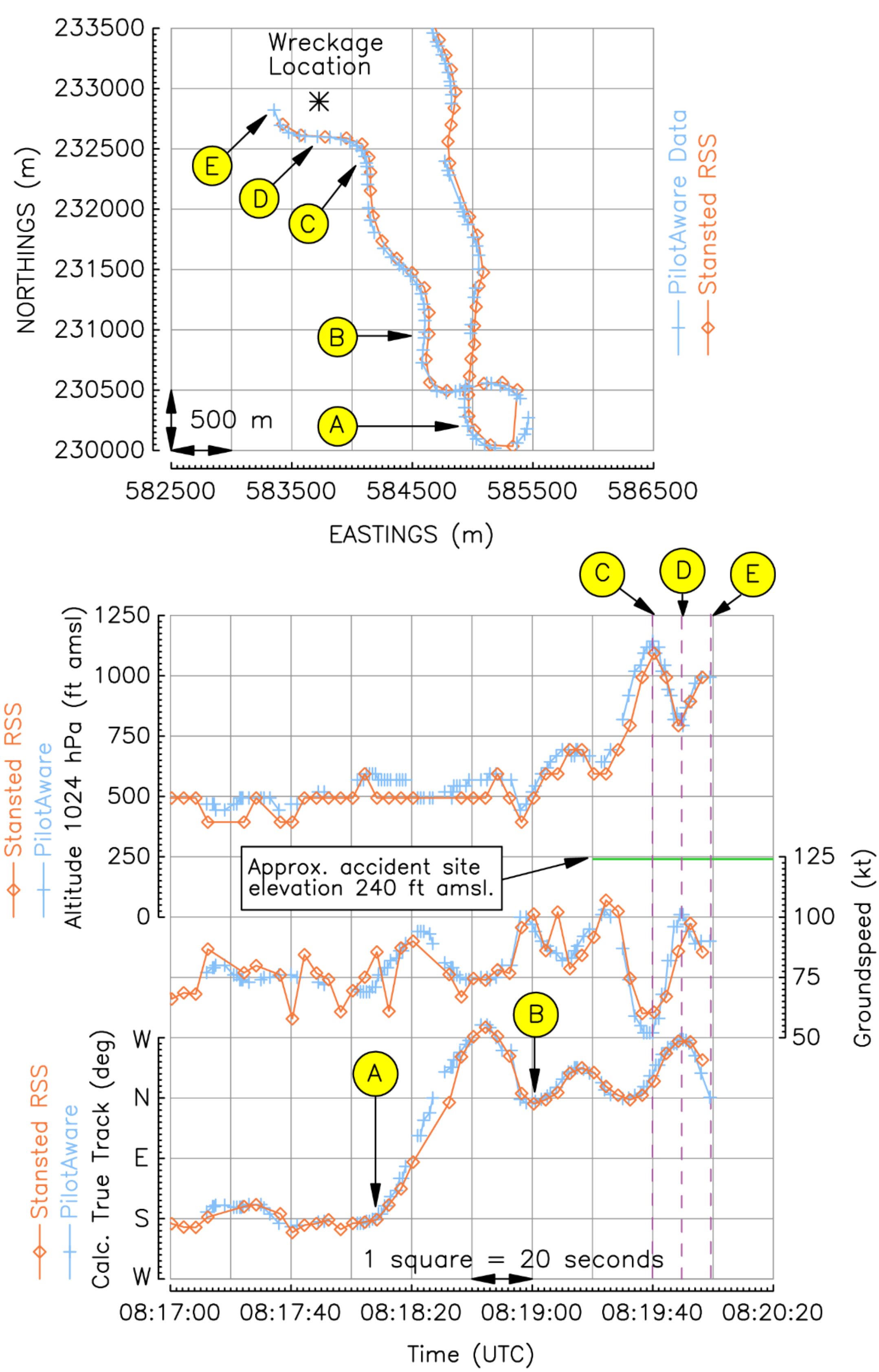


Figure 6

Altitude, groundspeed and heading from radar and PilotAware data, with an insert showing a plan view of the aircraft's recorded positions.

The aircraft's track began to move towards the north from a westerly heading, marked by point D in Figure 6, at up to 10 °/s [3]; the calculated groundspeed reached a maximum of about 100 kt at this point. This coincided with the aircraft entering a second climb from an altitude of about 800 ft amsl with reducing groundspeed.

The final recorded data point (point E) six seconds later indicated that G-AYUH reached approximately 1,000 ft amsl and was heading north. The calculated vertical speed between points D and E was approximately 2,000 ft/min.

CCTV

Both Old Buckenham and Earls Colne airfields had CCTV which was recorded. The CCTV at Old Buckenham Airfield showed the aircraft taking off in clear sky conditions at 0753 hrs (Figure 7). The departure appeared normal.

Figure 7

CCTV of G-AYUH departing from Old Buckenham (used with permission).

CCTV at Earls Colne Airfield (Figure 8) did not show the aircraft but provided evidence of the meteorological conditions at the following times; when the radio operator arrived at the airfield; when the pilot took off from Old Buckenham; at the approximate time the aircraft turned around over Colne Engaine (about 2 minutes before the accident), and approximately 10 minutes after the accident. The timestamps shown are converted to UTC from the embedded video timestamps.

Footnote

3 To achieve a 10 °/s turn in level flight and at 100 kt IAS requires bank angle of approximately 43°.

Land features annotated in yellow correspond to distances referenced on a 'Visibility Indicators' chart which was affixed to a window in the radio room.

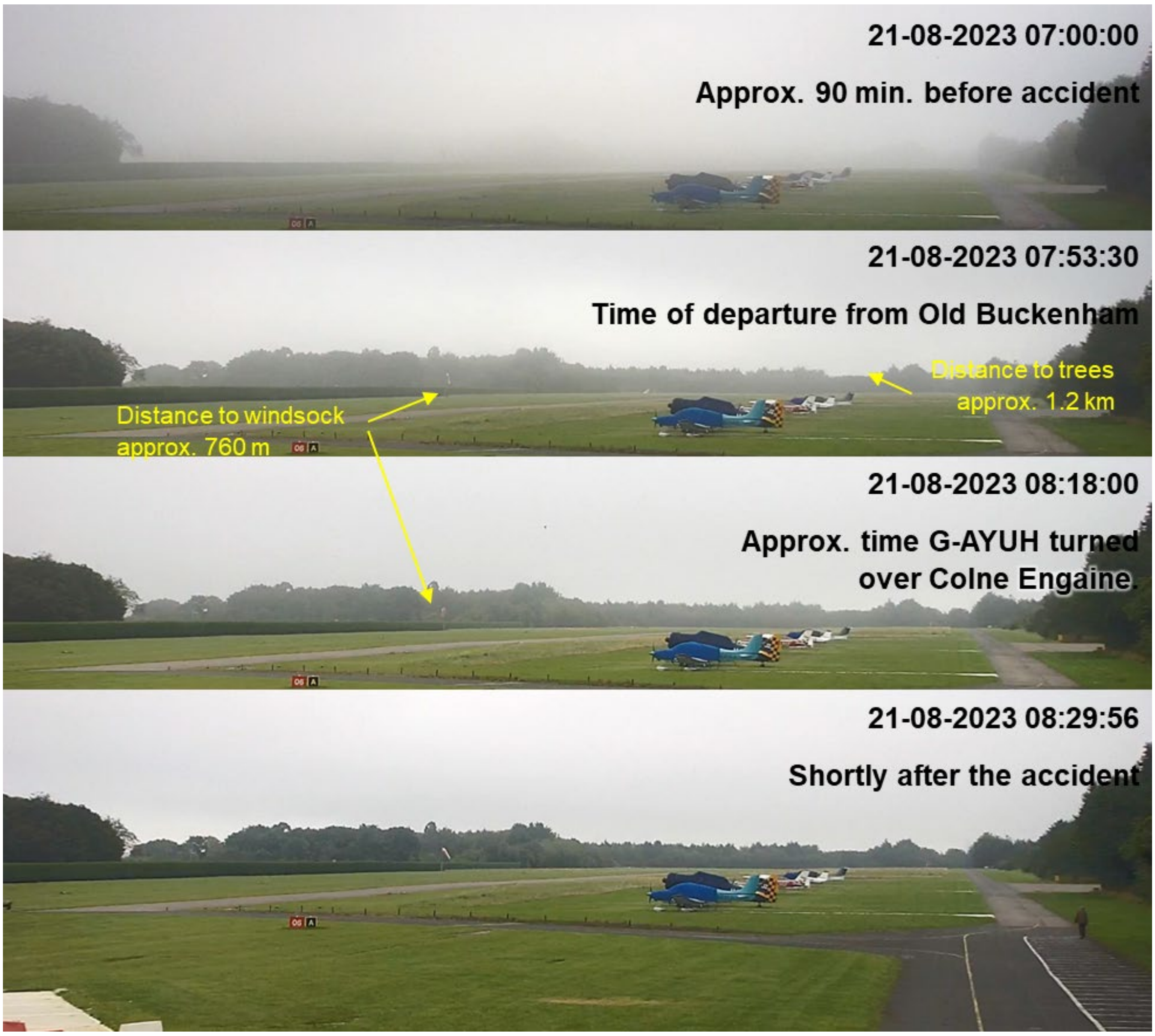


Figure 8

Snapshots from CCTV footage at Earls Colne, showing changing visibility in the area.

Aircraft examination

General description of the aircraft

The PA28 is a four seat, low wing monoplane of conventional design and is constructed primarily of aluminium. It is powered by a carburetted, four-cylinder piston engine driving a metal fixed pitch propeller. Fuel is carried in two integral wing tanks, one in each wing, with a total capacity of 50 USG. A fuel selector in the cockpit has three pilot-selectable positions: LEFT tank, RIGHT tank, and a guarded OFF position. The aircraft was equipped for flight in IFR conditions. A pilot-selectable cabin heater was fitted; it uses a heat exchanger to take heat from the metal parts of the engine exhaust system to warm fresh air for the passenger cabin. A portable electronic carbon monoxide detector was mounted on the instrument panel to detect any exhaust leaks; its battery had been replaced recently.

Maintenance information

The aircraft was maintained by an approved maintenance organisation. A review of the maintenance records showed that the aircraft had been maintained as required. Recent maintenance checks had identified one of the engine's cylinders was slightly low on compression. The compression value was within the engine manufacturer's limits for continued service, and it was being monitored for any further deterioration by the maintenance organisation in accordance with standard aviation practice. The owners were discussing options for future remedial work should it become necessary.

Fuel quantity

From the owner's records, records held by the aircraft's home airfield and the pilot of the previous flight, it was determined that the aircraft had departed with full fuel tanks. The aircraft therefore contained 48 USG of useable fuel of the correct grade; sufficient for over 4.5 hours of flying at the maximum cruise power setting.

Detailed examination of the wreckage

The aircraft wreckage was recovered to the AAIB facilities at Farnborough, Hampshire for further examination. The engine and its exhaust system were relatively intact but had suffered impact damage. No defects that could have contributed to the accident were identified with these components. The exhaust heat exchanger for the cabin heat was disassembled and found to be in good condition with no cracks or leaks. Examination of the remainder of the aircraft was limited due to the substantial effects of the post-accident fire. Within this limitation and examination of the aircraft log books, no pre-existing defects or anomalies that may have contributed to the accident were identified.

Meteorology

Met Office forecast and analysis

The Surface Analysis Chart published by the Met Office (Figure 9), valid for 0600 hrs on Monday 21 August 2023, shows an area of high pressure over southern UK and northern France. The south-east of the UK was therefore experiencing settled conditions with slack south-westerly winds.

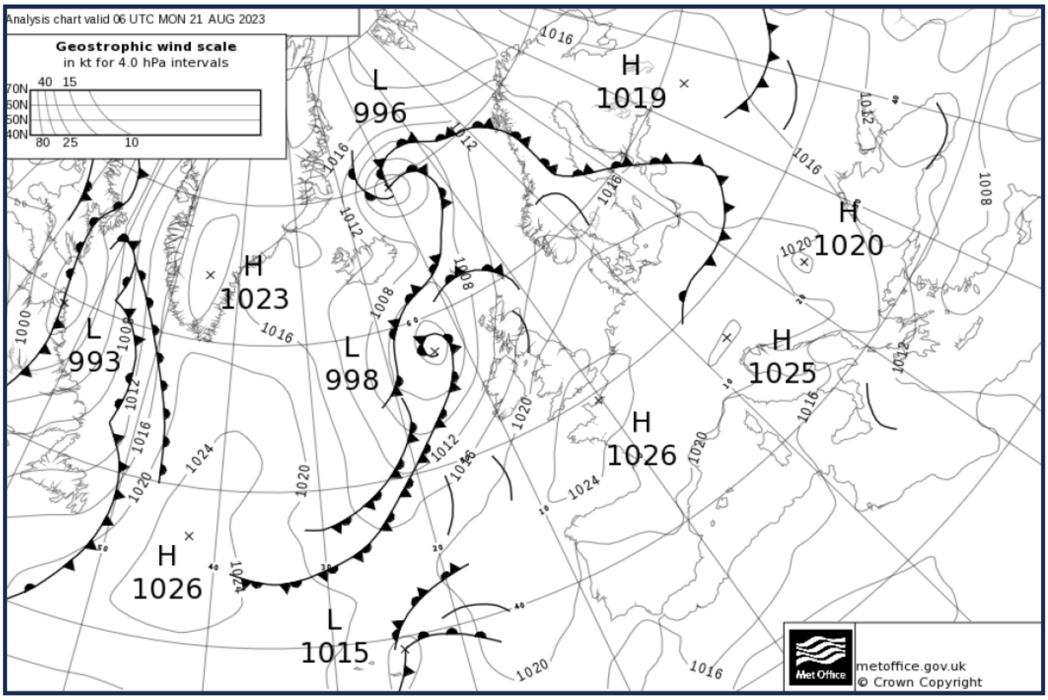


Figure 9

Surface Analysis Chart valid 0600 hrs Monday 21 August 2023

The Met Office published Low Level Significant Weather Charts (Form 215 – Figure 10) at 1514 hrs and 2053 hrs on Sunday 20 August 2023 (valid for 0000 hrs and 0600 hrs on Monday 21 August 2023). The flight was planned to be conducted within Area C, however the boundary of Area B would slowly approach the area of the planned flight overnight before retreating back to the south-west. The conditions within Area C were expected to be generally good with 35 km visibility, although this was forecast to reduce to 3,000 m in mist (BR) or 300 m in fog (FG)[4] over land (LAN) after 2200 hrs on 20 August, before clearing by 0800 hrs or 0900 hrs (0900 or 1000hrs local time) on 21 August. Occasional (OCNL)[5] scattered or broken (SCT/BKN) amounts of cloud between 2,500 and 3,500 ft were expected, however isolated (ISOL)[6] scattered or broken cloud between 300 and 600 ft was expected to develop at times in the south of Area C, lowering to the surface in the presence of fog.

Footnote

4 Fog is defined as a reduction in visibility to less than 1,000 m due to suspended water droplets. In effect, it is cloud on the ground.

5 Occasional: implies infrequent conditions which can be avoided. 25 – 50% of the area affected.

6 Isolated: implies isolated conditions occurring randomly and which can easily be avoided. < 25% of the area affected.

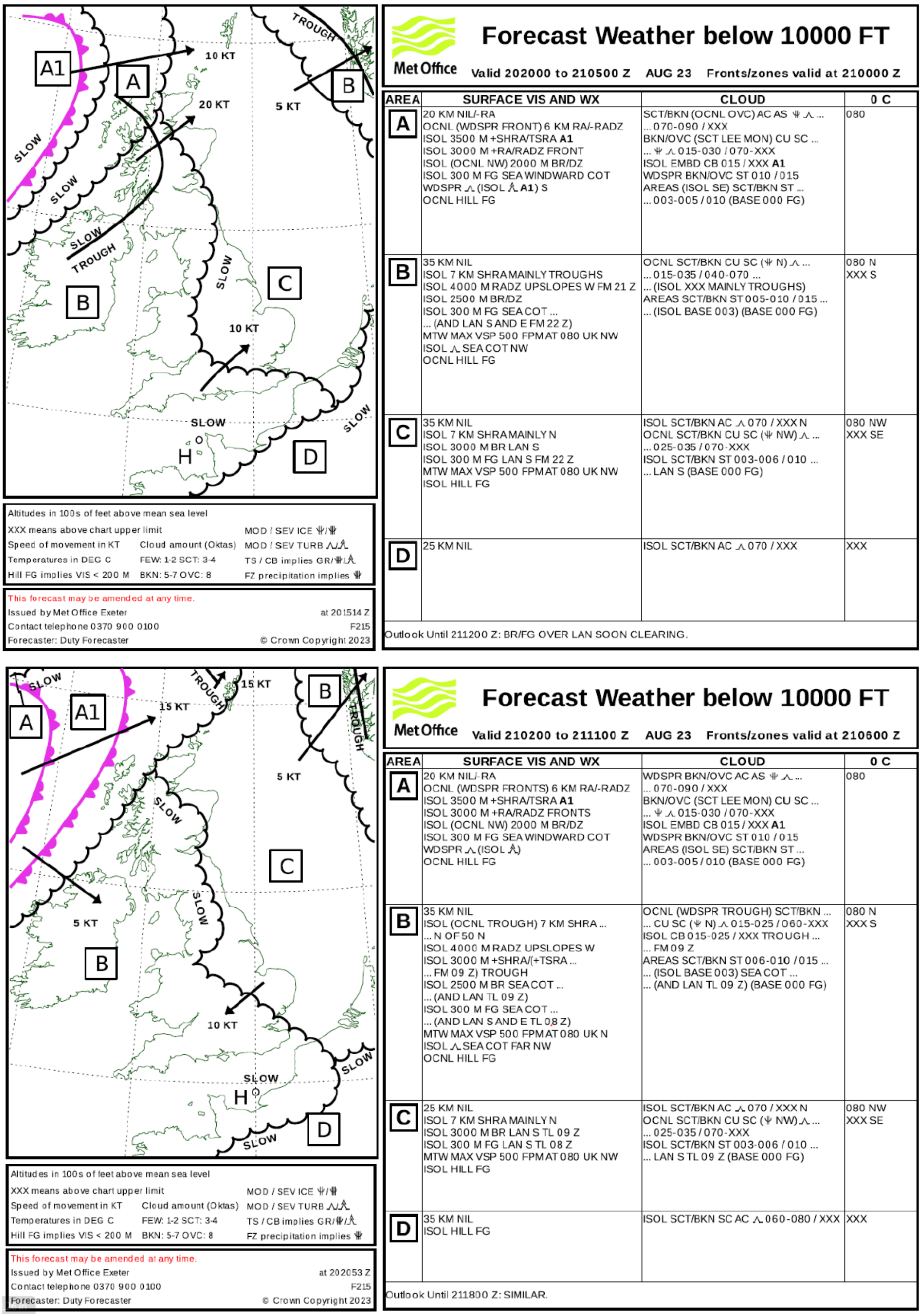


Figure 10

F215 Low Level Significant Weather Charts for 0000 hrs and 0600 hrs 21 August 2023

A visible satellite image taken at 0745 on 21 August 2023 (Figure 11) shows that the frontal edge of the cloud had moved across the area of Earls Colne.

