AAIB
Air Accidents Investigation Branch

AAIB Bulletin 8/2025

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01252 512299

Air Accidents Investigation Branch
Farnborough House
Berkshire Copse Road
Aldershot
Hampshire
GU11 2HH
United Kingdom

Tel: 01252 510300
Media enquiries: 01932 440015 (office hours) / 0300 777 7878 (out of hours)
www.aaib.gov.uk

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AAIB CORRESPONDENCE INVESTIGATIONS Cont

(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:	Piper PA-23-250, G-BKJW	
No & Type of Engines:	2 Lycoming IO-540-C4B5 piston engines	
Year of Manufacture:	1971 (Serial no: 27-4716)	
Date & Time (UTC):	6 July 2023 at 1845 hrs	
Location:	1 nm south-west of Bagby Airfield, North Yorkshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Aircraft destroyed and burnt	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	21 years	
Commander's Flying Experience:	440 total hours (3 hours on type) to 2 June 2023[1] Last 90 days – 46 hours to 2 June 2023[1] Last 28 days – not known[1]	
Information Source:	AAIB Field Investigation	

Synopsis

The pilot had departed Bagby airfield in the morning and flown to Deauville in France where he collected five passengers and delivered them to Abbeyshrule in Ireland. The accident occurred at the end of the return flight to Bagby, with the pilot the sole occupant of the aircraft. After the pilot made a normal radio call to Bagby to say that he was four miles from the airfield, the aircraft was seen on radar and CCTV to join right base for Runway 06. The CCTV video showed the aircraft's descent angle start to steepen while it was on right base. There was then a slight reduction in descent angle before the descent angle steepened sharply and the aircraft struck trees and then the ground at an angle of about 35° to 40° nose-down, with no indication that the aircraft was starting to recover. The ground impact caused a fire, and the accident was not survivable.

The post-impact fire destroyed a significant amount of physical evidence, but that which remained contained no identifiable defects that could have caused or contributed to the nose-dive. The one anomaly found was the position of the pitch trim drum which was 3 mm from the full nose-down position. Evidence from a flight trial on the same type of aircraft revealed that this was more nose-down than would be expected for any flap configuration in the speed range determined from the CCTV. However, the possibility of the trim having

Footnote

[1] No logbook entries were recorded after 2 June 2023.

moved during the post-impact break-up could not be discounted, so other theories of what could have caused the final nose-dive were considered. Of all the causes reviewed, a pitch trim runaway was considered to be the most likely, but there was insufficient evidence to determine that it was the definitive cause of the accident.

In conducting the investigation, it was apparent that although occurrences of pitch trim runaway are rare, when they do occur the results can easily be catastrophic, particularly if it occurs at low altitude where there is limited time to respond. Irrespective of whether a pitch trim runaway was the cause of the accident to G-BKJW, the investigation identified ways to reduce the risk of such an event. Consequently, the CAA plan eight safety actions which concern:

1. Training for a pitch trim runaway.
2. Deactivating inoperative autopilots.
3. Making autopilot and electric trim circuit breakers more visible.
4. Providing clearer information regarding differences training requirements.

History of the flight

The pilot arrived at Bagby airfield at about 0800 hrs on the day of the accident. His first flight that day was to deliver a Cessna 310 aircraft to Leeds East Airport where the aircraft was to be part of a static display for an airshow the following day. The aircraft departed Bagby at 0910 hrs for the short flight, with the pilot being collected on arrival and driven back to Bagby airfield by car.

The pilot then prepared to fly G-BKJW to Deauville, France to collect five passengers to be flown to Abbeyshrule airfield, Ireland. From Abbeyshrule, the pilot planned to fly the short distance to Navan airfield to collect an aircraft spare part before returning to Bagby airfield the same day. A witness stated the aircraft had been refuelled to full tanks the evening before departure.

The pilot departed Bagby airfield, alone, in G-BKJW at 1050 hrs, arriving at Deauville Airport at 1259 hrs. A fuel receipt showed it was refuelled there with 205 litres. He picked up the five passengers and departed Deauville at 1348 hrs, landing at Abbeyshrule airfield at approximately 1630 hrs where the passengers disembarked. The pilot then flew on to Navan airfield, a distance of about 35 nm.