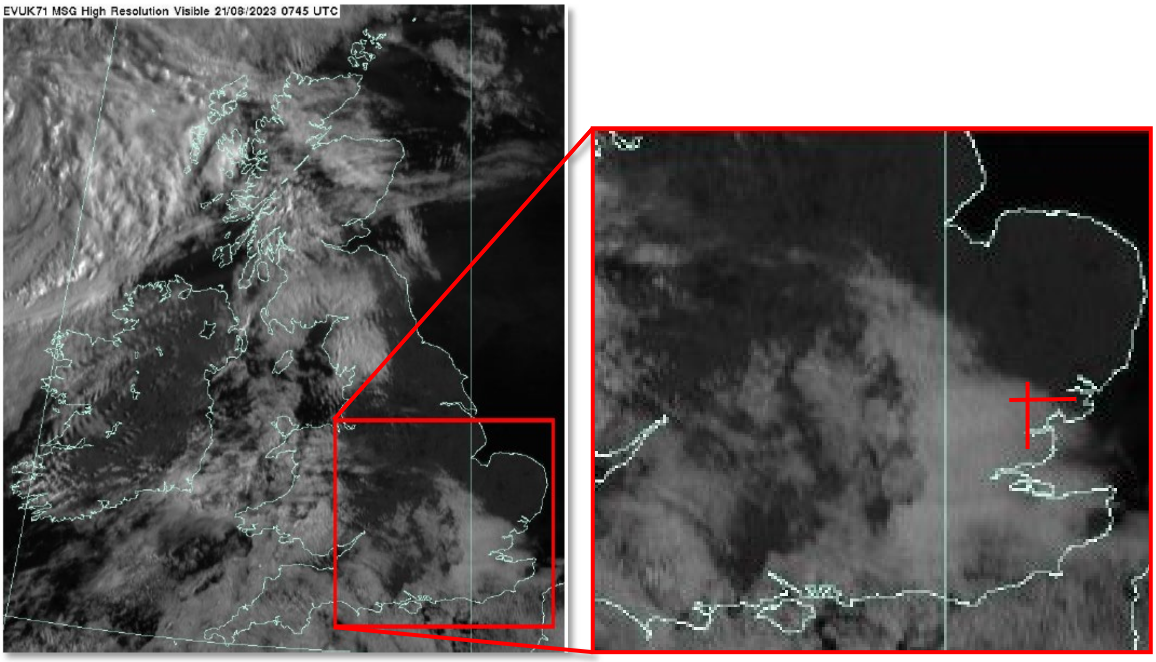


Figure 11

Visible satellite image taken at 0745 hrs on 21 August 2023 – intersection of red lines on right image shows approximate position of Earls Colne Airfield (© Met Office)

An infra-red satellite image taken 0700 hrs on 21 August 2023 (Figure 12) also shows cloud across the area of interest, but it appears less distinct than the visible satellite image. This indicates that the temperature of the cloud tops was close to the surrounding surface temperature, so at a very low level. The Met Office informed the AAIB that this is indicative of the presence of fog.

Visible and infra-red satellite imagery is available to pilots from the Met Office Aviation Briefing Service[7]. A range of pilot training resource is also available on the Met Office website[8]. Additionally, the Skyway Code published by the CAA contains information on pre-flight preparation and weather-related decision making[9].

Footnote

7 Available at https://www.metoffice.gov.uk/services/transport/aviation/regulated/aviation-briefing-service-guidance [accessed 29 May 2024].

8 Available at https://www.metoffice.gov.uk/services/transport/aviation/regulated/pilot-resources [accessed 29 May 2024].

9 Available at https://www.caa.co.uk/general-aviation/safety-topics/the-skyway-code/ [accessed 29 May 2024].

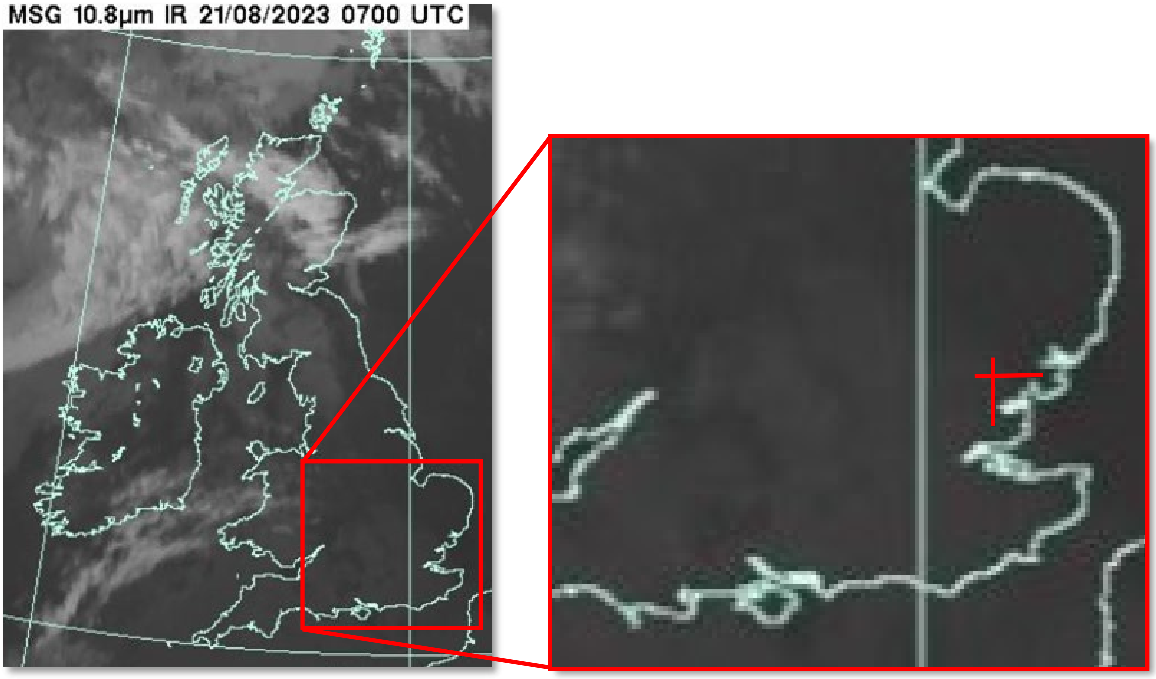


Figure 12

Infra-red satellite image taken at 0700 hrs on 21 August 2023 - intersection of red lines on the right image shows the approximate position of Earls Colne Airfield (© Met Office)

The bank of fog started to affect Stansted Airport (30 km west of Earls Colne) at around 0450 hrs on 21 August as it moved towards the area from the south-west. Stansted's 0450 hrs METAR reported a Runway Visual Range for Runway 22 of 650 m, decreasing in fog. The cloud was reported as overcast at 100 ft above the airport[10]. The presence of fog, then low cloud, continued to be reported at Stansted for the rest of the morning. The first TAF to raise the risk of fog was issued at 0440 hrs on 21 August.

TAFs produced for Wattisham Airfield (15 km NE of Sudbury) indicated good conditions for the morning of 21 August with light south-westerly winds, good visibility and no significant cloud. The METARs recorded at 0650 and 0720 hrs reported CAVOK conditions.

The Met Office provided the following opinion on the availability of meteorological planning information for the flight:

> *'A general aviation pilot would be able to see the cloud in the Visible satellite imagery, and by comparing to the Infra-Red images would be able to determine the presence of fog. However this would require a background knowledge of the differences between the two images. In addition to this the presence of fog was forecast in the Significant Weather charts issued on the 20th and the 21st. Although there was no mention of fog in the TAFs for the local area issued on the 20th the first TAF to raise a risk of fog was issued at 0440UTC on the 21st for Stansted, and would therefore been available for flight briefing after this time.'*

Footnote

[10] The elevation of Stansted Airport is 348 ft amsl.

A witness who worked at Earls Colne Airfield reported that the weather at Sudbury at 0615 hrs was cloudless with good visibility. As they approach Earls Colne village the weather conditions deteriorated such that by the time they drove past the threshold of Runway 24, some 30 minutes later, the windsock on the airfield was obscured by fog.

Following the accident, a police helicopter attended the scene at 0902 hrs. The pilot reported that the cloud base at the accident site was at 500 ft agl, and 300 ft agl at Earls Colne.

Geographic limits of TAFs and METARs

ICAO Doc 8896 – *Manual of Aeronautical Meteorological Practice* defines the geographic limits of TAFs and METARs as:

- **TAFs**: *'Forecasts of weather phenomena are for the area at the aerodrome, i.e. the area within a radius of approximately 8 km of the aerodrome reference point. The word "approximately" is used to cater for aerodromes that have perimeters which are not precisely a radius of 8 km from the aerodrome reference point. Forecasts of cloud are for the aerodrome and its vicinity, i.e. the area within a radius of approximately 16 km of the aerodrome reference point.'*

- **METARs**: in addition to the requirement for present weather information to be representative of the conditions within a radius of approximately 8 km of the aerodrome reference point, it should be representative *'for certain specified present weather phenomena*[11]*, in its vicinity, i.e. the area that lies within a radius of approximately 8 km and 16 km of the aerodrome reference point.'*

Meteorological information available on SkyDemon application

The investigation could not determine which sources of meteorological information the pilot consulted to plan the flight on 21 August 2023. However, it was found that he routinely used the SkyDemon flight planning and navigation application. A printed Pilot Log for the flight produced on the application was recovered from the accident site, but it did not include any meteorological information.[12]

SkyDemon can show a Virtual Radar display which graphically depicts some conditions in a TAF or METAR published for an aerodrome. SkyDemon provided the AAIB with an example (Figure 13) for an aerodrome reporting fog in a METAR.

Footnote

[11] Specified present weather phenomena includes precipitation and visibility factors such as fog, mist or haze.
[12] Users can select the contents of a 'Briefing Pack' for printing from the Pilot Log, Enroute Charts, Virtual Radar, Airfield Information, weather, NOTAM and Weight & Balance.

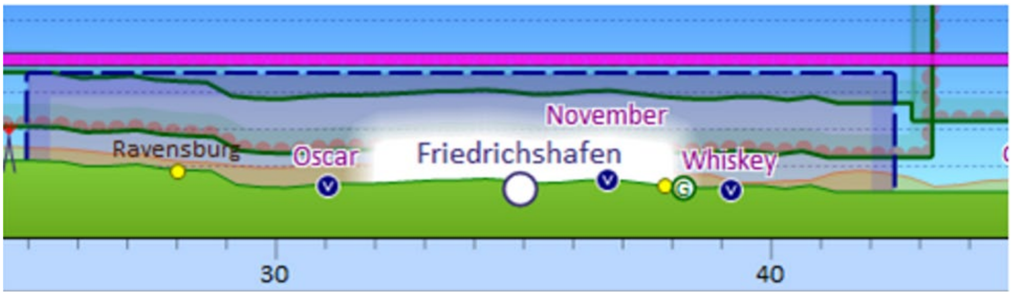


Figure 13

Example of the SkyDemon Virtual Radar display depicting fog (used with permission)

Weather information is automatically downloaded along a route as it is planned by the user and overlaid in the Virtual Radar window. The graphic displays a column that contains the relevant condition in the METAR[13] and is not intended to indicate that those conditions will be observed within a particular distance of the aerodrome shown on the display. This information cannot be displayed in flight, however full TAF and METAR details for relevant aerodromes can be accessed in a separate window when selected, either on the ground or in flight.

Aerodrome information

Earls Colne Airfield is situated six kilometres south-east of Halstead in Essex at an elevation of 227 ft amsl. It is a licensed airfield operating seven days per week and hosts an air ambulance helicopter unit. All aircraft arrivals are strictly PPR by telephone.

Provision of AGCS

Earls Colne operates an AGCS, call sign 'Earls Colne Radio', and the radio operators of this service hold a Radio Operator's Certificate of Competence (ROCC) issued by the CAA. The role and responsibilities of a radio operator is described in the Aerodrome Manual, which includes the provision of '*advisory information*' to pilots such as:

- Active runway and circuit direction.
- Indicated surface wind direction and speed.
- QNH / QFE.
- ATZ traffic in general terms.

Information on wind direction was obtained by reference to a windsock on the airfield and the wind speed reported at Stansted Airport which was available to the radio operators through Stansted's ATIS broadcast.

To assist the radio operators to determine the prevailing visibility there was a '*Visibility Indicators*' chart displayed on the window of the radio room which indicated distances, in metres, to features on and around the airfield.

Footnote

[13] Conditions that can be displayed are cloud layers, rain, snow and visibility (including fog and mist).

Additional duties involved the provision of PPR telephone briefings to visiting pilots in order to:

> *'Provide clear concise information on the runway condition, runway in use, circuit pattern / height, surface wind, advise noise abatement procedures are to be found on the…web site. Be able to discern from the response if the information has been understood.'*

Radio operators

When the pilot of G-AYUH made his initial radio call to Earls Colne Radio, the radio operators on duty shared a common belief that the privileges of a ROCC did not allow them to report weather conditions to pilots, except wind direction and speed. This was based primarily on their training and the fact that they were not qualified Aerodrome Meteorological Observers (AMOs)[14]. However, they acknowledged that they could relay weather conditions that had been passed to them by other pilots.

The ROCC training syllabus, contained in CAP 452[15], does not cover meteorological observations. Neither is the subject covered in CAP 1439, '*Guidance for examiners of aerodrome air-ground radio station operators*', which contains examples of ROCC written exam questions. This was confirmed by the CAA-authorised examiner who provided the training to the radio operators.

The radio operator who received the telephone PPR from the pilot on the day before the accident flight informed the AAIB that had the pilot telephoned before taking off, he would have told him that Earls Colne was experiencing fog. This was attributed to the fact the conversation was by telephone and not subject to the limitations the radio operator believed were imposed by the terms of his ROCC.

Aerodrome Manual

The Aerodrome Manual for Earls Colne stated that in poor weather conditions:

> *'The runway will not be closed for reasons of poor visibility or low cloud base. The decision to take off or land rests with the pilot which he / she may do despite being advised to the contrary unless Appendix 1 Termination of flight conditions[16] are deemed necessary.'*

Footnote

[14] Civil Aviation Publication 746: 'Requirements for meteorological observations at aerodromes', Issue 6, 2023, provides guidance on the requirements, training and qualification for AMOs. Available at https://www.caa.co.uk/publication/download/12602 [accessed 29 May 2024].

[15] Civil Aviation Publication 452: 'Aeronautical Radio Station Operator's guide', Edition 15, 2016. Available at https://www.caa.co.uk/publication/download/15805 [accessed 29 May 2024].

[16] Appendix I Termination of flight conditions refers to the authority of the Managing Director to prevent the commencement or continuation of any flight under certain conditions laid out in the Air Navigation Order, but not weather related.

The airfield operator informed the AAIB that they had no previous experience of visiting pilots attempting to approach the airfield when the weather was substantially below VFR limits. As such, they had not identified this as a potential hazard in their Risk Register or implemented specific measures to mitigate the risk.

AGCS

CAP 452, together with CAP 413, *'Radiotelephony Manual'*, are intended to provide *'the main reference documents for radio station operators'*. CAP 452 states that:

> *'AGCS radio station operators provide traffic and weather information to pilots operating on and in the vicinity of the aerodrome. Such traffic information is based primarily on reports made by other pilots. Information provided by an AGCS radio station operator may be used to assist a pilot in making a decision; however, the safe conduct of the flight remains the pilot's responsibility.'*

CAP 452 does not, however, provide further detail on the nature or content of '*weather information*' that may be provided to pilots. Similarly, there is no clarification in CAP 413.

In a later section on Operational Control Communications (OPC)[17], CAP 452 states that only flight regularity and flight safety messages may be transmitted under the remit of OPC. An example of a flight safety message is listed as:

> *'Meteorological advice of immediate concern to an aircraft in flight or about to depart (individually communicated or for broadcast).'*

A ROCC is not required to operate a ground radio when providing an OPC.

Previous AAIB investigations involving the provision of an AGCS

In the report into the accident involving G-OMAG and N68427[18] in 2021, where the aircraft collided on the runway at Dunkeswell Aerodrome, the AAIB found that CAP 452 provided insufficient guidance to licence holders on the delivery of an AGCS. In response, on 4 August 2022, the CAA published Supplementary Amendment 2022/01 to CAP 452[19], providing an update to the requirements for ROCC holders.

The amendment clarified that:

> *'The purpose of the ROCC AGCS/OCS is <u>to improve the situational awareness for Pilots and to assist them by providing information that is useful for the safe and efficient conduct of flights.</u>*

Footnote

[17] Operational Control Communications is an aeronautical radio station licensed and established for communication between an operator and their aircraft.

[18] Available at https://www.gov.uk/aaib-reports/aaib-investigation-to-cessna-182b-g-omag-and-boeing-stearman-a75n1-pt17-n68427 [accessed 29 May 2024].

[19] Available at https://www.caa.co.uk/publication/download/19841 [accessed 29 May 2024].

The information passed by an ROCC operator shall not be considered an instruction and does not substitute for pilot's responsibility to ensure the safe operation of their aircraft at all times.'

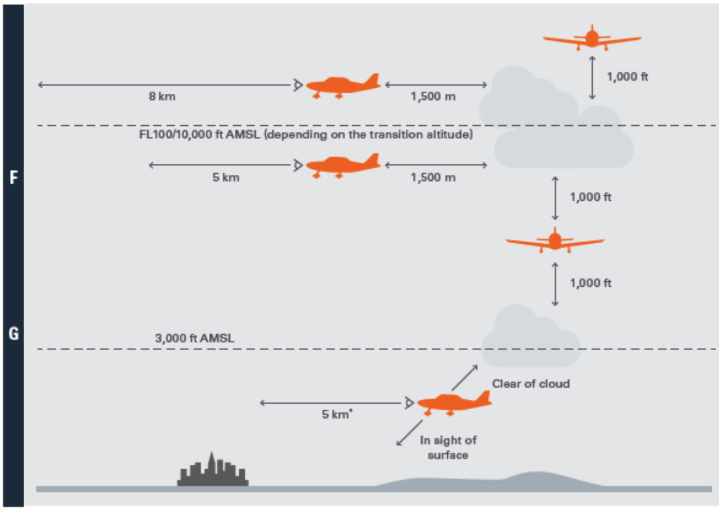
And that:

'Any information provided by the ROCC operator does not relieve the pilot-in-command of an aircraft of any responsibilities.'

Flight planning

Flight in accordance with VFR

Regulations governing flight in accordance with VFR are contained in the UK Standardised Rules of the Air Regulation[20]. The following extract from the Skyway Code[21] provides a graphical representation of VFR in Class G airspace (Figure 14).



Altitude band	Airspace class	Flight visibility	Distance from cloud
At and above 10,000 ft AMSL/FL100	A B C D E F G	8 km	1,500 m horizontally 1,000 ft vertically
Below 10,000 ft AMSL/FL100 and above 3,000 ft AMSL, or above 1,000 ft above terrain, whichever is the higher	A B C D E F G	5 km	1,500 m horizontally 1,000 ft vertically
At and below 3,000 ft AMSL, or 1,000 ft above terrain, whichever is the higher	A B C D** E	5 km	1,500 m horizontally 1,000 ft vertically
	F G	5 km*	Clear of cloud and with the surface in sight

VFR is not permitted in class A airspace, inclusion of VMC minima is for reference only.

***Class G exception:** In UK class G airspace the 5 km requirement may be reduced to 1,500 m, if flying by day, in sight of the surface and at 140 kts IAS or less.

****Class D exception:** Under the following circumstances you may fly 'clear of cloud' in class D airspace, without complying with the specific cloud separation distances: by day at or below 3,000 ft AMSL, in sight of the surface and at 140 kts IAS or less. 5 km visibility is still required, except for helicopters for which 1,500 m is required. Note this is a UK difference from Part-SERA as applies in the EU.

Figure 14

Graphical representation of Visual Flight Rules

Footnote

20 UK Regulation (EU) No 923/2012, available at https://regulatorylibrary.caa.co.uk/923-2012-pdf/PDF.pdf [accessed 29 May 2024].

21 Available at https://www.caa.co.uk/general-aviation/safety-topics/the-skyway-code/, page 65 [accessed 29 May 2024].

In UK class G airspace below 3,000 ft amsl, or 1,000 ft above terrain, whichever is the higher, the 5 km visibility requirement may be reduced to 1,500 m, if flying by day, in sight of the surface and at 140 kt IAS or less. The Skyway codes states on page 39 that:

> *'For operations in class G airspace, the VFR minima may allow an in-flight visibility as low as 1,500 m, provided you remain clear of cloud. The cloud height is often the limiting factor – in conditions of 1,500 m visibility, the cloud height would normally force you to fly dangerously low. The legal minima are not a good reference point for decision making because safe VFR flight normally ceases to be possible long before the visibility is that poor. They are limits not targets.'*

On page 40, the Skyway Code offers the following advice regarding VFR flight with a cloud ceiling of 1,500 ft agl or less:

> *'VFR flight with a cloud ceiling of 1,500 ft or less above ground level (AGL) requires particular attention to terrain and obstacles. Flight below 1,000 ft AGL is normally only suitable for circuits around the aerodrome or local flying in areas you are familiar with.'*

And where the cloud ceiling is sufficiently high:

> *'VFR flight when the surface visibility is being reported as less than 5 km is not recommended. You are unlikely to have a clear horizon to control the aircraft, and navigating visually will be difficult.'*

Pilot information

The pilot held a UK Private Pilot's Licence, first issued in 1979, then renewed in 2014. He had flown a total of 407 hours, mostly on PA-28s. He joined the G-AYUH syndicate in 2021 and underwent 3.5 hours of training with a local instructor at Old Buckenham. That training did not include instrument flying and was not required to do so. The pilot had logged 5 hours of instrument flying in the past, but it was not possible to determine when this occurred. Logbook evidence available to the investigation contained entries from September 2022 and there were no entries for instrument flying except a record of the cumulative total. The pilot did not hold an instrument rating.

The pilot's SEP rating was valid until 31 October 2024 and he last conducted biennial training on 25 September 2022. Biennial SEP revalidation flight tests, or the alternative of one hour of flight training with an instructor where the pilot achieves the required minimum hours, does not require any training on inadvertent entry into IMC or for pilots to demonstrate recovery from simulated entry to IMC.

CAA-directed training

The pilot was flying to Earls Colne to conduct a training package that had been directed by the CAA. He was required to complete the training by 27 August 2023. On 26 July 2023 he arranged with the training provider to undertake the flying element of the package on 21 August 2023 at Earls Colne. In preparation for that event, he flew to Earls Colne on 17 August to meet his instructor and discuss the requirements.

The AAIB was informed by the training provider that whilst the CAA had set the deadline of 27 August 2023 to complete the training, an extension could be sought where there were good reasons to do so. The investigation was not able to determine whether the pilot was aware of this option.

Medical

The pilot held a current CAA Class 2 medical, which was valid until August 2024.

Post-mortem report

Post-mortem examination of the pilot revealed no evidence of incapacitation before the accident or the presence of carbon monoxide. Injuries sustained during the impact were not survivable.

Analysis

Overview

The accident sequence began when the aircraft entered metrological conditions that were less than those required for flight in accordance with VFR. When the pilot recognised this and attempted to return to his aerodrome of departure, the aircraft departed from controlled flight. The pilot died from injuries sustained when the aircraft struck the ground. The post-mortem examination determined that there was no indication of medical impairment or incapacitation of the pilot before the aircraft struck the ground.

The accident

A review of the maintenance documentation indicated the aircraft had been maintained to the required standard and the examination of the wreckage did not identify any anomalies or defects that could have contributed to the accident. The fuel on board was more than sufficient for the intended flight and damage to the propeller and its mounting indicated that the engine was producing power at the time of the accident.

Following the turn at Colne Engaine, G-AYUH climbed from approximately 500 ft amsl (260 ft agl) to 1,100 ft amsl (860 ft agl) as the pilot likely attempted to gain separation from the ground in weather conditions that were either IMC or, at best, a degraded visual environment. It then commenced a turn to the left and immediately descended to 750 ft amsl (510 ft agl) before climbing again whilst reversing the turn to the right.

From the last recorded position and the orientation of the final wreckage location, it is likely that G-AYUH continued in a right turn. A combination of Stansted radar's rotation period and the likely low radar cross-section presented by the aircraft, did not allow for a detailed analysis of the final descent. However, witness evidence of G-AYUH's attitude as it emerged below cloud, combined with the release of aircraft components in the wreckage path, indicated that the aircraft continued in a descending right turn until the point of impact with the trees.

Planning and decision to fly

The investigation found that the pilot had planned the flight to Earls Colne, and his subsequent training flights for the day, using the SkyDemon application. The application can display weather information to a user in graphic and textual form. However, the 'Virtual Radar' display graphic can only show weather reported at an aerodrome that is in close proximity to the planned track. It would not have shown the presence of fog at Stansted, some 30 km to the west of Earls Colne. The pilot would have to review Stansted's METAR & TAF and interpret their significance for his planned route. However, the geographic limit of these forecasts and observations only extends to 16 km from the aerodrome, so further information would be required to establish an accurate picture of the conditions.

The Met Office Low Level Significant Weather Charts published at 1514 hrs and 2053 hrs on Sunday 20 August 2023 clearly indicated the likelihood of fog affecting the region of the planned flight on the following morning. The Met Office informed the AAIB that '*the first TAF to raise a risk of fog was issued at 0440UTC on the 21st for Stansted, and would therefore been available for flight briefing after this time'.* Similarly, the visible and infra-red satellite images showing the area to the east of Stansted affected by the fog were available before the planned departure. However, the Met Office advised that whilst a general aviation pilot '*would be able to see the cloud in the visible satellite imagery, and by comparing to the infra-red images would be able to determine the presence of fog',* that would require a '*background knowledge of the differences between the two images'.*

The AAIB did not find any evidence that the pilot had reviewed weather information from an aviation weather service provider, such as the Met Office, prior to the flight, and no meteorological information was found with the flight's paperwork. The CAVOK conditions at Old Buckenham on the morning of the flight may have led him to believe that the weather was suitable for the route to Earls Colne. METARs for Wattisham also declared CAVOK conditions, which may have reinforced his belief.

The pilot phoned Earls Colne to register his PPR on the evening before the flight as he planned to take off before they opened for operations. During the phone call the radio operator suggested that the pilot call again before departure the following morning to confirm the airfield conditions. However, The AAIB did not find any evidence of the pilot calling before he departed Old Buckenham. Had he done so, the radio operator stated that he would have informed him of the foggy conditions as phone conversations were not subject to the same restrictions as radio communication.

The pilot had a motivation to be at Earls Colne early in the morning to undertake a day of training directed by the CAA. The training provider informed the AAIB that whilst the CAA had set the deadline of 27 August 2023 to complete the training, an extension could be sought where there were good reasons to do so. The investigation could not determine whether the pilot was aware of this flexibility and could not rule out the possibility that a perceived sense of pressure to comply with the agreed training schedule influenced his decision to fly.

In-flight decision making

When the pilot of G-AYUH reported to Earls Colne Radio that he was abeam Sudbury at 1,500 ft amsl, it is probable that the prevailing conditions were VMC. Visible and infra-red satellite imagery shows the frontal edge of the bank of fog was still approximately three to four kilometres to his south. This was corroborated by witnesses who had driven from Sudbury to Earls Colne that morning. The aircraft's descent to about 500 ft amsl (260 ft agl) is consistent with the area of degrading visibility and low cloud associated with these conditions. It is likely that the pilot was descending to remain clear of cloud and remain in sight of the surface with the intention of landing at Earls Colne. However, he had not been informed of the presence of fog by the radio operator, which would have precluded a safe landing there.

The CAA publishes comprehensive guidance on flight under VFR in the Skyway Code and highlights the key hazard when weather conditions are close to published limits:

> *'The legal minima are not a good reference point for decision making because safe VFR flight normally ceases to be possible long before the visibility is that poor. They are limits not targets.'*

At the point the pilot informed Earls Colne Radio that he had entered '*thick cloud or fog*' and was attempting to return to Old Buckenham, the meteorological conditions would have presented a severe test of his flying skills with a high risk that the pilot would become spatially disorientated.

Manually flying an aircraft in IMC is a skill that requires training and currency to achieve safely. The pilot did not hold an instrument rating, and it was not possible to determine when in the past he undertook five hours of instrument flying training. There is no requirement for pilots to revisit the basic instrument flying skills taught in the PPL syllabus in subsequent licence revalidation checks. It is therefore likely that the pilot did not possess the current skills to safely control his aircraft on encountering IMC.

In the report into the fatal accident involving a Mudry Cap 10B, G-BXBU in 2021[22], where the pilot inadvertently encountered IMC, the AAIB made the following Safety Recommendation:

Safety Recommendation 2023-011

It is recommended that the Civil Aviation Authority publish guidance for general aviation pilots on responding to unexpected weather deterioration, highlighting the factors affecting their performance and the benefits of planning before the flight how they will respond.

Footnote

22 Available at https://www.gov.uk/aaib-reports/aaib-investigation-to-mudry-cap-10b-g-bxbu [accessed 29 May 2024].

The CAA responded that:

'In addition to the guidance highlighted in the CAA's initial response to this safety recommendation, the CAA is also developing a new Safety Sense Leaflet (SSL) dedicated to inadvertent entry into Instrument Meteorological Conditions (IMC) when operating under Visual Flight Rules (VFR). The SSL will include guidance on planning to avoid a 'VFR into IMC' scenario and what actions to take if a pilot is confronted with deteriorating weather conditions and ends up in IMC when not appropriately qualified.'

The CAA subsequently published Safety Sense Leaflet 33: '*VFR Flight Into IMC'*[23]*,* on 7 May 2024.

Communication

The radio operators who were on duty at Earls Colne did not feel empowered to inform the pilot of G-AYUH of the fog at the airfield when he radioed to request the airfield details. They had formed a collective view that the privileges of the ROCC did not permit them to pass meteorological information to an aircraft in flight unless it had first been relayed to them from another aircraft. This view had been influenced by a combination of their training, the airfield operator's expectation of their role, and the fact that they were not qualified metrological observers. The operator's Aerodrome Manual stated that *'The runway will not be closed for reasons of poor visibility or low cloud base'* and that the decision to take off or land rests with the pilot in command. The airfield operator informed the AAIB that they had no previous experience of visiting pilots attempting to approach the airfield when the weather was substantially below VFR limits. As such, they had not identified this as a potential hazard in their Risk Register or implemented specific measures to mitigate the risk such as empowering the radio operators to pass meteorological information that would be '*useful for the safe and efficient conduct of flight',* as clarified in the Supplementary Amendment 2011/01 to CAP 452, published in August 2022.

Therefore, to prevent recurrence, the airfield operator has introduced the following additional processes:

- *Request any pilot who PPR`s in advance of the date they intend to arrive to call on the day of the flight to verify that the weather conditions are suitable for them.*
- *If an aircraft is due to arrive at Earls Colne and the weather has deteriorated at the airfield, and we have any pilot reports from other aircraft on the state of the weather, this information will be passed to the pilot inbound.*
- *If the weather has deteriorated at the airfield and there are no pilot reports available, then the inbound pilot will be provided with some key pointers using the following standards:*

Footnote

23 Available at https://www.caa.co.uk/publication/download/21918 [accessed 29 May 2024].

> - *Horizontal visibility at midpoint of runway and end of runway.*
> - *'Unofficial' weather observations of prevailing conditions at the airfield.*
> - *The frequency of Stansted Airport's ATIS.*

In discussion with AAIB, the CAA agreed that CAP 452 permitted providers of an Operational Control Communications service, who did not have to hold an ROCC, to pass '*Meteorological advice of immediate concern to an aircraft in flight or about to depart'.* This contrasted with operators of an AGCS who were not similarly empowered. Therefore, to clarify the roles and responsibilities of the holders of a ROCC, and to highlight those occasions when they should provide pilots with additional information for the purpose of alerting them to hazards and avoiding immediate danger, the CAA published Safety Notice SN-2024/001, *ROCC 'Flight Safety Messages' Requirement*[24]*,* on 30 January 2024. This Safety Notice, under '*Meteorological Information*' states:

> *'2.1 Information regarding adverse weather conditions (although this is not an official meteorological report) should be passed to aircraft concerned with the use of the following prefixes:*
>
> *a) "reported by a pilot (at time)…." or*
> *b) "unofficial observation"*
>
> *2.2 Examples of meteorological information messages (this list is not exhaustive):*
>
> *a) "Unofficial observation, fog observed to East".*
> *b) "Departing aircraft (at time) reported low cloud base of approximately 200 ft".*
> *c) "Windshear reported (at time) by landing aircraft on final approach".*
> *d) "Thunderstorms reported by a pilot (at time)…."'*

The CAA also published a Supplementary Amendment to CAP 452, *Aeronautical Radio Station Operator's Guide*, No. 2024/01 (Version 1)[25], on 16 February 2024 which provides the following introductory information regarding the ROCC 'Flight Safety Message' requirements:

> *'1.1 The purpose of the Radio Operator's Certificate of Competence (ROCC) Air-ground communication service (AGCS) and Offshore Communication Service (OCS) is to improve the situational awareness for pilots and to assist them by providing information that is useful for the safe and efficient conduct of flights.*
>
> *1.2 ROCC holders are reminded of the requirement to consider 'Duty of care' to aircraft whilst operating on the AGCS/OCS frequency, and the importance of passing Flight safety messages, and additional safety information for the purpose of alerting aircraft of hazards and avoiding immediate danger. This*

Footnote

[24] Available at https://www.caa.co.uk/publication/download/21096 [accessed 29 May 2024].
[25] Available at https://www.caa.co.uk/publication/download/21226 [accessed 29 May 2024].

> *includes timely information regarding adverse weather to an aircraft in flight or about to depart.*
>
> …
>
> *1.5 Information provided by an AGCS/OCS radio station operator may be used to assist a pilot in making a decision; however, the safe conduct of the flight always remains the pilot's responsibility.*
>
> …
>
> *1.8 Depending on the operational circumstance these messages including any Meteorological advice of immediate concern may be individually communicated or passed via a broadcast on the frequency.*
>
> *1.9 Information regarding adverse weather conditions (although this is not an official meteorological report) should be passed to aircraft concerned with the use of the following prefixes "reported by a pilot (at time)…." or "unofficial observation".*
>
> *1.10 Transmissions must be passed in a clear and concise manner ensuring the use of unambiguous language, plain language may also be used to pass these safety critical messages if required.'*

To signpost the Safety Notice and Supplementary Amendment, on 16 February 2024 the CAA published Skywise alert SW2024/037 containing the following:

> ***'ROCC 'Flight Safety Message' requirement***
>
> *To remind Radio Operator's Certificate of Competence (ROCC) holders of the requirement to pass urgent flight safety messages we have published a Supplementary Amendment to CAP452 - Aeronautical Radio Station Operator's Guide (SA 2024/01) and Safety Notice (SN-2024/001).*
>
> - CAP 452 SA 2024/01: ROCC 'Flight Safety Message' requirement
> - SN 2024/001: 'Flight Safety Messages' Requirement
>
> *ROCC holders are also reminded of the previously published CAP 452 SA 2022/01: Update to requirements for ROCC Holders.*
>
> *We have also updated our Radio Operator's Certificate of Competence guidance to include more detail on the purpose of the ROCC and the holder's responsibilities.*
>
> *This action has been taken following an Air Accident Investigation Branch (AAIB) investigation into an accident and subsequent discussions between the AAIB and UK Civil Aviation Authority.'*

Conclusion

The accident happened when the aircraft struck trees and terrain after departing from controlled flight. This was as a result of the aircraft entering meteorological conditions which were not compatible with VFR and were beyond the pilot's experience and capabilities.

Meteorological forecasts available prior to the flight indicated the likelihood of low cloud and fog in the vicinity of the destination airfield. There was no evidence that the pilot had contacted Earls Colne on the morning of the flight to confirm the prevailing weather conditions.

When the pilot requested the airfield details, the radio operators at Earls Colne did not inform him that the airfield was in fog. They had formed a collective view that in providing an AGCS, the privileges of the ROCC did not permit them to pass meteorological information to an aircraft in flight unless it had first been relayed to them from another aircraft.

The investigation identified an inconsistency in CAP 452 which permitted providers of an Operational Control Communications Service, which does not require radio operators to hold a ROCC, to pass '*Meteorological advice of immediate concern to an aircraft in flight or about to depart'.* This contrasted with operators of an AGCS who were not explicitly empowered to provide pilots with such information for the purpose of alerting them to hazards and avoiding immediate danger.

Examination of the aircraft did not identify any pre-existing defects or anomalies that may have contributed to the accident.

Safety action

The operator of Earls Colne Airfield has introduced the following additional processes:

- Request any pilot who PPR`s in advance of the date they intend to arrive to call on the day of the flight to verify that the weather conditions are suitable for them.
- If an aircraft is due to arrive at Earls Colne and the weather has deteriorated at the airfield, and we have any pilot reports from other aircraft on the state of the weather, this information will be passed to the pilot inbound.
- If the weather has deteriorated at the airfield and there are no pilot reports available, then the inbound pilot will be provided with some key pointers using the following standards:
    - *Horizontal visibility at midpoint of runway and end of runway.*
    - *'Unofficial' weather observations of prevailing conditions at the airfield.*
    - *The frequency of Stansted Airport's ATIS.*

To clarify the roles and responsibilities of the holders of a ROCC, and to highlight those occasions when they should provide pilots with additional information for the purpose of alerting them to hazards and avoiding immediate danger, the CAA has:

- Published Safety Notice SN-2024/001, ROCC 'Flight Safety Messages' Requirement.
- Published a Supplementary Amendment to CAP 452, Aeronautical Radio Station Operator's Guide, No. 2024/01 (Version 1) which provides further information regarding the ROCC 'Flight Safety Message' requirements.
- Published Skywise alert SW2024/037 to highlight Safety Notice SN-2024/001 and the Supplementary Amendment.

Published: 27 June 2024.

Accident

Aircraft Type and Registration:	Jabiru UL-450, G-CDFK
No & Type of Engines:	1 Jabiru 2200A piston engine
Year of Manufacture:	2006 (Serial no: PFA 274A-14144)
Date & Time (UTC):	4 April 2023 at 1107 hrs
Location:	Damyns Hall Aerodrome, Upminster, Essex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Serious) Passengers - 1 (Serious)
Nature of Damage:	Extensive
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	230 hours (of which 173 were on type) Last 90 days - 1.5 hours Last 28 days - 0.5 hours
Information Source:	AAIB Field Investigation

Synopsis

During the climb after what was thought to be a normal takeoff the aircraft did not climb as expected. When at 300 ft, the pilot identified that the engine was not developing full power. With insufficient height or speed to return to the runway, and no suitable landing sites immediately available, the pilot attempted to remain airborne. The engine then stopped, the aircraft stalled and entered a spin before striking the ground.

The loss of engine power was probably caused by an age-related split in the rubber coupling attaching the carburettor to the engine's plenum chamber. No issues with the engine were identified during a 100-hour engine service or the subsequent check flight, carried out in January 2023. The location of the coupling and its mounting clips made inspection problematic. The engine manufacturer's manual for the engine stated that the coupling had a 1,000 hour, or five-year life but there was no evidence that the coupling had been replaced since the aircraft had been built in 2006.

The Light Aircraft Association (LAA) are revising its documents to clarify the processes and responsibilities of owners and LAA inspectors to make judgements about the management of life-limited components on LAA aircraft.

The UK Civil Aviation Authority (CAA), in addition to the information published in Safety Sense Leaflets 02, 07 and 12 regarding stall/spin awareness and aircraft performance, have hosted a workshop to discuss what to do in the event of an engine failure after takeoff and provide some guidance on staying safe. They also intend to produce a podcast about engine failures after takeoff and a communication campaign to promote the workshop and podcast.

Two Safety Recommendations have been made to the CAA to mandate a life limit for the Jabiru carburettor coupling and consider mandating a life limit for similar components used on other engine and aircraft types.

History of the flight

The pilot had arranged to take a friend on a couple of sightseeing flights from Damyns Hall Aerodrome where he kept his aircraft (G-CDFK). It was a clear day with a surface wind varying between 070° and 140° at approximately 10 kt giving a crosswind on Runway 03. The temperature was 10°C and dew point was 1°C.

After completing the necessary pre-flight inspections and pre-takeoff checklist, the aircraft took off from Runway 03 at 1018 hrs and flew to Hannningfield Reservoir. During the flight the pilot noticed the engine was “struggling a little”. As the aircraft crossed the M25 the pilot noted they were only at 900 ft when he would expect them to be at 1,200 ft. The pilot also saw the cylinder head temperature was slightly higher than usual. However, as the aircraft had recently been serviced at an approved facility with experience of the aircraft and engine type, he was not unduly concerned and decided to see how the engine performed on the second flight. The aircraft returned to Damyns Hall, landing at 1043 hrs.