The owner of Navan airfield described the weather as being poor at the time G-BKJW arrived and that he was impressed the pilot had been able to land. He reported that he then helped the pilot refuel, adding 160 litres, so that the two inner tanks were full. A spare part for a light aircraft canopy rail was also loaded onto the aircraft for delivery to Bagby. The airfield owner knew the pilot and reported that there appeared to be nothing unusual about his demeanour. He stated that he had, however, told the pilot he was concerned about the poor weather conditions.

Having refuelled, the pilot departed Navan airfield for the flight back to Bagby airfield, with radar first picking up the aircraft about 8 nm east of Navan at 1743 hrs and later recording a cruising level of FL070. During the flight, the pilot sent a photo by text to the owner of Navan airfield of the weather conditions en route, with the aircraft appearing at the time to be flying in clear air between broken layers of cloud. The accompanying text described the weather conditions as 'smooth as silk'.

The pilot received a flight information service for much of the flight from London Information ATC and, during the descent towards Bagby airfield, had made a blind call on the Leeming ATC frequency that he would be flying through their Combined Military Aerodrome Traffic Zone (CMATZ). The aircraft entered the CMATZ 8 nm west-southwest of Bagby. There was no other contact with the aircraft until at about 1842 hrs when the pilot called the Bagby Air/Ground station, reporting he was four miles from the airfield and would be joining on a right base for Runway 06. The Air/Ground operator replied, providing the airfield QFE and weather conditions. He reported that there was nothing unusual in the pilot's transmission. The operator looked out of the radio room window for the aircraft and could see it in the distance. He reported that, soon after seeing the aircraft, he saw it suddenly enter a steep, wings-level, nose-down descent, from an altitude of about 1,000 ft while on base leg. The aircraft continued to descend until it disappeared behind some trees and a plume of black smoke could be seen to rise.

At the same time, the aircraft was seen by another witness who was out walking near the airfield. They reported seeing the aircraft suddenly pitch nose-down from a low height, wings-level and diving to the ground.

Some people at the airfield, realising the aircraft had crashed, quickly drove to the accident site which was in a field about 1 nm south-west of the airfield. They found the aircraft badly damaged and on fire. The emergency services were quickly in attendance, putting out the fire and finding that the pilot had been fatally injured.

Recorded information

A tablet and two smartphones were found in the wreckage, but they were too severely damaged by fire to recover any data.

Surveillance data

Position data and timings for the majority of the route flown by G-BKJW during the day were obtained by the AAIB. The data was sourced from en route NATS radar heads and the PilotAware network. The data covered most of the journey within UK airspace, apart from on the short flight between Abbeyshrule and Navan airfields, and on descent and climb out from these airfields when G-BKJW was not in range of any ground stations. Figure 1 shows this data and salient flightpath timings.