The pilot refuelled the aircraft and prepared for the second flight. He intended to fly to the Queen Elizabeth II Bridge then to Brands Hatch before returning to the aerodrome.

The pilot taxied from the refuelling pump to Runway 03. He was conscious that another aircraft was on the downwind leg of the circuit so planned to expedite his takeoff. Before takeoff he recalled he checked the “hatches and latches”, engine temperatures and increased the engine power then reduced it back to idle to check that it didn’t cut out. He remembered it “all sounded alright and the temperatures and pressures were all in the green”. He elected to start his takeoff roll from a position inset from the full length as he had done on the first flight. He recalled making the radio call “*G-CDFK lined-up 03, immediate takeoff*”. He commenced the takeoff at 1105 hrs.

His recollection of the accident flight is blurred but he remembered that the takeoff was normal. He recalled that the engine note sounded normal, but during the climb identified that he was lower than he would have expected, realising that when he should have been at 400 ft agl he was actually at approximately 300 ft agl. He recalled seeing the airspeed reducing rapidly from “60 [kt] to 50 [kt]” and put the flaps up to see if that helped him gain airspeed. He remembered “it all going quiet” and the speed reducing. He thought he may have started to turn to the right to parallel the power cables. He then remembered “the wings waggled a bit” and the aircraft “just dropped”. Reflecting afterwards, he felt the engine must have stopped running when it went quiet. He did not recall hearing the stall warner before entering the descent.

A flight instructor, who was on the ground at the aerodrome, saw G-CDFK climbing away from the runway and witnessed the accident. They reported seeing the aircraft flying slowly with a nose-high attitude. They described seeing the aircraft “wobbling” or “waffling” in what they described as “classic slow flight”. They then saw the aircraft stall and enter a spin, rolling to the right. They saw the aircraft descend and heard the impact with the ground and immediately called the emergency services. The pilots of the aircraft that were on the downwind leg also witnessed the accident but were too far away to see what happened. They contacted Southend Radar to report the accident and were able to give the location.

The pilot remained conscious after the accident and attempted to make a MAYDAY call. He was able to speak to his passenger who was able to walk away from the accident despite having broken several ribs and bones in her back and received a severe laceration to her knee.

The emergency services arrived at the site and sedated the pilot before he was airlifted to hospital having received serious chest and leg injuries. He was in hospital for several weeks but was eventually able to return home to continue his recovery.

The passenger recalled that the takeoff and initial climb had appeared normal to her. She had not noticed anything different to the first takeoff until the aircraft started to roll to the right then “fell out of the sky”. She did not recall hearing any abnormal noises before the accident.

When asked about his normal pre-takeoff engine checks the pilot stated that he normally increased the throttle to 2,000 rpm for a few seconds to let it warm up, then increased up to full power for a couple of seconds, then reduce to idle then back to 2,000 rpm. He would check for “smooth operation and no popping or banging”. He did not know a figure for the maximum rpm he would expect but he thought he knew what normal looked like. He recalled that before the accident flight the engine all seemed to be normal, the engine indications were in the right place and it sounded normal.

The pilot also stated that he did not normally use the transponder fitted to his aircraft on local flight as he found it difficult to use due to a previous hand injury.

Accident site

The accident site was in a wooded area (Figure 1) approximately 900 m from the start of the aircraft’s takeoff roll and 390 m from the upwind threshold of Runway 21 at Damyns Hall Aerodrome. Damage to the trees indicated that it had entered them nearly vertically, striking the trunk of a mature tree before coming to the ground.

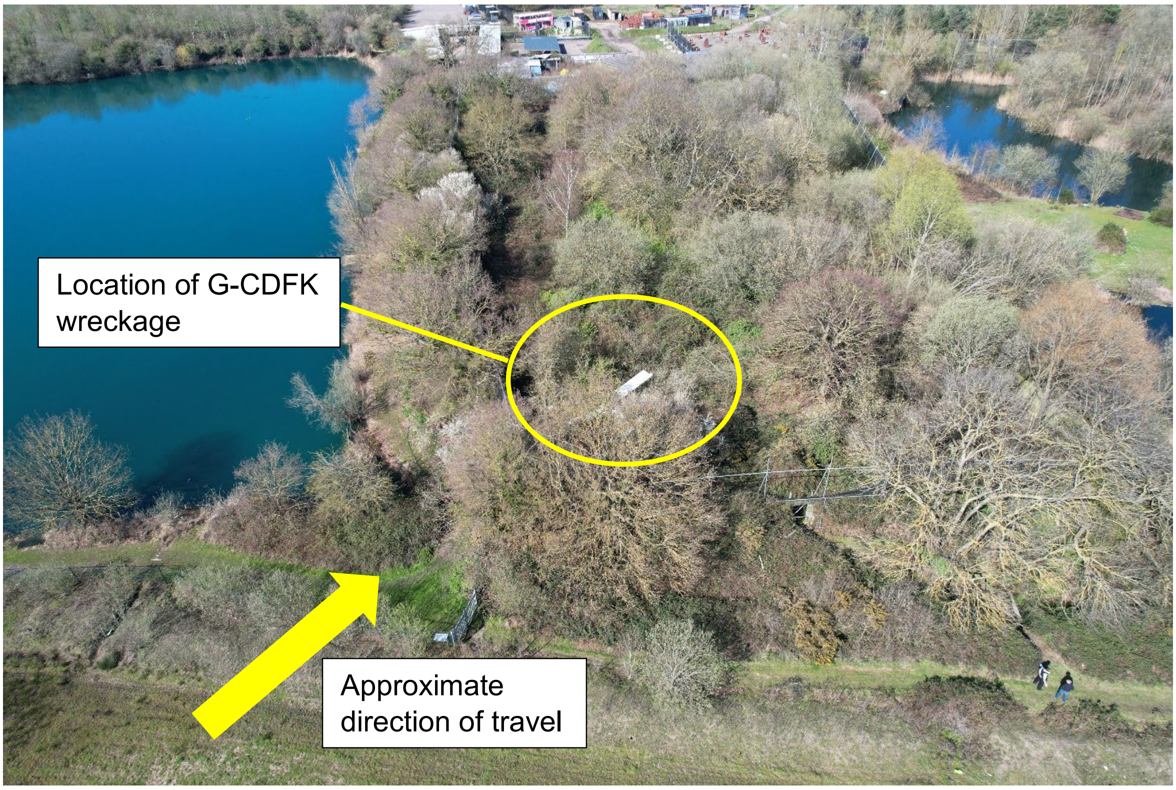


Figure 1

Area of woodland in which G-CDFK came to rest (courtesy of London Fire Brigade)

The aircraft came to rest upright with its right wing supported by foliage and the left wing on the ground. The cockpit floor had crumpled, as had the engine mounts.

One of the propeller blades was mainly intact with its tip missing, however the other blade had fractured at the hub. Fragments of propeller blade material remained close to the accident location. The condition of the propeller indicated that the propeller was not rotating, or was rotating slowly, when it struck the trees.

Control continuity was confirmed for the ailerons and elevator. Due to the cockpit floor damage and associated rudder pedal damage, rudder system continuity could only be confirmed up to the forward end of the control cable. The wing flaps were retracted with the flap lever positively located in that position.

When the AAIB arrived on site, all switches on the instrument panel were in the OFF position. The position of the engine throttle levers could not be positively determined.

Although some fuel had leaked from the aircraft, the fuel tank remained intact and contained approximately 30 litres of fuel. The fuel was later analysed and was found to be consistent with Aviation Gasoline, 100LL, and was free from contaminants. The fuel line to the engine was continuous and was filled with fuel. The fuel valve was in the ON position.

Recorded information

The aircraft was not fitted with any recording or logging devices. A transponder was fitted but was not operating[1]. No external flight tracking services recorded the flying activity.

No CCTV or local traffic dashcam recordings of the accident flight were found.

The pilot was using an aviation app on a tablet which recorded many flights including the first flight on the day of the accident and the subsequent accident flight. For both flight recordings on the day of the accident, the quality of the altitude data was poor in the vicinity of the airfield. The pilot later reported this was often the case.

The recording of the accident flight started at 1101:01 hrs. At 1101:40 hrs the aircraft moved from the fuel bowser location and taxied back to the south-western area of the airfield, turned onto the runway, and at 1105:00 hrs, immediately accelerated for takeoff. The start of the takeoff roll was approximately 50 m further into the runway than the previous takeoff. The altitude data did not allow analysis of the climb.

Aircraft information

The Jabiru UL450 is a two-seat high-wing light aircraft of composite construction with a maximum all up weight of 450 kg. It is powered by a Jabiru 2200A engine with a directly-driven, two-bladed, fixed-pitch wooden propeller.

Pitch and roll control are from a centrally mounted control column, yaw control is from rudder pedals in both the left and right footwells. A lever mounted on the roof to the left of the pilot's seat operates the flaps. An engine throttle lever is provided for each occupant. The throttle levers extend from below the seat to occupy a position between the occupant's legs.

The aircraft is fitted with a stall warning system which consists of a hole in the leading edge of the left wing that is connected, by a flexible pipe, to a horn positioned in the ceiling of the cockpit. When the wing is approaching the stall, low pressure around the hole draws air through the horn, vibrating a reed within it. The noise generated is intended to alert the pilot that the aircraft is approaching the point of stall so that they can take avoiding action to prevent a stall occurring. The noise should commence approximately 5 to 10 kt above the stall speed and sound continuously if the speed is further reduced.

The Jabiru 2200A engine is an uncertified four cylinder, four stroke naturally aspirated engine with a single carburettor and electronic ignition system. The carburettor is mounted on the engine's plenum chamber using a rubber coupling and secured by jubilee clips at each end. Carburettor heating is activated using a lever in the cockpit. This is accomplished by

Footnote

1 The UK AIP Part 2 En-route section 1.6 part 2 states the requirements for transponder use in UK airspace. It states that 'when a serviceable SSR transponder is carried, a pilot shall operate the transponder at all times during flight, regardless of whether the aircraft is within or outside airspace where SSR is used for ATS purposes […] and should enable pressure-altitude reporting if available, in order to facilitate detection of their aircraft by collision avoidance systems and ATS surveillance equipment'.

moving a baffle in the air intake box, so the intake air is passed through a heat exchanger around the engine exhaust before entering the carburettor. In addition to conventional carburettor heating the carburettor fitted to G-CDFK had inbuilt electrical heating, which was controlled by switches in the cockpit.

G-CDFK was built from a kit and made its first flight in 2006. The aircraft then changed ownership in 2012, 2015 and 2020. At the time of the accident the pilot was the fourth owner and had owned the aircraft for nearly three years.

The aircraft's LAA administered Permit to Fly was revalidated on 6 January 2023 at a maintenance facility familiar with the aircraft and engine type, but had not serviced or maintained G-CDFK previously. At the time of the permit revalidation it had flown 706 hours. At that time several items, including the nose landing gear leg, an elevator hinge pin and main landing gear rubber top hats were replaced. A 100-hour engine service was also carried out in which the spark plugs, distributor rotor arms, oil, oil filter and fuel filter were replaced. The aircraft was re-weighed and a new weight and balance report was issued.

During the permit renewal check flight, the aircraft performance was satisfactory and only differed slightly from previous years' results (Table 1). The stall characteristics were also consistent with previous test flights. It was noted that there was no discernible buffet prior to the stall, but the stall warning horn did alert the pilot of impending stall commencing at 48 kt, 4 kt minimum airspeed achieved.

Date of test flight	Loaded weight (kg)	Time to climb from 1000 to 2000 ft (s)	Climb speed (kt)	Engine rpm during climb (rpm)
10 Feb 2023	450	61	65	3,050
5 Jan 2022	386	53	65	3,100
15 Oct 2020	386	53	65	3,100
5 Oct 2019	386	47	65	3,100
8 Oct 2018	363	63	70	3,100
30 Oct 2017	390	63	62	3,150
30 Aug 2016	390	60	62	3,150
9 Sep 2015	448	68	62	3,000

Table 1

Permit revalidation flight test climb performance data for previous eight years

The aircraft had flown approximately 1 hour 40 minutes between the permit renewal test flight and the accident flight.

Pilots operating handbook and checklists

The Pilot's operating handbook (POH) among other things provides normal and emergency procedures when operating the aircraft. A printed version of the POH, dated 6 July 1999, was provided to the investigation by the pilot.

Under normal procedures, the before takeoff checklist identifies the following procedure:

1	**Brakes**	**CHECK**
2	Cabin Doors	CLOSED & LATCHED
3	Flight Controls	FREE & CORRECT
4	Flight Instruments	SET
5	Fuel Shutoff Valve	ON
6	Elevator Trim	NEUTRAL
7	Flaps	SET FOR TAKEOFF
8	Ignition Check	Throttle to 2000 rpm. Hold this engine speed for 10 seconds. Switch OFF No 1 Ignition and watch for RPM drop Switch ON the No 1 Ignition & switch OFF the No 2. Ignition watching for the rpm drop. RPM drop should not exceed 100 rpm on either system. If drop is excessive, shut down & determine the reason. Switch No 2 Ignition ON.
	NOTE During the check with one system only, the inactive sparkplugs may tend to load up slightly. To clean the plugs, run the engine with both ignitions for a few seconds, then recheck the second system.	
9	Power Check	Throttle to 2850 rpm. Open the throttle fully & slowly to check the maximum RPM being produced. Wind conditions may effect, but as an average 2,850 should be seen.
	NOTE If the RPM is found to be more that 150 rpm lower than normal, the engine should be examined to determine the reason.	
10	Idle Check	Throttle back to idle position & check that the engine runs smoothly. With too low an idle speed, or rough running, the cause must be located & corrected to avoid the potential for an in-flight stoppage.
11	Carburettor Heat Check	Throttle up to 2,000 rpm. Pull out the carburettor Heat Control & look for an rpm drop. Return the Carburettor Heat Control to the Full IN or cold position.

Whereas a laminated sheet in the aircraft's door pocket had the following list for pre-takeoff checks:

- Controls full and free;
- Hatches / Harnesses;
- Instruments set and working;
- Fuel sufficient / pump on;
- 1 stage of flap / trim for takeoff;
- Set power 2,000 rpm;
- Check mags;
- Full power check;
- Wind strength & direction;
- All clear runway and approach;
- Use full power to 500 ft;
- Keep CHT[2] out of the red.

The POH also explained, within the '*Emergency Procedures*' section, the importance of using carburettor heat, and highlighted the causes of carburettor icing as well as when to apply carburettor heat. The explanation also identifies that carburettor icing can occur when on the ground, particularly when the aircraft and engine have become damp. It also identifies a procedure to check for carburettor icing after taxiing.

Aircraft examination

The aircraft wreckage was transported to the AAIB in Farnborough for detailed assessment. The stall warning system functioned correctly and the dynamic pressure tapping from the pitot probe for the ASI was connected. The static pressure tubing had become dislodged behind the instrument panel. This is likely to have been because of the impact.

Although the engine mounts had buckled resulting in the firewall contacting the rear of the engine and the oil cooler had broken off, most of the engine was intact. The spark plugs were clean and undamaged and in a condition commensurate with their few hours of operation. The internal appearance of the cylinders was good, and the engine could be turned over. The coupling that connects the carburettor to the plenum chamber inlet was found to be split. The coupling was removed, and a new coupling fitted to the engine. The engine was then run on a test stand with the oil cooler bypassed and a donor propeller fitted. The engine ran through the operating range, with no indication of a loss of power or any other issues. A subsequent engine teardown found no issues that could have resulted in an engine failure in-flight.

Footnote

2 Cylinder Head Temperature (CHT).

The nitrile rubber coupling (Figure 2), part number 4691084, removed from the engine was examined in a laboratory. A 360° crack radiating from the inner diameter outward through most of the coupling was found. Additionally, cracks were present radiating inboard from the outer diameter that met the 360° crack. The coupling had a through crack around 65% of the circumference.

Figure 2
Split carburettor coupling from G-CDFK

Assessment of the fracture surfaces indicated that the main crack from the inner diameter had been present for some time and exhibited fatigue striations (Figure 3). It could not be determined for certain whether the external cracks were present during the accident flight, as a result of the impact or during later manipulation when the coupling was removed, but there were five distinct areas of different external crack morphology, two of which exhibited fracture surfaces consistent with overload, leaving the remaining three areas likely to have been present during the accident flight. This suggests that at least 30% of the circumference was fractured during the flight. External cracks were also present in the coupling that had not joined with the main inner crack.

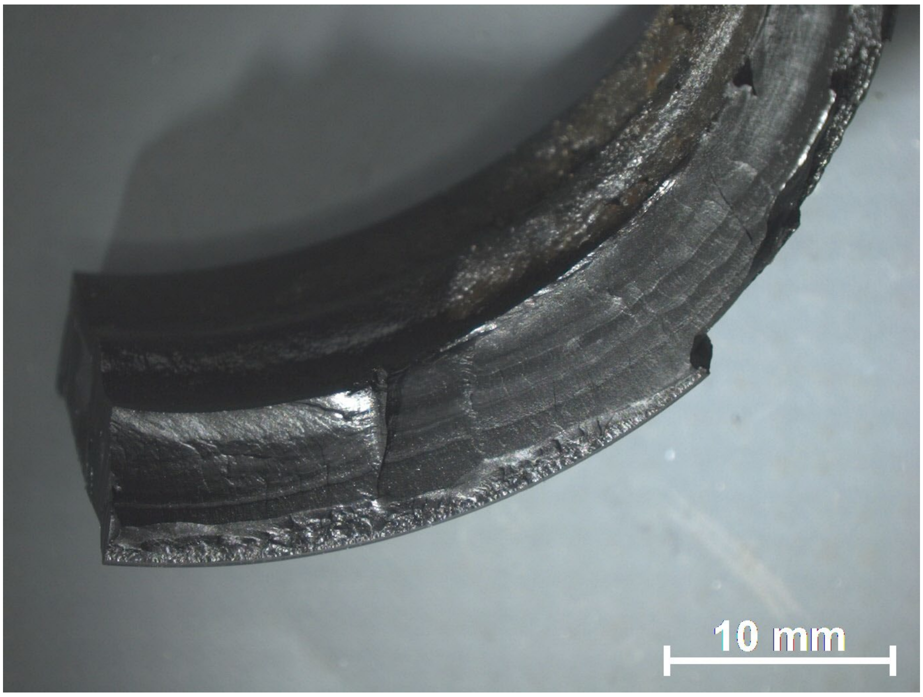


Figure 3

Cracks in coupling wall, showing fatigue propagation from inner diameter

The laboratory examination identified that the rubber showed signs of age-related degradation and embrittlement.

The rear face of the inlet to the plenum chamber showed staining (Figure 4), possibly indicating the location of the split in the coupling,

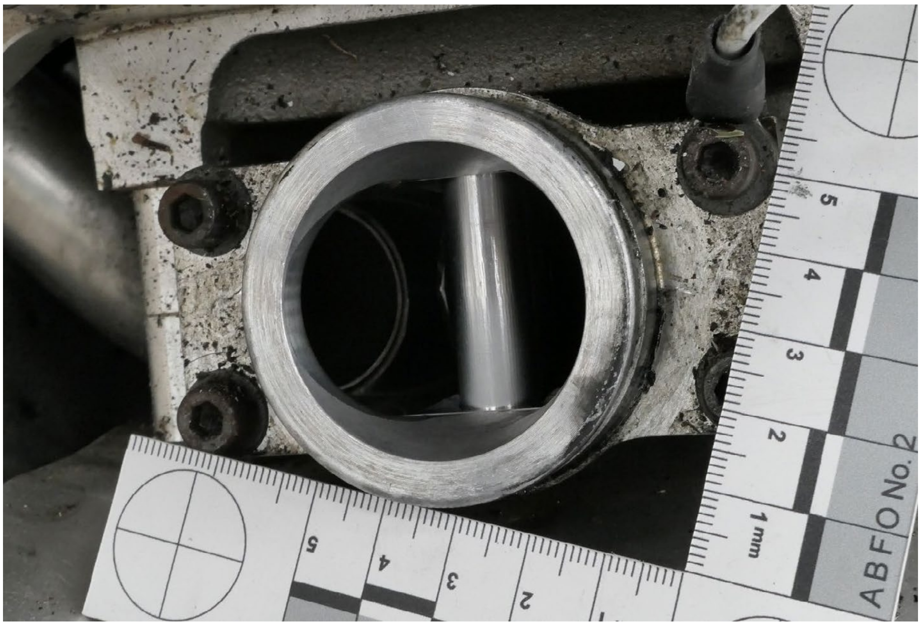


Figure 4

Inlet to plenum chamber showing marking indicating leak in coupling

Technical documentation

LAA documents

The LAA publish Type Acceptance Data Sheets (TADS) for both aircraft and engines which provide:

> *'a summary of the available information about the aircraft [or engine] type and should be used during the build, operation and permit revalidation phases to help owners and inspectors.'*

They also advise that it is:

> *'hoped that the information is as complete as possible, other sources such as the manufacturer's website may contain more up to date information.'*

TADS are normally written in three sections.

> *'Section 1 contains general information about the type.*
>
> *Section 2 contains information about the type that is MANDATORY and must be complied with.*
>
> *Section 3 contains advisory information that owners and inspectors should review to help them maintain the aircraft in an airworthy condition. If due consideration and circumstances suggest that compliance with the requirements in this section can safely be deferred, is not required or not applicable, then this is a permitted judgement call. This section also provides a useful repository for advisory information gathered through defect reports and experience.'*

The first paragraph within section 2 of the TADS states:

> *'At all times, responsibility for the maintenance and airworthiness of an aircraft rests with the owner. A condition stated on a Permit to Fly requires that: "the aircraft shall be maintained in an airworthy condition".'*

TADS 274A Issue 6 Revision D for the Jabiru UL-430 and UL-450 was published on 2 June 2021 and was valid at the time of the accident.

Section 3 advised that the aircraft kit manufacturer supplied an Operators Manual which contains a maintenance schedule, but a link to a relevant manual or specific reference to one was not provided. The manufacturer's website allows anyone to access and download their manuals, however there were no manuals specific to the UL-450 type on the site.

TADS E03 issue 3, for Jabiru engines was current at the time of the accident. Within section '*2.1 Lifed Items'*, the LAA Technical leaflet TL 2.23 *'Engine Overhaul Life and Operating 'On Condition'* described providing:

> *'a large amount of information on dealing with engine life for engines installed in LAA administered aircraft.'*

TADS E03 went on to link to the manufacturer's website for relevant service bulletins and manuals and within section *'2.2 Operator's manual'* a link to a copy of the Jabiru J2200 and J3300 engine Maintenance Manual (JEM0002-9) was provided.

Within section '*3.4 Operational Issues'* of TADS E03 a number of previously report operational issues are listed, the fourth item listed is the '*carburettor connection to rubber mounting.'*

TL 2.23 gave guidance to owners and LAA inspectors of ways to operate engines beyond manufacturer's life limits on an 'on-condition'[3] basis. The guidance included advice about how to track an engine's performance over time which provides an indication of certain aspects the engine's internal condition and in some circumstances provides an early warning that a failure condition is developing. There was no guidance on how to manage calendar-lifed components within this or any other LAA document reviewed by the AAIB in relation to this investigation.

Engine manufacturer

The Jabiru engine maintenance manual JEM0002-11, published on 25 October 2021 and overhaul manual JEM0001-23, published on 30 April 2020 were downloadable from the manufacturer's website. *'Section 8.4, Mandatory Inspections & Lifed Items'* within the maintenance manual detailed limitations on various components fitted to the engine and stated flexible hoses '*should be replaced at engine overhaul or every 2 years whichever comes first'* and in paragraph 8.4.2 the carburettor rubber mount was referred to:

> *'The rubber connector attaching the carburettor to the plenum chamber must be replaced at overhaul or every 5 years whichever comes first. Connectors which show deterioration (cracking, splitting etc) must be replaced irrespective of age.'*

Section 8.5 of the manual provided the engine maintenance schedule in tabular form, identifying all inspection and maintenance items due at each 25-hour, 50-hour, 100-hour, 200-hour and Annual Inspection. The carburettor mount was not identified in this table.

The engine overhaul manual stated:

> *'2.8.1 Operating engine "On Condition"*
>
> *Under no circumstances is it deemed acceptable to operate any model Jabiru Engine in aircraft of any certification type (be it type certified, LSA or experimental categories) beyond the previously stated top end and full overhaul intervals, without the appropriate overhaul being conducted on the engine.*
>
> *Jabiru Engine MUST NOT be operated "on condition" beyond the engine overhaul intervals prescribed.'*

Footnote

[3] On-condition describes how an engine or component is sometimes able to continue in use past its manufacturer-stated time between overhaul provided it is judged to remain in good airworthy condition.

LAA requirements for lifed components

The requirements provided by the engine manufacturer regarding replacement of calendar-lifed components and the LAA documentation regarding the management of engines on-condition were discussed with the LAA. Although it is not explicitly stated in the LAA documentation, for aircraft operated on an LAA permit, the LAA considers their advice to take precedence over that provided by manufacturers unless limits are specified in the Operating Limitations document or a Mandatory Permit Directive (MPD), Airworthiness Directive (AD) or similar is available stating a requirement. In this particular case, the LAA would support any owner who maintained their engine as specified in the manufacturer's manuals but would allow extending the life of the engine on-condition if the processes defined in TL2.23 were followed.

Aircraft logbook

There was no record within G-CDFK's aircraft or engine logbook of the carburettor coupling having been replaced during the life of the aircraft. It is therefore assumed that the coupling was over 16 years old at the time of the accident and some 11 years over the 5-year life limit set by the manufacturer.

Weight and balance

Fuel receipts showed the pilot uplifted 37.63 l of AVGAS fuel when he refuelled before the accident flight. He estimated the aircraft had 7-10 l left before he refuelled so would have had approximately 45 l onboard before the flight. An assessment of the weight and balance of the aircraft completed by the AAIB which included approximate weights of the occupants indicated that the aircraft would have been within balance limits and would have been close to the maximum takeoff weight.

Aircraft performance

The altitude the aircraft achieved on the accident flight was not recorded. However, based on the maximum rate of climb demonstrated on the aircraft's last flight test and the approximate lift-off position the maximum height the aircraft could have achieved was estimated to be 370 ft agl. The pilot remembered seeing 300 ft on the altimeter. The altimeter was set to the local QNH so this equates to approximately 244 ft agl.

Airfield information

Damyns Hall is an unlicensed airfield with a main grass runway orientated 030°/210° and 650 m long (Figure 5 runway highlighted in blue). The runway slopes down towards the threshold on Runway 03. Pylon power cables run 0.7 nm to the north-east of the airfield as shown in Figure 5.

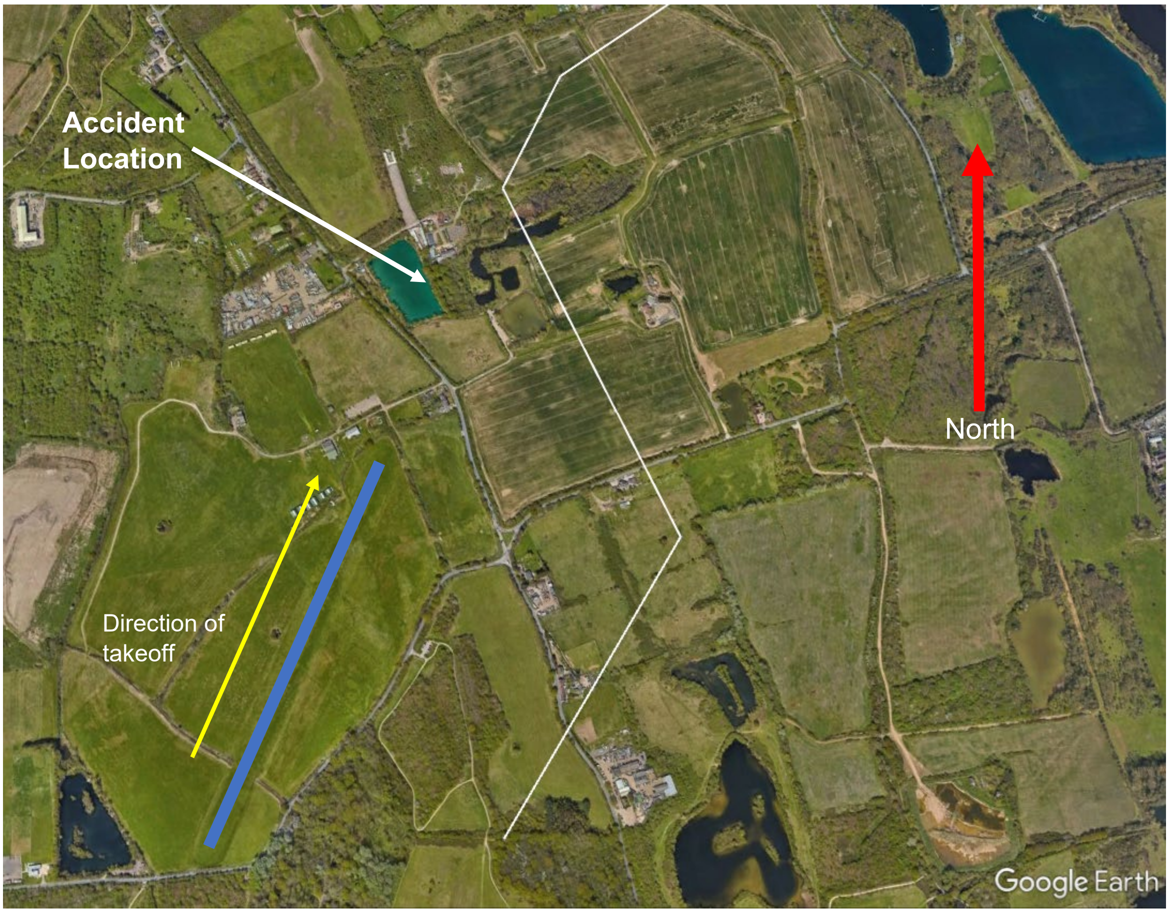


Figure 5

Aerial view of Damyns Hall Aerodrome highlighting the power cables to the northeast (highlighted in white). Runway 03/21 is marked in blue

There are limited options for a forced landing after takeoff from Runway 03 before reaching the power cables. Ahead on the runway centreline after crossing a road is a small lake and woodland, to the left is a field with livestock and to the right is a field with the powerlines across the middle. One local flight instructor reported they preferred to use Runway 21, even with a slight tailwind, for this reason.

Pilot information

The pilot held a National Private Pilot's Licence with a valid microlight rating (expiry 30 April 2023). He had completed a self-declared medical. His last flight with an instructor was on 12 April 2021 when he revalidated his microlight rating.

He started flying in June 2014 and had accumulated a total of 230 flying hours including 173 hours in G-CDFK. His last flight before the day of the accident was on 27 February 2023.

Tests and research

An engine test was conducted using a similar Jabiru 2200A engine fitted with the carburettor from the accident aircraft. The test took a previously used coupling which had been operated for approximately five years. A baseline test run was completed with the coupling intact followed by tests using the coupling with a series of scalpel cuts made in the rubber to attempt to mimic a split. The testing showed that the engine performance was unaffected by splits of up to 60% of the circumference, but whilst the engine was operating with a large split, the engine stopped immediately when rearward pressure was applied to the carburettor, moving it away from the plenum chamber and opening the split.

Examination of the carburettor icing chart in CAA Safety Sense Leaflet 14- Piston Engine Icing[4] suggested that, given the conditions of the day, carburettor icing could occur at low engine power. The possibility of ice build-up during pre-takeoff taxiing prior to the second takeoff was considered but dismissed as the first takeoff from Damyns Hall showed no evidence of carburettor icing and the intervening time between the first flight and the accident flight would have allowed any moisture present on the grass to further dissipate.

Other information

Previous similar accidents

The AAIB have investigated many previous accidents which involved a partial or complete power loss leading to a loss of control of the aircraft. During the period 2011 - 2021 the AAIB completed 16 field investigations in which partial loss of power was involved. Arising from those 16 accidents, there were 15 fatalities and 9 serious or life-threatening injuries. In two of these accidents there were no injuries, and both were as a result of flying the aircraft under control to a successful forced landing or ditching.

On 16 June 2022 the AAIB published a report into an accident involving G-BBSA, a Grumman AA5 which suffered a partial power loss shortly after takeoff followed by a loss of control[5]. This report made three recommendations to the CAA to include training about partial power loss for new pilots and pilots renewing or revalidating their licence. The CAA is working to address these recommendations.

On 13 October 2022 the AAIB published a report into an accident involving G-REJP, a Europa XS[6]. The aircraft developed a significant left yawing tendency during its takeoff roll resulting in the pilot rotating the aircraft early to avoid a lateral runway excursion, probably causing the wing to stall. The aircraft than struck a raised earth bank. The report highlighted the benefits of pilots self-briefing when and how they would abort a takeoff before they start the takeoff roll.

CAA publications

The CAA have published a number of documents intended to provide information which will assist pilots. Safety Sense Leaflet 02- Stall/Spin Awareness provides guidance on stall avoidance and recovery, Safety Sense Leaflet 07- Aircraft Performance deals with aircraft

Footnote

4 https://www.caa.co.uk/publication/download/12659 [accessed 03 June 2024].
5 G-BBSA report available at https://www.gov.uk/aaib-reports/aaib-investigation-to-grumman-aa-5-g-bbsa [accessed 03 June 2024].
6 G-REJP report available at https://www.gov.uk/aaib-reports/aaib-investigation-to-europa-xs-g-rejp [accessed 03 June 2024].

performance including loss of power after takeoff and Safety Sense Leaflet 12-Strip Flying provides information regarding operating from small airstrips.

The emergencies section of CAA CAP 1512 The Skyway Code[7] also provides guidance for managing power loss after takeoff. It states:

- 'Know your best glide speed and procedures for your aircraft.
- Particularly at low level, focus on maintaining speed and control. Provided you keep the aircraft at flying speed and under control, engine failures are unlikely to be fatal.
- If a failure happens shortly after take-off, landing ahead is safer than attempting to turn back. Assess the area immediately in front of you and pick the place that is likely to cause the least damage.'

Inattentional deafness

It is likely that the aircraft's stall warning sounded as the aircraft's speed reduced and the wing approached the critical stalling angle of attack. However, neither the pilot nor the passenger reported hearing the warning. Research[8] [9] has shown that in high workload situations it is common that auditory alerts do not capture people's attention. This is known as inattentional deafness.

Analysis

On takeoff the aircraft initially suffered a partial power loss followed by a total power loss. Control of the aircraft was then lost and the aircraft stalled and entered a spin. This analysis first considers why the engine lost power and secondly why control was lost.

Engine power loss

Apart from the split coupling between the carburettor and plenum chamber, there were no issues identified with the engine that could have resulted in a power loss. Fuel was present in the fuel lines and the fuel in the tank was 100LL the normal fuel for this engine. No issues were identified with the quality of the fuel.

A test of the engine that was fitted to the aircraft with its coupling replaced with a serviceable one confirmed that it was able to produce power and ran normally without issue. An engine strip also confirmed that there were no issues internally.

Footnote

7 CAA Skyway Code (CAP1535) available at https://www.caa.co.uk/our-work/publications/documents/content/cap1535/ [accessed 03 June 2024].

8 Dehais, F., Causse, M., Vachon, F., Régis, N., Menant, E., & Tremblay, S. (2014). Failure to Detect Critical Auditory Alerts in the Cockpit: Evidence for Inattentional Deafness. Human Factors, 56(4), 631-644. https://doi.org/10.1177/0018720813510735 [accessed 03 June 2024].

9 Dalton P, Fraenkel N. (2012). Gorillas we have missed: sustained inattentional deafness for dynamic events. Cognition, 124(3), 367-372. https://doi.org/10.1016/j.cognition.2012.05.012 [accessed 03 June 2024].

The coupling from the accident engine was assessed in a laboratory and confirmed that it showed signs of age-related degradation and embrittlement, and that there were pre-existing through-cracks present at the time of the accident. The main crack had initiated on the internal surface around 360° propagating outwards before it combined with smaller cracks propagating inwards from the outer surfaces. The location of the main crack means that its presence cannot be detected without the coupling being removed from the engine.

Review of the aircraft logbook did not find an entry to suggest that the coupling had been replaced during the life of the aircraft and was therefore likely to have been over 16 years old, an age commensurate with the condition reported by the laboratory.

The rubber coupling mounts the carburettor onto the engine and allows the air/fuel mixture to pass through it into the engine. This air/fuel mixture is then directed through the inlet manifolds to the cylinders where combustion takes place. When the engine is running, the movement of the pistons draws air and fuel through the induction system and establishes a low pressure region inside the coupling. With a split in the coupling additional air can be drawn into the plenum chamber, downstream of the carburettor resulting in the mixture becoming leaner. As a split develops it may go un-noticed, especially at high power, as engines are designed to run rich at high power, the additional fuel provided acting as a coolant. With a leaner mixture at high engine power settings, the engine performance will often improve, however the exhaust temperatures will likely increase. As the mixture is leaned further, the engine performance will diminish until the air to fuel ratio is insufficient to support combustion.

As shown by the engine test conducted as part of the investigation the low pressure may force the split closed resulting in the engine running without indicating a performance issue. This was likely to be associated with the cut made in the rubber being with a scalpel, leaving a clean pair of surfaces which, when drawn together, acted as a one-way valve. The coupling fitted to the engine at the time of the accident was old, brittle and had lost elasticity so, although would have had some ability to act as a seal, was unlikely to perform like the test piece.

Evidence of staining in an arc on the rear face of the plenum chamber union indicates that there was disrupted airflow in that location. This suggests a split in the coupling had been present for some time.

Although it is likely that a split was present for some time, its length may not have been sufficient to cause a performance issue with the engine. It was not possible to determine the size of the split in the coupling at the time of the accident as the split was likely to have extended during the accident sequence and when the coupling was removed from the engine. However, it will have been sufficiently large to allow the carburettor to move away from the engine to open the gap and cause the engine to stop.

Although the engine had been serviced recently, and only operated for a few hours after the service, it did not show any symptoms of the split during the test runs and permit revalidation test flight. It is likely that at the time of the last engine service, the coupling would have been showing signs of degradation, however the location of the coupling and the position of the mounting clips obscure the outer surfaces making inspection challenging.

The engine maintenance manual specifies that the coupling has a calendar life and should be replaced at overhaul (1,000 operational hours) or every 5 years whichever comes first. It goes on to specify that couplings which show deterioration (cracking, splitting etc) must be replaced irrespective of age. In addition, the Jabiru engine maintenance manual identifies that the engine should not be operated on-condition.

Although the LAA TADS identified the engine manufacturer's documentation within section 2 which were identified as mandatory, the same document also referred to the management of engines on-condition in the mandatory section. There was no guidance within the LAA documents to instruct owners which documents take precedence where contradiction, such as managing engines on-condition, are present, but the LAA intent is that their technical documentation takes precedence over manufacturers' instruction in the UK.

Although the engine was below the overhaul life of 1,000 hours and therefore not being managed on-condition due to operating hours, with a component past its calendar life limit it should have been managed with these principles in mind. As a result of AAIB enquiries with the LAA in relation to managing calendar-lifed components, the LAA published an article in the November 2023 edition of Light Aviation Magazine[10], highlighting the importance of managing the lifed components in accordance with LAA guidance.

The LAA is also working to revise their TADS to remove any inconsistencies regarding the treatment of manufacturers' stated component life limits. This will coincide with the LAA's interpretation that life limits are mandatory if imposed by a MPD, in the approved data relating to the aircraft or an AD, for previously certified aircraft. Approved data includes any life limitations stated on the aircraft's Permit to Fly Operating Limitations document, or within other documents referenced on the Operating Limitations document, or on approved modification or approved repair documentation relating to the aircraft. The LAA have advised the AAIB that the TADS will reflect the fact that, other than for critical components where the limits are mandated by the LAA (and/or the CAA) by one of the mechanisms above, decisions about the embodiment of manufacturers' stated life limitations should be dealt with locally by the owner and inspector involved.