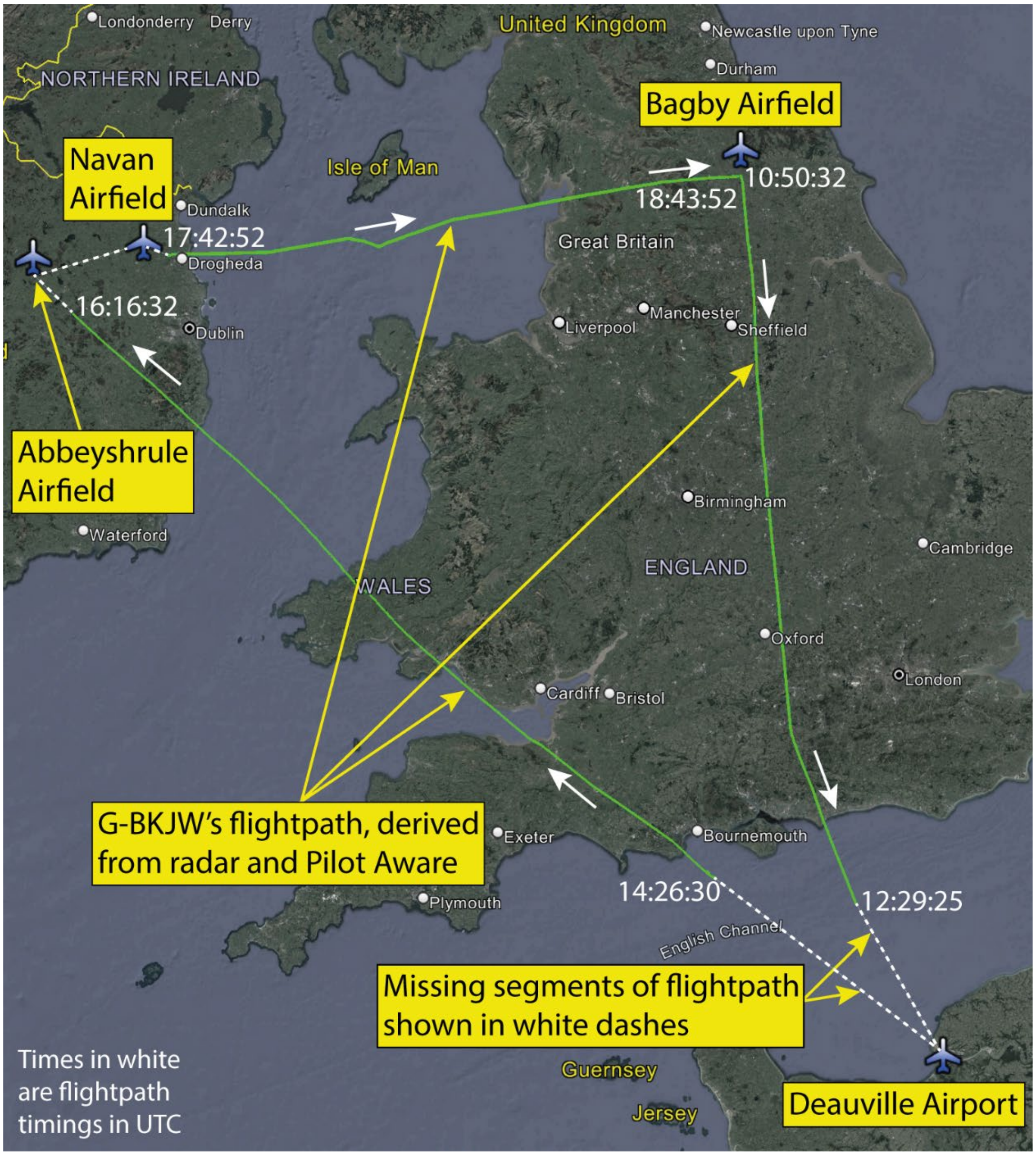

Figure 1

G-BKJW's flightpath on the day of the accident
Map data: SIO, NOAA, US Navy, GEBCO / Image: Landsat/Copernicus

Two of the en route NATS radar heads, at Claxby and Great Dunn Fell, tracked G-BKJW until radar coverage was lost just prior to the accident. Altitude data from these radar sites, as well as the descent rate calculated using both sets of radar data, are shown in Figure 2. The last radar return for G-BKJW at 18:43:52 was 875 m south-southeast of the accident site and the reported altitude was 740 ft amsl. The descent rate data shows that 70 seconds prior to the last radar return, G-BKJW's descent rate increased markedly reaching 1,800 ft/min (point 1 on Figure 2), before briefly reducing toward 1,000 ft/min (point 2), and then increasing again until radar coverage was lost (point 3). The average groundspeed during the rapid descent prior to the turn on to base was about 168 kt. An overview of the final radar ground track from Claxby is shown in Figure 3.

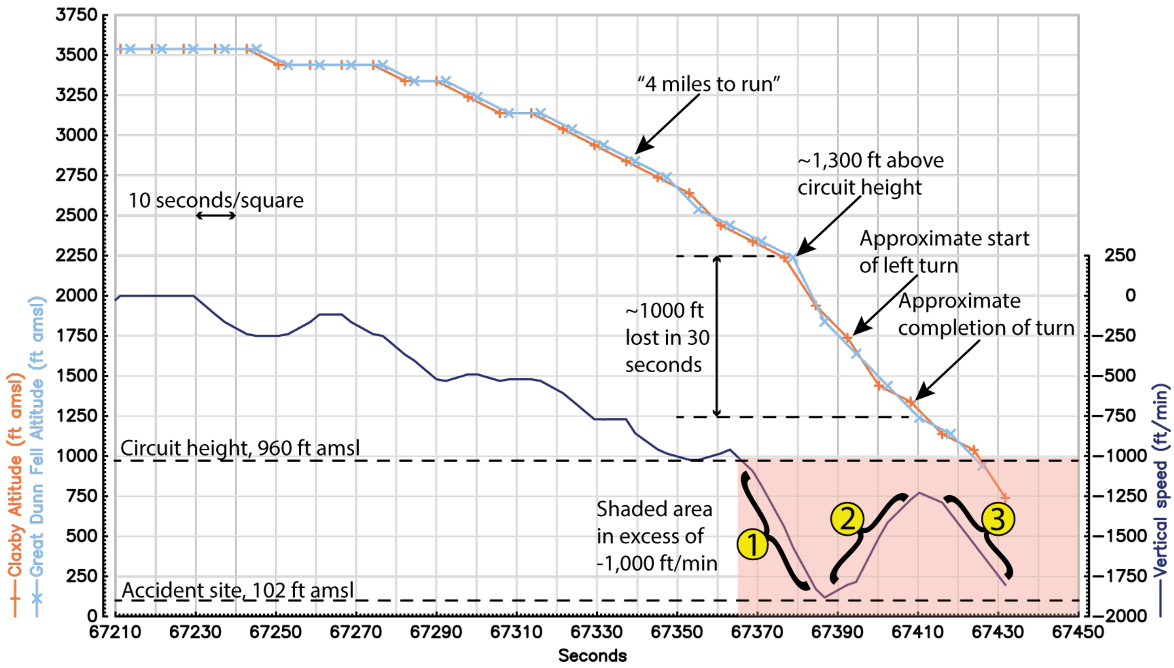

Figure 2

Altitude data and calculated descent rate derived from radar for G-BKJW

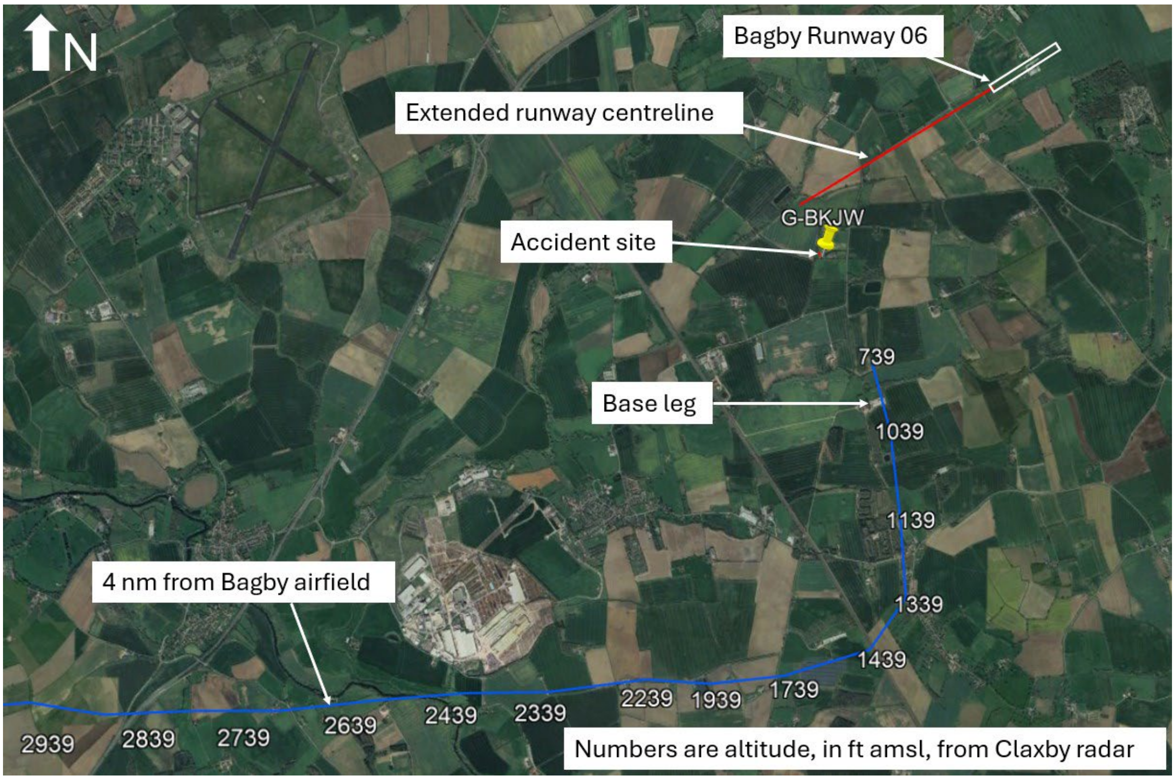

Figure 3

Final radar ground track, accident site and Bagby runway
© Google Earth, Image © Airbus