Although the TADS are being revised by the LAA, they maintain that in line with BCAR section A, chapter A3-7 the '*responsibility for the maintenance and airworthiness of an aircraft rests with the owner'* and that an '*aircraft shall be maintained in an airworthy condition'.* This places the responsibility of ensuring that the aircraft remains in an airworthy condition on the owner of the aircraft. This includes the replacement of any life-limited components mandated by the regulator.

Footnote

10 Page 46 of November 2023 Light Aviation "Rubber components and other engine bits with a 'life'" https://issuu.com/sharpey/docs/nov_23?fr=sMGI2YjcwMzAwNjI [accessed 03 June 2024].

Since G-CDFK's permit revalidation, the LAA have revised the process through which the revalidation is completed. Within the new Permit to Fly Airworthiness Review Report process, section 3 *'Airworthiness Review Declaration'* part 3a now requires the LAA inspector to state the Aircraft Maintenance Programme under which the owner is having the aircraft maintained. Additionally in section 3d, the inspector is required to state whether mandatory service life-limited components installed on the aircraft have been properly identified and recorded, and whether or not they have exceeded their approved service life limit.

This process change now requires that a maintenance programme under which the aircraft is being maintained is defined. For those aircraft where the LAA does not specify a maintenance programme that must be followed, when available, the content of the manufacturers' suggested maintenance schedule should be considered. Where there is no manufacturers' suggested maintenance schedule, the LAA recommends that the LAA's Generic Maintenance Schedule is used as a starting point for developing the individual aircraft's schedule. Whichever programme is being used this may give the owner opportunity to identify life-limited components that need to be inspected or replaced. Similarly, the need to declare any mandatory life-limited items in part 3d of the form may also prompt the owner to review whether components need to be assessed.

Although the LAA processes have been clarified to help prompt the owner to review whether any life-limited components are fitted to their aircraft, unless a component has a mandated life limit it could be operated on-condition indefinitely. With the knowledge that the carburettor coupling in question cracks from the inner diameter and is therefore not able to be inspected in situ and to prevent cracking associated with age-related degradation and subsequent partial or complete loss of power, the following Safety Recommendations are made:

Safety Recommendation 2024-013

It is recommended that the UK Civil Aviation Authority mandate a suitable life limit for the carburettor to plenum chamber coupling, Jabiru part number 4691084 (or equivalent parts), to ensure the couplings are removed from use before a crack can propagate.

Safety Recommendation 2024-014

It is recommended that the UK Civil Aviation Authority consider mandating a suitable life limit for components used in similar applications to the Jabiru carburettor to plenum chamber coupling on other engine and aircraft types, to ensure the components are removed from use before their condition deteriorate beyond an airworthy condition.

Loss of control

The pilot increased the engine power to confirm it was operating normally before commencing the takeoff. The pilot's recollection was blurred, but recalled a normal takeoff with no signs that the engine was underperforming until he reached approximately 300 ft agl where he realised he was lower than he would normally have expected.

Once in the climb the pilot realised he did not have enough engine power to continue climbing but did not have enough altitude to turn back. Looking ahead he could not see anywhere suitable to attempt a forced landing. The pilot showed characteristics of startle and surprise as the aircraft was not performing as would have been expected. As the speed was reducing he selected the flaps up to reduce the drag, but this would have reduced lift and is likely to have made the situation worse. The pilot did not recall hearing the stall warning although the evidence suggests this was working. This was possibly due to inattentional deafness caused by the high workload situation.

The AAIB have investigated numerous previous accidents where control has been lost after an engine has lost power. The emergencies section of the CAA skyway code gives guidance for managing this situation.

The CAA Safety Sense leaflet titled 'strip flying' gives the following guidance:

- *'You should review the options in the event of an engine failure on takeoff. The obstacle environment may require turning in a particular direction. Have a picture in your head of what the area in front of you will look like in the event of a low level engine failure.'*

The CAA are also undertaking work to address the three recommendations made in the G-BBSA report relating to partial power loss.

However, neither of these give any guidance about what to do if there are no suitable landing areas ahead. Once at a safe altitude a single engine aircraft can be flown such that suitable landing areas are within gliding range. However, immediately after takeoff from many UK airfields there are limited options. The CAA agreed that it would be helpful to provide more information to pilots about how to manage this situation. On 13 December 2023 the CAA hosted a workshop to discuss what to do in the event of an engine failure after takeoff and provide some guidance on staying safe.

The CAA also intend to produce a podcast about engine failures after takeoff which will include discussion of this issue and reference the workshop.

Checklist

For non-certified aircraft there are no requirements for pilots to use approved checklists and therefore there is no requirement for owner-produced checklists to be written to a particular standard or checked against a manufacturer-provided checklist.

Comparing the manufacturer's checklist against the laminated pre-takeoff checks found in the aircraft's door pocket, it was apparent that the POH had not been accurately translated in the laminated checklist available to the pilot. The checklist in the aircraft didn't provide a target rpm for maximum rpm during the power check and didn't identify the idle or carburettor heat functionality checks. As a result of the injuries he sustained in the accident, the pilot was unable to recall the rpm that the engine achieved when set to maximum during takeoff so it is not possible to determine whether use of a checklist that more closely represented the POH would have prevented the pilot from commencing the accident flight if he had used it. Although the likelihood of carburettor icing was ruled out as a possibility for this accident, the fact that the checklist did not have the carburettor heat checks on it highlights the risk that where personalised checklists don't represent the manufacturer defined checks there is a possibility that crucial checks are missed that could lead to complications.

Conclusion

Before commencing the takeoff, the pilot increased the engine power to confirm it was operating normally. As he climbed through 300 ft agl he realised that the aircraft had not climbed away normally. With insufficient height, or speed, to return to Damyns Hall and no suitable landing sites immediately available the pilot attempted to remain airborne. The aircraft stalled and entered a spin at a height where a recovery could not be carried out before striking the ground.

The loss of engine power was probably caused by a split in the rubber coupling attaching the carburettor to the engine's plenum chamber. Examination of the coupling confirmed that it had suffered from age-related degradation and embrittlement and staining on the rear face of the plenum chamber union indicated that a split in the coupling had been present for some time. There was no evidence from the aircraft or engine logbooks that the coupling had been replaced since the aircraft had been built in 2006.

No issues with the engine were identified during a 100-hour engine service, carried out on 6 January 2023, but the location of the coupling and its mounting clips makes inspection problematic. During the permit renewal check flight, the aircraft performance was satisfactory and only differed slightly from previous check flights.

The engine maintenance manual specified that the coupling was a lifed item and should be replaced at overhaul (1,000 operational hours) or every 5 years whichever came first. Although the LAA TADS identified the engine manufacturer's documentation as mandatory, the same document highlighted the management of engines on-condition within the mandatory section. There was no guidance within the LAA documents to instruct owners which documents took precedence.

The LAA is revising the TADS to remove any conflicting statements and clarify the circumstances in which it is mandatory to maintain engines in accordance with the manufacturer's advice regarding limited-life components. Since G-CDFK's Permit to Fly revalidation the LAA have revised the process through which these are completed. A declaration is required of the aircraft's maintenance programme and that all mandatory life-limited components have been properly identified and recorded and have not exceeded their approved service life limit, which should improve the ability of LAA inspectors to identify components which may be close to or have exceeded life limits.

The CAA, in addition to the information already published in Safety Sense Leaflets 02, 07 and 12 regarding stall/spin awareness and the management of a loss of engine power after takeoff, have hosted a workshop to discuss what to do in the event of an engine failure after takeoff and provide some guidance on staying safe. They also intend to produce a podcast about engine failures after takeoff and a communication campaign to promote the workshop and podcast.

Safety actions taken

On 13 December 2023 the CAA hosted a workshop discuss what to do in the event of an engine failure after takeoff and provide some guidance on staying safe.

The LAA has revised the Permit to Fly revalidation process to require declarations of the maintenance programme and that all mandatory life limited components have been properly identified and recorded and have not exceed their approved service life limit and have improved their guidance regarding the appropriate treatment of life-limited components specified by the manufacturer, but not mandated by the LAA or CAA. This is designed to improve the ability of LAA owners and Inspectors to identify components needing replacement before they become unairworthy.

The LAA is revising the Type Acceptance Data Sheet to remove any conflicting statements and clarify the circumstances in which it is mandatory to maintain the engine in accordance with the manufacturer's advice regarding limited-life components when the engine is operating in an LAA-supervised aircraft.

Published: 20 June 2024.

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.

Serious Incident

Aircraft Type and Registration:	Boeing 737-4K5, G-JMCV
No & Type of Engines:	2 CFM56-3C1 turbofan engines
Year of Manufacture:	1989 (Serial no: 24128)
Date & Time (UTC):	1 December 2023 at 0613 hrs
Location:	East Midlands Airport
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to tail skid and drainage mast
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	7,649 hours (of which 2,720 were on type) Last 90 days - 39 hours Last 28 days - 10 hours
Information Source:	Aircraft Accident Report Form submitted by the commander and subsequent enquiries by the AAIB

Synopsis

The aircraft was operating a cargo flight from East Midlands Airport to Aberdeen Airport. During the departure preparations, an incorrect load sheet was used to input figures for the takeoff performance calculation and so the aircraft was approximately 10 tonnes heavier than anticipated. During the takeoff the aircraft tail struck the ground damaging the tail skid and a drainage mast. No personnel were injured.

History of the flight

The crew arrived at the aircraft at 0430 hrs and the commander decided that it required de-icing. This was carried out by two separate vehicles each of which provided receipts to the commander. Both receipts contained errors, which the commander asked the dispatcher to have corrected. When the dispatcher returned, he gave the commander some forms including the load sheet for the flight, the de-icing receipts and Notifications to Captain, which contain essential information related to the cargo. During this time the aircraft was being loaded. The load sheet for the flight was checked, found to be correct and acknowledged by the commander in accordance with the operator's Operations Manual.

The sheaf of papers given to the crew also contained a load sheet for the same aircraft on a previous flight. Although not recognising this at the time, the crew used the figures from this incorrect load sheet to calculate the takeoff performance figures using the manufacturers Onboard Performance Tool (OPT). The OPT calculates thrust settings, stabiliser trim setting and takeoff speeds. The incorrect load sheet was for an aircraft mass approximately 10 tonnes lighter than the incident flight, so the aircraft dispatched with inappropriate performance settings.

The taxi out was uneventful and after an engine run up check due to the low temperature, the commander, as PF, commenced the takeoff run. The commander described the rotation as normal but stated that both crew members felt a "small bump*."* The crew checked engine parameters and warnings, but no issues were apparent. They then completed the after takeoff check list. They discussed possible causes of the "bump", considering a tail strike or a possible load shift. However, as there were no abnormal indications and the aircraft was handling normally, the commander decided to continue the climb to the cruising level of FL240. The co-pilot was inexperienced and under training, so the commander stated his workload was now higher than normal.

The Operations Manual Part B (OMB) contains the following guidance in the event of a loadshift:

> *'Should a load come loose, there is a serious risk to the aircraft. The deck angle must be maintained as stable as possible to avoid further movement.'*

Once in the cruise the commander asked the co-pilot to visually check the cargo hold to eliminate any concerns regarding unsecured freight. The load bay is in three sectors designated A, B and C from front to back. Bay B was empty for this flight so the commander was concerned cargo from Bay A could have moved aft. The co-pilot was only able to see the cargo in Bay A and that appeared secure. The crew then revisited the possibility of a tail strike and consulted the aircraft's Quick Reference Handbook (QRH). The checklist for a tail strike is shown at Figure 1.

Though the aircraft was handling normally and there were no abnormal indications, given the absence of any other explanation for the 'bump' at takeoff, the commander decided to action the tail strike checklist in the QRH. The checklist directed the crew to depressurise the aircraft but, due to the inexperience of the co-pilot, the commander decided to descend to FL90 before actioning the depressurisation. He checked the fuel figures before descent to confirm sufficient fuel remained to reach Aberdeen at the reduced flight level.

Tail Strike

Condition: A tail strike is suspected or confirmed.

Caution! Continued pressurization of the airplane can cause further structural damage.

CPCS airplanes

1 Pressurization mode selector . . . . MAN DC

DCPCS airplanes

2 Pressurization mode selector . . . . .MAN

Use momentary actuation of the outflow valve switch to avoid large and rapid pressurization changes.

3 Outflow VALVE switch. . . . . Move to Open until the outflow VALVE indication shows fully open to depressurize the airplane

4 Plan to land at the nearest suitable airport.

■ ■ ■ ■

Figure 1

QRH Tail Strike Checklist

Image Copyright © Boeing. Reproduced with permission

The crew carried out an ILS approach to Aberdeen and the aircraft landed without further incident. After the aircraft was parked and shut down the commander carried out a walk round check which revealed damage to the tail skid and a drainage mast.

Aircraft performance

The crew calculated the takeoff performance using the OPT application. Aircraft mass, centre of gravity position, runway in use and meteorological data are entered into the application and it calculates speeds, thrust settings and stabiliser trim position for each takeoff. Both crew members make the calculations using their own OPT to trap any errors made in data entry. In this case both crewmembers used information from a previous flight to enter the figures into the OPT. The calculation for the actual aircraft mass is shown at Figure 2.

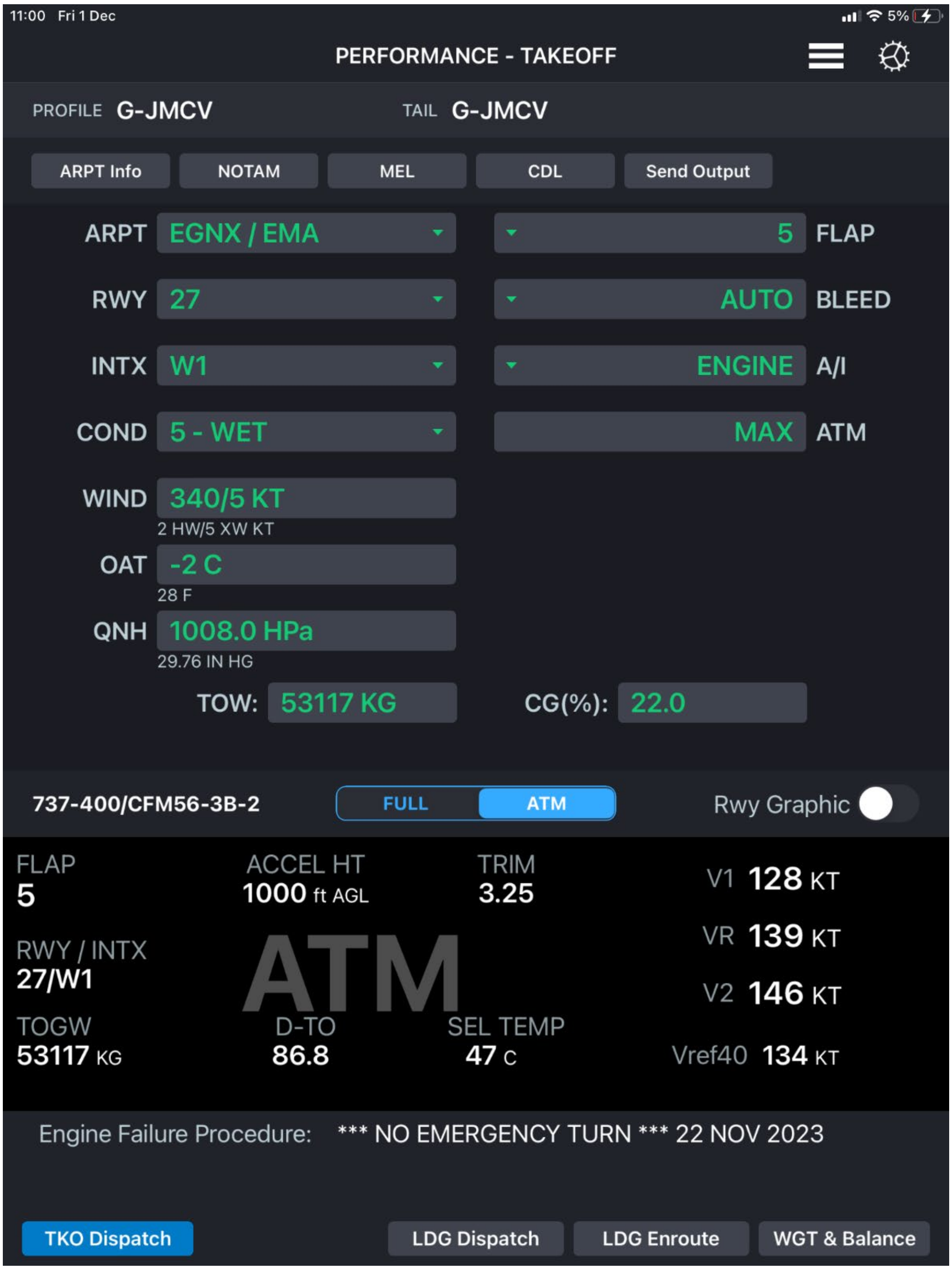


Figure 2

Performance calculation with actual aircraft mass

The calculation used by the crew on the incident flight is shown at Figure 3.

Figure 3

Performance calculation with mass from previous flight

The PF commences the rotation at V_R[1], which was 139 kt for the correct mass but only 124 kt for the calculation used by the crew. Calculated thrust setting was also lower on the calculation used for the flight with N_1 calculated at 81.9% against 86.8% for the actual mass. The OPT also outputs a setting for the stabiliser trim, intended to give consistent handling of the aircraft at takeoff. In this event the setting used by the crew gave a slightly more nose-up trim than the actual mass figures.

Footnote

[1] V_R is defined as the speed at which the rotation of the aircraft toward takeoff attitude should be initiated.

Recorded information

The FDR information was not recovered but information from the Quick Access Recorder (QAR) was downloaded and analysed by the manufacturer. An extract from the information is shown at Figure 4.