Closed-circuit television (CCTV) video

CCTV video obtained from Bagby airfield showed G-BKJW joining the visual circuit at Bagby and then descending into terrain. A composite image, made up of individual frames of this CCTV is shown in Figure 4. The approximate position of the last radar return is also shown.

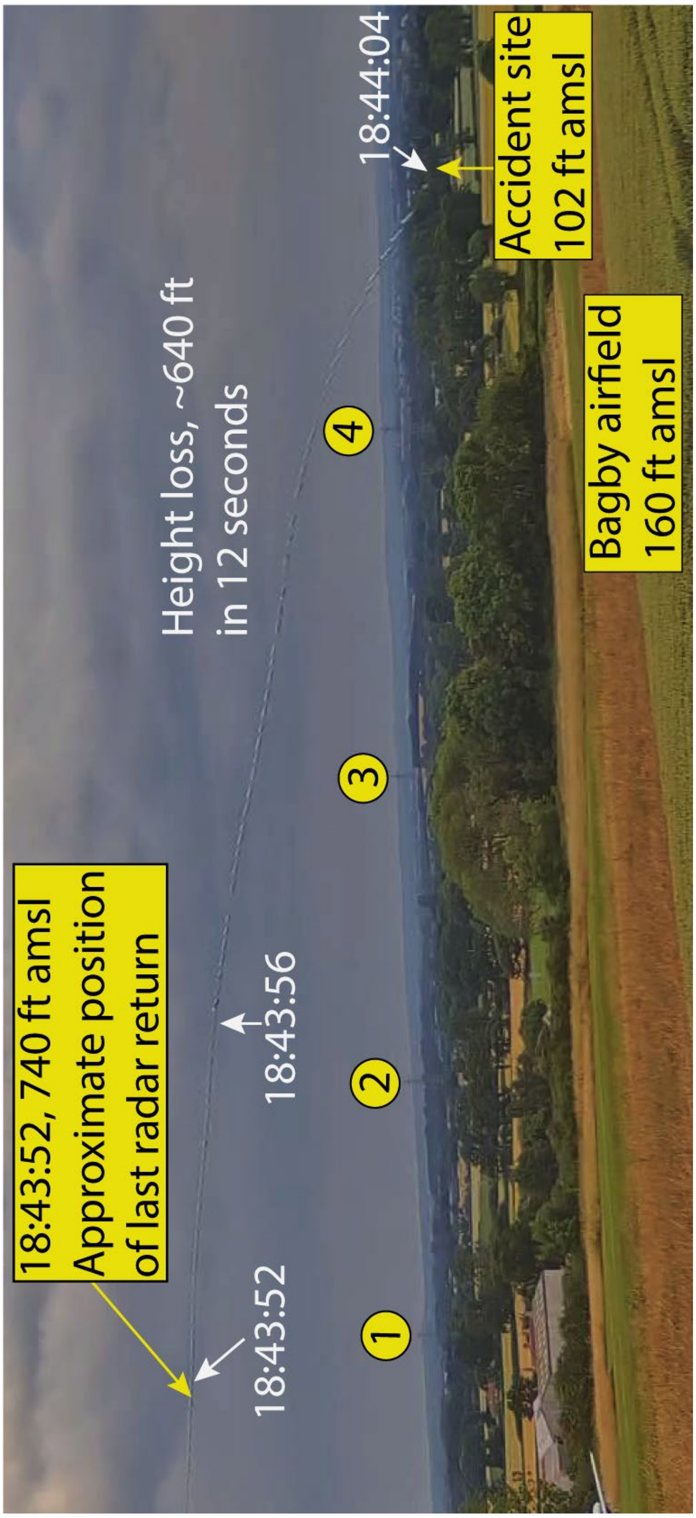

Figure 4

Composite CCTV image of G-BKJW descent into terrain

Several electricity pylons are visible in this image, numbered 1 through 4, and G-BKJW's groundspeed was calculated by timing the passage of the aircraft between these points, using an assumed ground path for G-BKJW between the position of the last radar return and the accident site. These calculations resulted in an estimate for G-BKJW groundspeed of approximately 122 kt, although the associated error in these calculations may be as much as ± 18 kt. With the reported 10 kt wind from the south, G-BKJW's airspeed would have been approximately 112 kt ±18 kt. A close-up of the aircraft's final descent is shown in Figure 5.

Figure 5

Close-up of final descent from composite CCTV image

Accident site

The accident site was located 1.0 nm south-west of the Runway 06 threshold at Bagby airfield (Figure 6). The site revealed that the aircraft had struck trees in a steep nose-down attitude before hitting the ground and catching fire, consistent with the CCTV video. The direction of travel from the trees to the ground and the aircraft fuselage remains was in a line of about 335°(T) (Figure 7). There was no indication of aircraft roll or yaw at impact. Both engines had created similar impact craters, and their location indicated a flight path of about 35° to 40° nose-down from tree impact to ground impact. The wreckage spread was about 47 m and the pilot's body was found 34 m beyond the remains of the fuselage. The wreckage was extensively damaged by fire, but the aircraft's tail section was relatively intact (Figure 8). The horizontal stabilator was free to move and its control cables were connected. The stabilator pitch trim drum was found in a nearly full nose-down trim position. The pre-impact flap and landing gear positions could not be determined.

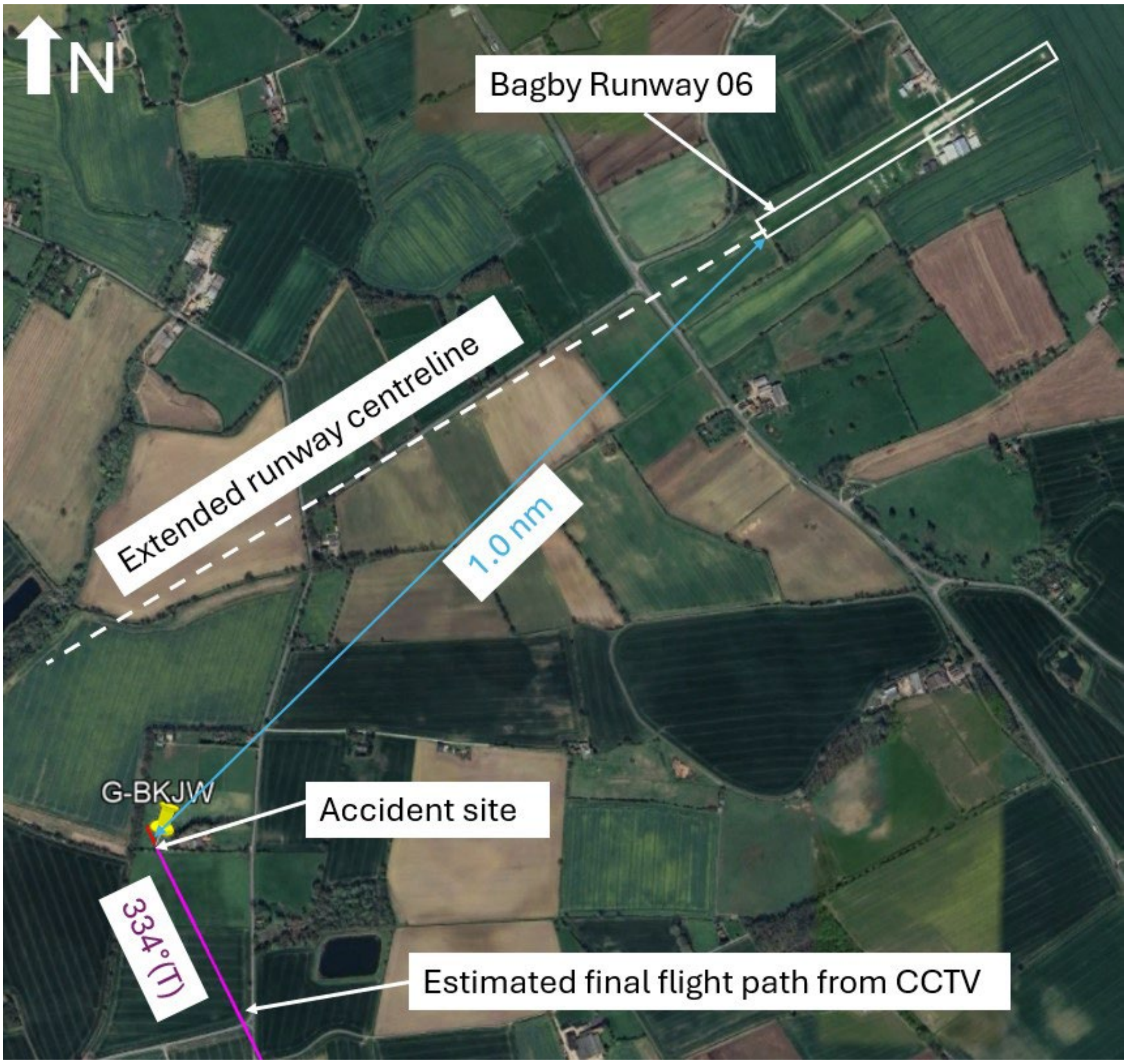

Figure 6
Accident site location relative to runway at Bagby airfield

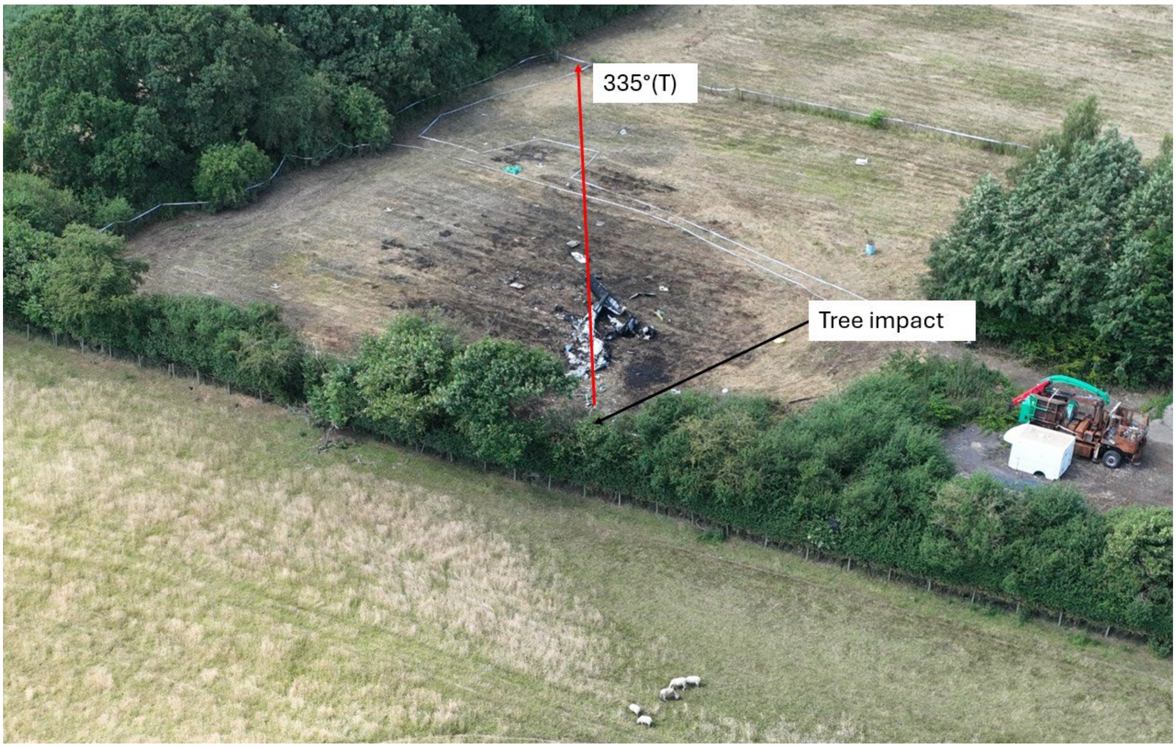

Figure 7

Aerial view of accident site

Figure 8

Wreckage extensively damaged by fire

Aircraft information

Background

The Piper PA-23-250 Aztec is a six-seat twin-engined light aircraft that was first certified in 1959. The accident aircraft, G-BKJW, was an 'E' model Aztec manufactured in 1971 (Figure 9). G-BKJW had sat unused at Sandtoft airfield between the end of 2020 and the beginning of 2023. During this period, it had been parked outside under a cover and the engines were occasionally run. The aircraft was bought and taken to Bagby airfield on a Permit to Fly (ferry permit) on 9 February 2023 and then underwent an annual inspection over the subsequent three months. The aircraft's technical log was not found in the wreckage, but the maintenance organisation estimated