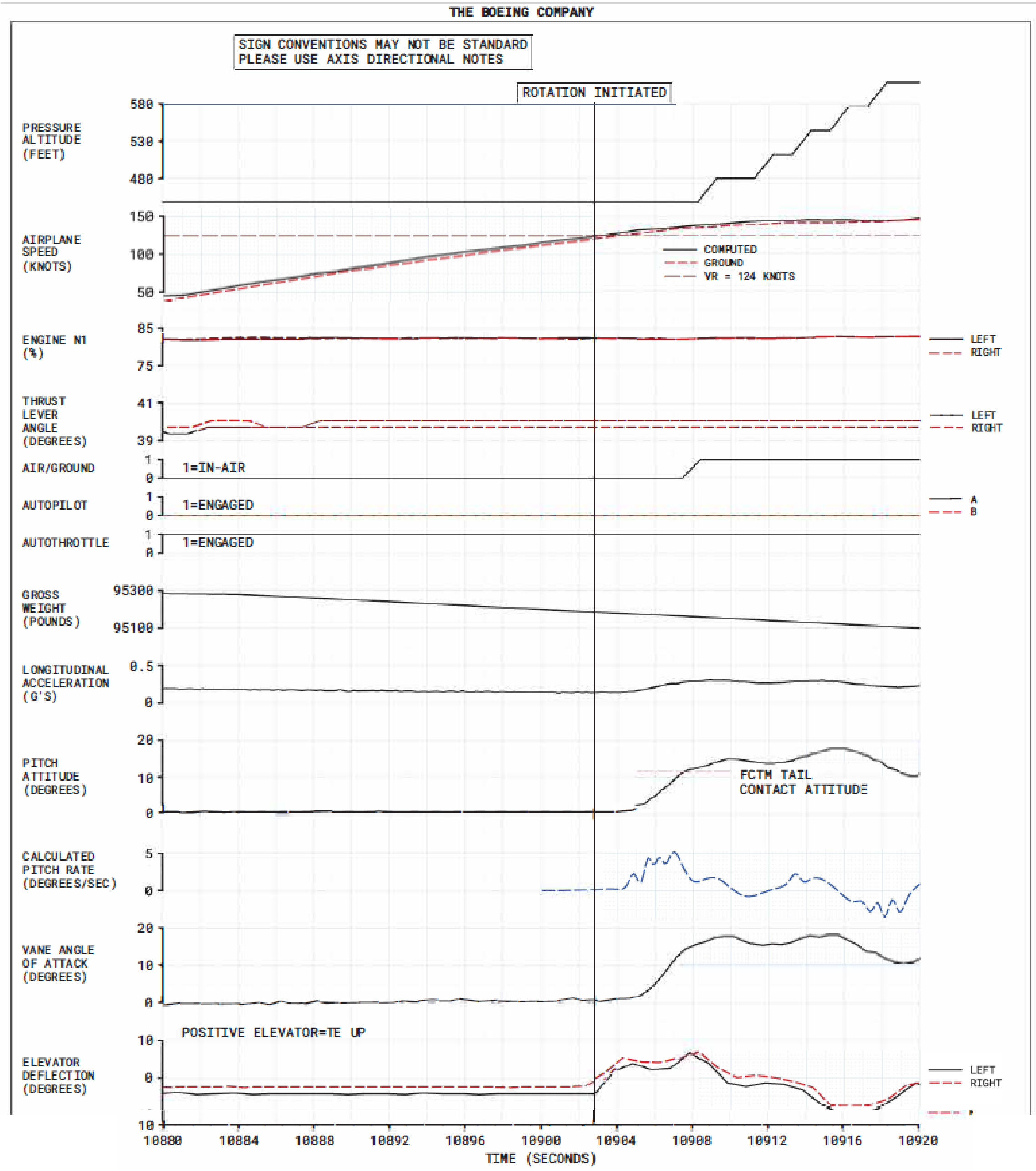


Figure 4

Extract of QAR information.
Image Copyright © Boeing. Reproduced with permission

The QAR data shows that the elevator deflected trailing edge up to commence the takeoff rotation at an airspeed of approximately 123 kt which is consistent with the V_R calculated by the crew. The V_R for the actual mass of the aircraft was 139 kt. The aircraft's attitude started to increase approximately 2 seconds after rotation was initiated. Around 4 seconds after rotation was initiated the calculated instantaneous pitch rate peaked at 5°/s just prior to liftoff. The air/ground discrete parameter indicated liftoff occurred at a computed airspeed of around 137 kt, approximately 5 seconds after rotation was initiated. Pitch attitude was then 12.3° which exceeded the pitch attitude for a tail strike (11.4°).

Manufacturer's information

The Flight Crew Training Manual (FCTM) for the B737 contains guidance for takeoff techniques and tail clearance during rotation. For the rotation phase the FCTM states:

> '*Above 80 knots, relax the forward control column pressure to the neutral position. For optimum takeoff and initial climb performance, initiate a smooth continuous rotation at VR toward 15° of pitch attitude. However, takeoffs at low thrust setting (low excess energy) will result in a lower initial pitch attitude target to achieve the desired climb speed.*'

A note on the guidance states:

> *'Using the technique above, resultant rotation rates vary from 2° to 3° per second, with rates being lowest on longer airplanes. Liftoff attitude is achieved in approximately 3 to 4 seconds depending on airplane weight and thrust setting.'*

The FCTM contains the image at Figure 5 for a typical takeoff which shows that the lowest tail clearance will occur close to lift off speed (V_{LOF}).

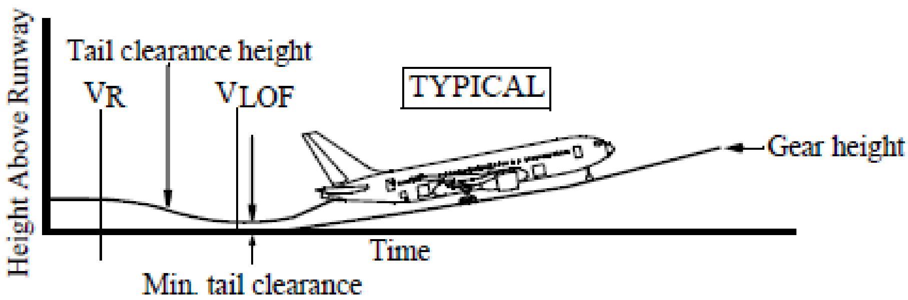


Figure 5

Typical takeoff profile for B737 FCTM
Image Copyright © Boeing. Reproduced with permission

The actual tail clearance distance and the pitch attitude for a tail strike varies with the length of the aircraft. G-JMCV is a B737-400 and the FCTM states that for a takeoff with flap 5 set, lift off should occur at 9.1° pitch attitude, the minimum tail clearance will be 23 inches and the tail strike attitude will be 11.4° with the main wheels on the ground.

The FCTM lists five factors that are liable to increase the risk of a tail strike as follows:

'Mis-trimmed Stabiliser
Rotation at Improper Speed
Trimming during Rotation
Excessive Rotation Rate
Improper Use of the Flight Director'

In amplification of the mis-trimmed stabiliser the FCTM notes that this usually results from the use of erroneous takeoff data. Should a tail strike be suspected the FCTM contains the following guidance:

'Any one of the following conditions can be an indication of a tail strike during rotation or flare:

- *a noticeable bump or jolt*
- *a scraping noise from the tail of the airplane*
- *pitch rate stopping momentarily*

Note: Anytime fuselage contact is suspected or confirmed, accomplish the appropriate NNC (Non Normal Checklist) without delay.'

Analysis

The crew used the data from a loadsheet for a previous flight to calculate the takeoff performance figures for the aircraft. This led to the takeoff performance being calculated for a mass 10,082 kg less than the actual mass of the aircraft at departure. Therefore, the commander, as PF commenced the takeoff rotation at 123 kt as opposed to the 139 kt required for the aircraft's actual mass. The FCTM advises that pilots should make a smooth continuous rotation at V_R towards a pitch attitude of 15° nose-up. The stabiliser trim setting was more nose-up than for the correct mass resulting in pitch control forces being lighter than anticipated by the PF, possibly contributing to the pitch rate peaking at 5°/s just prior to the tail striking the ground. As the aircraft rotated the airspeed was too low to generate sufficient lift for the actual mass of the aircraft. The aircraft did not therefore lift off at the point in the rotation anticipated by the crew but, instead, lifted off as the PF continued the rotation. As described in the FCTM the aircraft tail struck the ground damaging the tail skid and a drainage mast.

The commander recalled feeling a small bump during the takeoff but saw no other abnormal indications. Once the after takeoff checklist was complete the crew discussed the possibility of a tail strike or a load shift as being the cause of the bump. The commander was confident that the rotation and lift off had been normal, with no abnormal indications or flight parameters he considered liable to cause a tail strike. His workload was high due to the inexperience of the co-pilot so with the aircraft handling normally the commander decided to continue the planned departure as this also kept the deck angle stable in accordance with the load shift guidance in the OMB. Continuing the planned departure and climb also avoided the increased workload of an immediate diversion.

In the cruise at FL240 with the workload much reduced, the commander revisited the symptoms after the co-pilot had visually checked the cargo. With the suggestion of a load shift excluded the commander decided to action the Tail Strike QRH procedure out of an abundance of caution. Concerned about exposing the co-pilot to the very unusual task of depressurising the aircraft at high altitude the commander decided to first descend and then complete the QRH actions. Sufficient fuel remained to carry on to the destination which, in considering the workload, the commander decided to do. The sector was short and so comparatively little time would have been saved by diverting.

The aircraft then flew an uneventful approach to Aberdeen and, after landing, was checked by the commander and the damage identified. The crew reviewed their paperwork and realised that the loadsheet signed by the commander was not the one they had used for calculating takeoff performance.

Conclusion

The crew used incorrect loading figures to calculate the aircraft performance at departure. The aircraft was approximately 10 tonnes heavier than anticipated and the PF therefore commenced the takeoff rotation 15 kt too slow. Due to the lower speed the wing did not develop sufficient lift for the aircraft to takeoff as expected and the tail struck the ground.

Accident

Aircraft Type and Registration:	Boeing 737-8AS, EI-EGD
No & Type of Engines:	2 CFM56-7B26/3 turbofan engines
Year of Manufacture:	2010 (s/n 34981)
Date & Time (UTC):	4 October 2023 at 1320 hrs
Location:	London Stansted Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 103
Injuries:	Crew - None Passengers - None
Nature of Damage:	Right wing leading edge damaged
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	10,803 hours (of which 7,915 were on type) Last 90 days - 102 hours Last 28 days - 41 hours
Information Source:	Air Accident Report Form submitted by the commander and subsequent enquiries by the AAIB

Synopsis

A ground vehicle collided with EI-EGD when it was turning onto stand across the back-of-stand road the vehicle was travelling on. The vehicle driver may have experienced 'inattentional blindness' and may have been affected by task fatigue. The vehicle operator and airport authority both issued safety notices to airport drivers regarding safe driving practices.

History of the accident

EI-EGD landed on Runway 22 at Stansted and was cleared to taxi to stand D62R at Apron D via Taxiway Juliet. The aircraft entered Apron D at 12 kt with engine 1 N1 at 20% and engine 2 shut down.

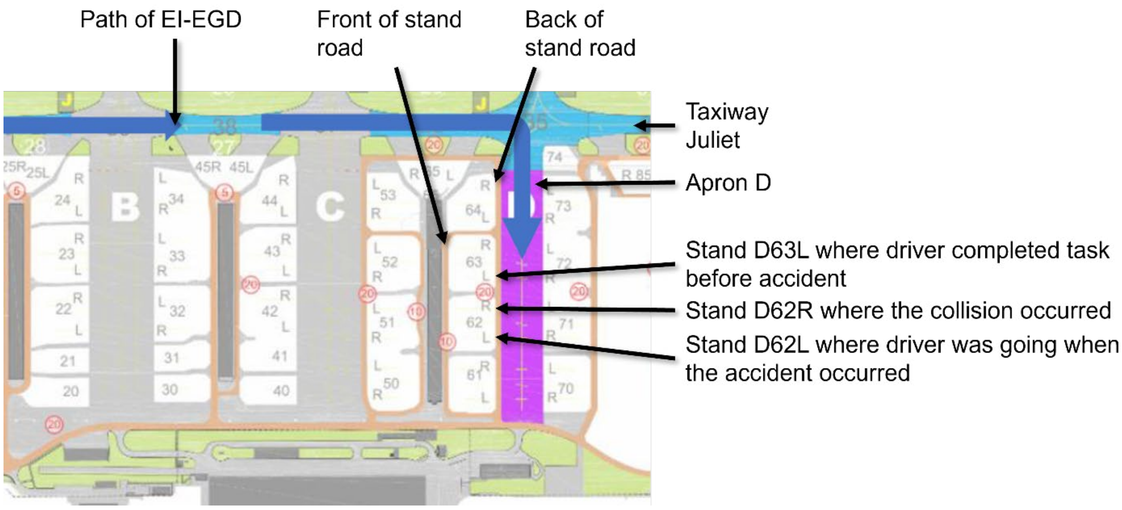


Figure 1
Location map

The vehicle driver reported it had been a busy morning. Data from the vehicle operator showed that he had completed 13 tasks on the day and there had been periods of downtime in between the tasks. The operator reported this was consistent with the time of year.

The driver was initially tasked with assisting a passenger at Stand D62L and went to that location to prepare, but before completing this he was sent to D63L (Figure 1).

The driver attended Stand D63L and loaded his only passenger on to an aircraft. He was then instructed to go back to D62L. The driver reported he felt annoyed by this request and that someone else should be assigned. The driver reversed off the aircraft at D63L and joined the back-of-stand road heading towards Stand D62L. The vehicle was driven along the back-of-stand road at 13 mph. The speed limit was 20 mph.

Meanwhile, the aircraft continued along Apron D towards the allocated stand. The pilots completed a check that the stand entrance and stand area were clear before beginning the right turn on to stand D62R. The co-pilot was pilot monitoring and announced "CLEAR RIGHT". He recalled seeing the vehicle but thought it had stopped. When this check was made the vehicle was travelling towards the back-of-stand road from the rear right of the aircraft parked at Stand D63R and was facing towards EI-EGD. It had not yet joined the back-of-stand road and was not in conflict with the aircraft. Once the co-pilot's check was complete, the pilots' attention turned to the stand guidance system and the personnel and equipment at the head of the stand.

The vehicle joined the back-of-stand road and was travelling parallel to the aircraft in the same direction at a slightly faster speed. The driver did not notice when EI-EGD started to turn across the back-of-stand road on to Stand D62R. When turning on to stand the aircraft was travelling at 10 kt with engine 1 at 24% N_1.

A ground handling agent was positioned at the head of stand and realised that the vehicle was not going to stop. He attempted to signal to the pilots using hand signals but did not use the STOP button on the stand guidance system and the pilots did not notice him.

Just before the collision, the driver noticed the aircraft, performed an emergency stop and attempted to reverse out of the way but the right wing of the aircraft collided with the roof of the vehicle and then travelled over it. EI-EGD was travelling at 8 kt with engine 1 at 24% N_1 when the collision occurred. At this point the vehicle was behind the cockpit.

During the collision the aircraft's wing passed over the vehicle and the vehicle ended up behind the right wing. The vehicle was then driven behind EI-EGD and stopped on Stand D62L next to the back-of-stand road where the driver reported the accident to the relevant parties. The damage to the aircraft is shown in Figure 2.

Figure 2

Damage to the aircraft

Accident location

Apron D at Stansted is a busy location with a high number of aircraft and vehicle movements. On the side where the accident occurred there are roads at both the front and rear of the aircraft stands. There are no airbridge facilities and passengers cross the front-of-stand road on foot to reach the terminal on arrival. To reduce risk of harm to passengers, the front-of-stand road is one-way and has a lower speed limit of 10 mph. On the back-of-stand road there is the potential for conflict with other vehicles and aircraft that are pushing back or entering the stand. Aircraft pushing back are protected by a ground handler who stands on the back-of-stand road and signals to approaching vehicles to stop. There are no similar provisions for aircraft turning onto stand.

Recorded information

CCTV footage showed the aircraft and vehicle movements. Aircraft were boarding at stands D63L and D62L. There were no other vehicle movements along the back-of-stand road or the road between Stand D63L and D62R during the time when the accident vehicle was driving from D63L to D62L.

The vehicle was fitted with an external 360º camera system and an internal behaviour monitoring system. The internal system faced to the rear of the vehicle and captured the driver's actions and head movements before the collision.

The aircraft FDR and CVR were available.

CCTV footage, internal vehicle system recordings and the CVR were synchronised and used to examine the timeline and driver's glance behaviour. The vehicle was reversed away from the aircraft at D63R then driven forwards towards the back-of-stand road. Travelling forwards took about seven seconds and during this time the driver made three distinct glances through the left window along the back-of-stand road and one glance to the right along the road.

At this point EI-EGD was directly ahead of the vehicle. The co-pilot announced "CLEAR RIGHT" just before the vehicle joined the back-of-stand road about 15 seconds before the collision.

While driving on the road, the driver's attention appeared to be focused through the front window. There were no obvious glances through the left window towards the aircraft or to the right towards the stand guidance or activity at Stand D62R. EI-EGD started to turn on to stand about 11 seconds before the collision and the driver appeared to notice the aircraft about 5 seconds later.

Vehicle information

The Bulmor SideBull OMNI 135 (Figure 3) was used to transport passengers requiring assistance between the terminal building and aircraft. This vehicle type can engage with aircraft under the operation of one driver. The vehicle at the time was serviceable with pre-use inspections having been completed on the day and several days prior.

Figure 3

Example Bulmor SideBull OMNI 135 vehicle

The vehicle provided a wide direct field of view through the windows as shown in Figure 4 with some obscuration caused by the vehicle structure. Vision to the rear was enhanced with multiple mirrors and the camera system.

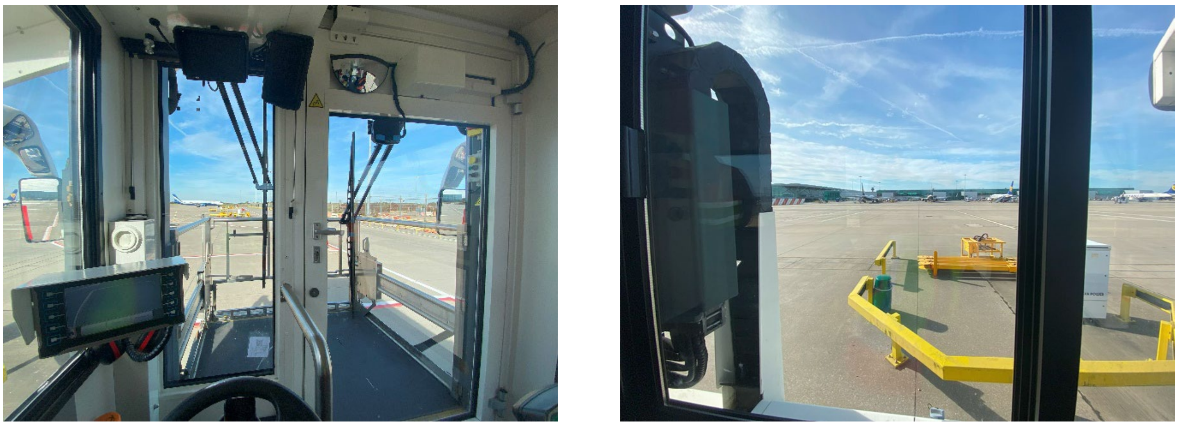


Figure 4

Views from the front and left side windows

Figure 5
Damage to the vehicle

Personnel

The vehicle driver began work in the airport environment in March 2023 and gained his airside driving permit in April 2023. Training for the Bulmor SideBull vehicle was completed in June 2023.

At the time of the accident, the driver was working his first shift after four rest days. The driver's first task was at 0526 hrs. The driver's pre-licence medical and post-accident drugs and alcohol testing showed nothing of concern.

The driver had been involved in a collision with another vehicle six weeks before this one.

The vehicle driver commented that he felt that more time was needed for each job and that there was an unfair distribution of work. He stated that he found driving on the airport "unnerving" due to the other vehicles and had previously reported a near miss with another vehicle. He stated that, in general, when driving on the back-of-stand road he was most conscious of looking out for other vehicles and aircraft that might be about to push back.

Research

The phenomenon of 'look but don't see' errors or inattentional blindness is well researched. It was demonstrated in the classic gorilla experiments by Simons and Chabris (1999)[1] where participants watched a video of two teams, one wearing white and one wearing black, passing a ball around. Participants were asked to count the number of passes made by the white team. During the video, another figure in a black gorilla suit walks through the scene. About half of the participants didn't see the gorilla even though it was visible and attention grabbing. The *'Selective attention test'* video can be viewed at http://www.dansimons.com/videos.html.

Analysis

All the taxiing speeds were in accordance with the operator's procedures. The pilots completed a visual check before the turn on to stand but when the check was completed the vehicle was not in conflict with them. By the time the vehicle started to come into conflict with the aircraft, the pilots' attention had moved to the stand guidance system, and they were concentrating on accurately parking according to that system. Taxiing on to stand, particularly with one engine shut down, is a challenging manoeuvre that requires accuracy and focused attention.

The pilots did not see the signals from the ground handler as their attention was focused on the stand guidance. Use of the STOP function of the stand guidance system would have been a more effective way to signal to them.

The vehicle provided a good overall field of view and the obscuration caused by the vehicle structure was not sufficient to hide EI-EGD. The aircraft was visible through the windows and the vehicle design did not contribute to the accident.

The vehicle was driven below the speed limit and the vehicle driver appeared to be attentive but either did not see the aeroplane or saw it but did not anticipate that it would turn on to the stand. The internal vehicle CCTV showed that when the driver was about to join the back-of-stand road, most of his attention was to the left and right along the road rather than straight ahead where the aircraft was passing. When travelling on the road, most of the driver's attention was ahead along the road, and not to the left where the aircraft was beginning to turn or towards the stand area where the driver may have noticed clues that an aircraft was about to arrive, such as the stand guidance system and the ground handler.