that the aircraft had flown about 30 hours since the annual inspection with no reported issues apart from a rough running engine which was resolved by cleaning the injectors. The total airframe hours were about 6,340 hours. The left and right engines had accumulated about 280 hours and 450 hours respectively since last overhaul.

Figure 9
Accident aircraft, G-BKJW

Flight controls

The aircraft was fitted with conventional mechanical flight controls. The aircraft had an all-moving horizontal stabilator for pitch control which was connected to the control yoke via cables. It had an anti-servo trim tab on its trailing edge which had two functions. It deflected in the opposite direction of the stabilator in order to provide an aerodynamic stabilising force. It also acted as a trim tab, controlled by the pilot or autopilot, to remove control forces. The trim tab was actuated by a rod connected to a pitch trim drum, which was in turn actuated by cables connected to a trim handle in the roof of the cockpit (Figure 10).

Figure 10

Pitch trim handle in the roof of the cockpit of a PA-23-250

Flaps

The aircraft had a hydraulic system that actuated the landing gear and the flaps. The flaps were commanded by moving a flap control lever in the cockpit up or down, holding it in that position and then moving it back to neutral to stop the flaps from moving. Moving the flap lever back to neutral trapped the hydraulic pressure in the hydraulic lines to the flap actuator. There was no mechanical lock in the actuator. When the flap lever was moved all the way down or up, the lever would lock in position, and when the flaps reached full travel the lever would automatically spring back to neutral. The flaps had the following four positions and maximum extension speeds:

Flap Position	Maximum Flap Speed
Up	N/A
Quarter	139 kt (160 mph)
Half	122 kt (140 mph)
Full	109 kt (125 mph)

Table 1

PA-23-250 Flap positions and extension speeds