The driver described his primary concern in that environment as being other vehicles and aircraft pushing back. Although, at this time, there were no other vehicles or aircraft pushing back, the driver's visual behaviour was consistent with searching for them and little attention was directed towards the taxiway on his left. As demonstrated in the invisible gorilla experiment, when searching an environment, humans 'tune' their search pattern and attention to the specific stimuli they are searching for. This makes those specific stimuli

Footnote

[1] Simons, D.J and Chabris, C.F. (1999). Gorillas in our midst: Sustained inattentional blindness for dynamic events. Perception, vol 28, pages 1059 – 1074. See www.dansimons.com for further information.

more likely to be noticed but other stimuli are less likely to be noticed even when they are highly conspicuous. The inattentional blindness phenomenon may account for the driver not seeing EI-EGD even when it was clearly visible.

The vehicle operator will conduct a review of the training process for Bulmor drivers and increase active and visible supervision. The external and in-vehicle footage captured by the Bulmor SideBull vehicles provides a resource that could potentially be used as a coaching tool during training and on-going competency assessment to improve drivers' visual search.

The driver was relatively inexperienced in the airport environment and his account and history suggested that he found it challenging. The driver reported that it had been a busy morning and he felt annoyed about the way that jobs were allocated. Although the number of tasks was consistent with the time of year and not unusually high, this individual driver was potentially feeling fatigued by the workload that day and distracted by his emotional response to the last-minute tasking. These factors may have reduced his performance.

The environment and operational context in Apron D is challenging for all drivers. There are lots of opportunities for conflict between vehicles and aircraft. On the back-of-stand road in particular, conflicts can arise from any direction. When workload is high, drivers and pilots are fatigued and everyone is trying to achieve fast turnaround times, it is not surprising that visual searches will not always be completely thorough, especially considering phenomena such as inattentional blindness. Safety could be improved if the layout or operating rules of the stands and roads could be changed to increase the predictability of the behaviour of other vehicles and reduce the number of different directions from which conflicts could arise. The airport authority plans to evaluate the current road layout and design and to consider whether any modifications can be made without introducing new risks.

Conclusion

A Bulmor SideBull OMNI 135 vehicle collided with EI-EGD because the vehicle driver did not see the aircraft or did not anticipate it would turn onto stand. The driver may have experienced inattentional blindness and his performance may have been reduced by the fast operating tempo, high workload and task related fatigue. The stand and road layout in the area created the potential for conflict between vehicles and aircraft to arise from any direction.

Safety action

> Following this event, the vehicle operator and airport authority both issued safety notices to airport drivers regarding safe driving practices. The airport's safety notice drew attention to clues that drivers can use to recognise that an aircraft would soon be turning on to stand, such as the presence of personnel and equipment at the head of stand and the activation of the stand guidance system.

Serious Incident

Aircraft Type and Registration:	Boeing 777-236, G-YMMG
No & Type of Engines:	2 Rolls-Royce RB211 Trent 895-17 turbofan engines
Year of Manufacture:	2000 (Serial no: 30308)
Date & Time (UTC):	9 March 2024 at 1215 hrs
Location:	London Gatwick Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 13 Passengers - 272
Injuries:	Crew - None Passengers - None
Nature of Damage:	Outboard Auxiliary Support Fairing missing
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	61 years
Commander's Flying Experience:	23,000 hours (of which 1,579 were on type) Last 90 days - 183 hours Last 28 days - 48 hours
Information Source:	Enquiries made by the AAIB

History of flight

G-YMMG landed at Gatwick Airport after an uneventful flight from Jamaica. Engineers working for the operator met the aircraft and during the post-flight inspection it was noticed that the Outboard Auxiliary Support Fairing (OASF) was missing from the right wing (Figure 1). The area was inspected, and the primary attachment bracket was found to have failed. The fairing was not recovered.

Service Bulletin

The attachment of the OASF was the subject of the aircraft manufacturer's Service Bulletin 777-57-0055 from January 2007 and the current revision 3 was issued in May 2014. The SB provides instructions for a one-time inspection of the attachments of the OASF as cracking had been discovered on some aircraft, which could lead to a loss of the fairing.

Previous inspection

Both fairing attachments on the incident aircraft were inspected in accordance with the SB in June 2010 and cracks were found on the left-wing fairing. The aircraft was modified as per the SB and returned to service. The right-wing fairing was the original equipment fitted to the aircraft and no cracks were detected at the time of the inspection.

Figure 1

G-YMMG right wing after landing at Gatwick Airport

Safety Action

As a consequence of this loss of the fairing, the operator initiated a fleet wide inspection programme to re-inspect the fairing attachments. This will be accomplished when the aircraft are scheduled for a suitable maintenance interval. The operator reported no further findings to-date but the inspections are on-going.

The manufacturer has limited information on the findings from the SB inspections as there was not a requirement to report them. From the reports received they do not consider any further action is required at this time, but it will remain under review as part of the continued airworthiness program.

Accident

Aircraft Type and Registration:	Rotorsport UK Cavalon, G-CLDV	
No & Type of Engines:	1 Rotax 915 iS piston engine	
Year of Manufacture:	2019 (Serial no: RSUK/CVLN/032)	
Date & Time (UTC):	16 January 2024 at 1019 hrs	
Location:	Field near Breedon Holt, Norfolk	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - 1 (Serious) 1 (Minor)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	65 years	
Commander's Flying Experience:	3,500 hours (of which 100 were on type) Last 90 days - 25 hours Last 28 days - 6 hours	
Information Source:	Aircraft Accident Report Form submitted by the commander	

Synopsis

The aircraft struck trees during an attempted go-around from a Practice Forced Landing (PFL). After striking the trees the aircraft fell to the ground and was extensively damaged. Both those on board were able to escape the aircraft, though the student suffered serious injuries. The instructor suffered minor injuries.

History of the flight

The aircraft, a Rotorsport Cavalon (Figure 1) was being flown on a training sortie in preparation for the student's General Flying Test (GFT). The student had not flown for approximately six weeks but, although he was low on solo hours, rather than just do a circuit check the instructor decided to conduct a mock GFT. The student was briefed on the exercise profile and the instructor informed him he would say as little as possible, save to direct the next required element. The aircraft departed Felthorpe Airfield at 0945 hrs.

Figure 1
Rotorsport Cavalon

After takeoff the aircraft departed the Felthorpe circuit to the north-west and climbed to approximately 2,000 ft amsl. The student completed various upper air manoeuvres to a standard the instructor described as "adequate to pass his test." Then, over a clear area and at 2,000 ft amsl, the instructor directed the student to simulate an engine failure. The student established the aircraft in the descent at 70 mph, identified a suitable field for the PFL, indicated this field to the instructor and began his approach. The instructor noted that the student did not make a simulated distress call or simulate an engine restart procedure. The student recalled simulating the forced landing checklist actions. The speed reduced to 50 mph from the best descent speed of 65 to 70 mph, but the instructor considered this a normal way to reduce height during a PFL in a gyroplane.

At approximately 500 ft the instructor asked the student to confirm the field he had selected for the approach. The instructor believed the student was going to make a straight in approach to a field ahead, accepting a crosswind component. However, the student had actually planned to make an into-wind approach towards a different field and so commenced a 90° turn to the right. This turn was made with approximately 30° angle of bank (AOB) and commenced at approximately 400 ft agl. The turn took the flight path over a wood and, although the instructor assessed that in a real emergency the student would have reached his chosen field, he directed a go-around. At this point the airspeed was approximately 60 mph and the height 300ft agl.

The instructor stated that the student "pulled the stick hard back and applied partial power." The standard go-around actions are to apply full power, correct any yaw, and pitch the aircraft to achieve 60 mph. The student recalled applying full power for the go-around. The instructor stated he applied full power and placed his hand on the control column to pitch down but could not recall if he was able to get the stick forward at all. He could not recall if he said "I have control." The aircraft struck the edge of the trees and fell to ground (Figure 2).

Figure 2

Aircraft at accident site

The student turned off the master switch to shut the aircraft down. Though there was extensive damage, both occupants were able to vacate the aircraft. No MAYDAY call had been made and, as the aircraft was away from an airfield, the crew were uncertain if anyone was aware of the accident. The student had an accident warning app on his mobile phone, which was used to pass an exact location to the emergency services.

The first emergency responders reached the site approximately 15 minutes after the accident and both occupants were taken to hospital. The student suffered serious injuries.

He believed he was rendered unconsciousness during the accident and described his memory of events as "hazy." The instructor suffered minor injuries and was released from hospital the day after the accident.

Recorded information

No data was recovered from the aircraft but the aircraft flight path was partially recorded by a flight tracking application. The recording ceased at approximately 1,200 ft amsl and at a speed of 45 kt. The latter stages of the PFL and the attempted go-around were not recorded.

Analysis

The aircraft was being flown on a simulated GFT for a student who had not flown for approximately six weeks. After a series of successful upper air exercises the instructor directed the student to simulate an engine failure and carry out a PFL. The student manoeuvred the aircraft to position for an approach into his chosen field and reduced speed to increase the rate of descent. When the instructor asked for confirmation of the field at approximately 500 ft agl it became evident that the pilots had misunderstood each other and their expectations of the intended field differed. The instructor was expecting an approach straight ahead, accepting a crosswind in the final stages, whereas the student planned to approach directly into the wind using a field to the right of the aircraft. The student commenced a turn at approximately 400 ft using 30° AOB, taking the aircraft over an area of woodland. Though the instructor judged that the student would have reached his intended field had the engine failure been genuine, concerned for the proximity of the trees the instructor directed a go-around at approximately 300 ft.

The recollections of actions taken for the commencement of the go-around differed. The student believed that he selected full power to establish the climb. The instructor stated that the student pulled back on the control column and applied only partial power. If the aircraft pitched up its speed would reduce and with only partial power the rate of descent would increase. The instructor recalled that he applied full power and tried to move the control column forward to reduce pitch attitude. He did not recall if this pitch change was successful.

The aircraft did not recover to the climb and struck the edge of the trees before falling to the ground. As the recollections of those on board differed and with no data retrieved from the aircraft, it was not possible to determine the cause of the aircraft striking the trees.

Despite the damage to the aircraft and the injuries to those on board, both were able to vacate the aircraft. A crash detection app on the student's phone gave an accurate position of the accident site and this was passed to the emergency services facilitating an effective response.

Conclusion

The aircraft struck trees during an attempted go-around from a PFL. A cause could not be positively determined.

AAIB Record-Only Investigations

This section provides details of accidents and incidents which were not subject to a Field or full Correspondence Investigation.

They are wholly, or largely, based on information provided by the aircraft commander at the time of reporting and in some cases additional information from other sources.

The accuracy of the information provided cannot be assured.

Record-only investigations reviewed: May - June 2024

24 Mar 24 **Piper PA-38-112** **G-RVRY** Liverpool Airport

In the final stages of a glide approach the instructor called for a go around because the aircraft was not correctly aligned with the runway. After repeating the instruction when the student didn't respond, the instructor took control and initiated the go-around from "about 50-100 feet…and 60 kt" at which point the right wing dropped. As he corrected for this the left wingtip struck the runway, so he converted to a full stop landing. The instructor reflected that an earlier call to go around or intervening immediately after the first instruction might have prevented the incident.

30 Mar 24 **Piper PA-28-181** **G-KDHI** Nether Thorpe Airfield, South Yorkshire

Taking off with two stages of flap from a grass strip that was wet and soft, the aircraft "seemed to take longer to accelerate than normal". The aircraft rotated at about 60 kt approximately 3/4 the way down the 553 m runway after which the stall warner sounded. The pilot lowered the nose but the aircraft undercarriage struck the airfield perimeter hedge and the aircraft came to stop in the adjacent field.

18 Apr 24 **TL-3000 Sirius 600** **G-NEEV** Old Park Farm Airstrip, Glamorgan

The pilot was returning from Haverfordwest Airfield to land at a private airstrip in Glamorgan where the aircraft was based. The pilot reported that the approach and initial touchdown on grass Runway 36 appeared normal but that the nose gear had then suddenly collapsed.

4 May 24 **Jabiru J430** **G-JABU** Cold Harbour Farm, Willingham, South Cambridgeshire

The aircraft, at close to its maximum takeoff weight, was taking off from a grass strip in light winds. The grass was cut to a medium length, but the end 20% of the strip was soggy due to continuous rain the previous day. When the aircraft encountered the soggy ground, it decelerated markedly so the pilot aborted the takeoff, but could not stop the aircraft overrunning into a ploughed field where it nosed over onto its back causing substantial damage.

6 May 24 **Denney Kitfox Mk3** **G-PPPP** Northcotes Airfield, Lincolnshire

During takeoff the right wing dropped when the aircraft was at a height of approximately 15 ft. The aircraft descended and landed heavily in a field causing the landing gear to collapse and damaging the propeller.

Record-only investigations reviewed: May - June 2024 cont

7 May 24 **Aeroprakt Foxbat A22** **G-CHAD** Otherton Airfield, Staffordshire

The pilot reported that shortly after taking off from Runway 07, the engine suddenly stopped. The pilot decided to land in an adjacent field as the aircraft's relatively low height and position precluded a turnback to the airfield. During the landing roll the nose gear collapsed.

10 May 24 **Yak-18T** **G-YAKJ** 3 nm west of Settle, Yorkshire

During the flight, following an unsuccessful engine restart after a muffled "pop" and "immediate and complete power loss" at about 1,300 ft agl, the pilot selected a field which appeared to be "firm and smooth". The main gear touched down first but the nose gear collapsed on contact with the ground, and then the aircraft pitched onto its back.

10 May 24 **Jodel (Modified) DR200** **G-AYDZ** Enstone Airfield

After landing the aircraft entered an area of soft ground which caused the main wheels to dig in and the aircraft to become inverted.

11 May 24 **Jodel D117A** **G-BIOU** Hamilton Farm Airfield, Kent

The aircraft landed with a tailwind which resulted in a faster than normal groundspeed. The aircraft's propeller struck the surface of the grass runway causing the aircraft to become inverted.

11 May 24 **Jodel D112** **G-BGWO** Eaglescott Airfield, Devon

Shortly after takeoff the aircraft's engine suffered a power loss. The pilot landed the aircraft on the remaining runway but the touchdown was hard resulting in damage to the landing gear and propeller.

12 May 24 **Mission M108** **G-CLKY** Draycot Aerodrome, Wiltshire

During taxi the nose gear collapsed due to a failure of a weld.

17 May 24 **Beech 76 Duchess** **N800VM** Shobdon Airfield, Herefordshire

During takeoff a door came open and the pilot abandoned the takeoff. The aircraft could not be brought to a stop before it ran off the end of the runway, coming to rest after striking the boundary fence.

17 May 24 **Agusta A109E** **G-GDSG** Oxford Airport

The helicopter landed heavily during a practice autorotation which resulted in the nose landing gear collapsing.

Record-only investigations reviewed: May - June 2024 cont

18 May 24 **Aeronca 11BC** **G-BRCW** Eshott Airfield, Northumberland

During landing, the aircraft began to drift to the right but the pilot did not have enough airflow over the rudder to control the drift. He applied full power to regain directional control and go around but the right main landing gear caught on a low fence causing the aircraft to yaw right into the fence. The main landing gear collapsed and the propeller "disintegrated". The pilot was unsure why directional control had been lost but considered it might have been a combination of accidentally-applied heel brake, a gust of wind and/or the right landing gear running into longer grass. He also commented that the runway was narrow, which meant there was little time to correct the drift before reaching the edge of the runway.

19 May 24 **Piper PA-28-161** **G-ENNA** Near Beccles Aerodrome, Suffolk

Whilst landing on Runway 09 with a crosswind from the left, the aircraft veered left and exited the runway, coming to rest in an adjacent field. The aircraft was undamaged, and the pilot was uninjured. The pilot considers that he braked heavily to stop within the asphalt section of the runway, and that he may have applied too much rudder to account for the crosswind, resulting in the loss of directional control.

20 May 24 **Sling 4 TSI** **G-HTSI** Redhill Aerodrome, Surrey

The aircraft bounced several times after landing which resulted in the collapse of the nose landing gear.

1 Jun 24 **Europa** **G-OJHL** Balado Airfield, Perthshire

The pilot reported that while preparing for landing at an unfamiliar landing site he forgot to lower the landing gear. The aircraft touched down and slid to a halt, breaking the propeller.

2 Jun 24 **Pegasus Quik** **G-YSMO** Sutton Meadows Airfield, Cambridgeshire

During takeoff, the pilot pushed the bar forward to lift off but, for reasons unknown, the aircraft "kicked" to the left. The nose landing gear collapsed as the aircraft passed over the lip of the intersecting runway. The aircraft slid over the intersecting runway on it nose and came to a halt in an adjacent field.

2 Jun 24 **Ikarus C42 FB80** **G-CECC** Little Gransden Airfield, Cambridgeshire

At about 150 ft after takeoff, the engine stopped. The pilot tried to restart engine without success, so landed ahead in a field. During landing, the nose landing gear caught in the crop and broke, and the aircraft turned onto its back.

Record-only investigations reviewed: May - June 2024 cont

3 Jun 24 **Jodel D120A** **G-BKCZ** Deanland Airfield, Sussex

The aircraft floated along the runway during landing and, after touchdown, the pilot began braking to avoid overrunning the runway and running into a hedge. The aircraft tipped forward onto its nose damaging the propeller.

9 Jun 24 **Jabiru UL** **G-BZEN** Southend Airport

The pilot reported that he made a normal approach to Runway 23 with the wind from right. On touch down the aircraft started to shimmy and then veered to the left onto the grass where the left main landing gear broke. The pilot believes that the left main wheel tyre burst on landing causing the loss of directional control on the ground.

12 Jun 24 **Nipper T.66 RA45 Series 3** **G-AWJE** Eddsfield Airfield, East Yorkshire

Shortly after take off the aircraft experienced a loss of engine power. The pilot conducted a forced landing straight ahead into a ploughed field where the aircraft then tipped upside down.

16 Jun 24 **Jodel DR1050** **G-ARXT** Wellesbourne Mountford Airfield

The aircraft landed heavily, tail first. As the aircraft was taxiing from the grass strip to tarmac the stern post came away from the fuselage.

16 Jun 24 **Cessna 172P** **G-MCLY** Priory Farm Airstrip, Norfolk

The final approach to the grass strip was turbulent. The pilot was aiming for his selected landing point beyond the runway threshold and was monitoring the speed when, at about 30-50 ft agl, the aircraft experienced sink. As the aircraft was close to the threshold, the pilot chose to continue with the approach rather than initiate a go-around. However, the mainwheels clipped the crop in a field about 5-10 m from the threshold, and then the side of a ditch close to the threshold. The aircraft pitched down "hard" onto the nose gear, which immediately collapsed followed by the left main gear.

29 Jun 24 **Ikarus C42 FB80 Bravo** **G-CHVY** Wadswick Airfield, Wiltshire

The aircraft experienced a hard landing which resulted in damage to the nose landing gear.

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).

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

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.

1/2018 Sikorsky S-92A, G-WNSR
West Franklin wellhead platform, North Sea
on 28 December 2016.

Published March 2018.

2/2018 Boeing 737-86J, C-FWGH
Belfast International Airport
on 21 July 2017.

Published November 2018.

1/2020 Piper PA-46-310P Malibu, N264DB
22 nm north-north-west of Guernsey
on 21 January 2019.

Published March 2020.

1/2021 Airbus A321-211, G-POWN
London Gatwick Airport
on 26 February 2020.

Published May 2021.

1/2023 Leonardo AW169, G-VSKP
King Power Stadium, Leicester
on 27 October 2018.

Published September 2023.

2/2023 Sikorsky S-92A, G-MCGY
Derriford Hospital, Plymouth, Devon
on 4 March 2022.

Published November 2023.

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 Service
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 Union 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
GNSS	Global Navigation Satellite System
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
PM	Pilot Monitoring
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
TODA	Takeoff Distance Available
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
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

Air Accidents Investigation Branch