The flap actuator moved a bellcrank that was welded to a torque tube and connected to a rod that actuated the right flap. The torque tube was also connected to a rod that actuated the left flap; the torque tube linked both flaps so that when the torque tube rotated both flaps extended or retracted together.

When the flaps were extended the aircraft pitched up. It is normal for light aircraft to pitch when flaps are extended, but the pitch up in the PA-23-250 was sufficiently significant that on later F models the aircraft manufacturer introduced a flap-to-trim-tab interconnect system which automatically moved the trim tab to counter the pitch effect of the flap. This was not fitted on G-BKJW which was an earlier E model.

Autopilot and electric trim systems

The aircraft was equipped with a Piper Altimatic IIIB autopilot system that was placarded inoperative but known to have some functionality. The build record for G-BKJW revealed that this system had been fitted at original manufacture. It was an analogue autopilot system that had three servos to control the ailerons, the stabilator and the pitch trim tab respectively. Its control console was fitted to the lower instrument panel on the pilot's left side (Figures 11 and 12). The autopilot was turned on by pressing the Autopilot/Roll engage switch. This would engage the autopilot in roll mode which could then maintain a selected bank angle or be used to track a heading after pressing the heading engage button. The pitch mode was engaged using a separate Pitch Engage button. Prior to engaging the pitch mode it was important to centre the trim indicator using the Pitch Command Disk. If this was not done the aircraft would pitch up or down upon pitch mode engagement. Once the pitch mode was engaged the Pitch Command Disk could be used to select a desired pitch angle up to 8° nose-up or 6° nose-down, or the Altitude Selector could be used to select a desired altitude. The autopilot was disengaged by either pressing the Autopilot/Roll Engage switch OFF, or by pressing the autopilot disconnect switch on the control yoke; however, the yoke mounted disconnect switch was not fitted on G-BKJW – there was an empty hole for it (Figure 12).

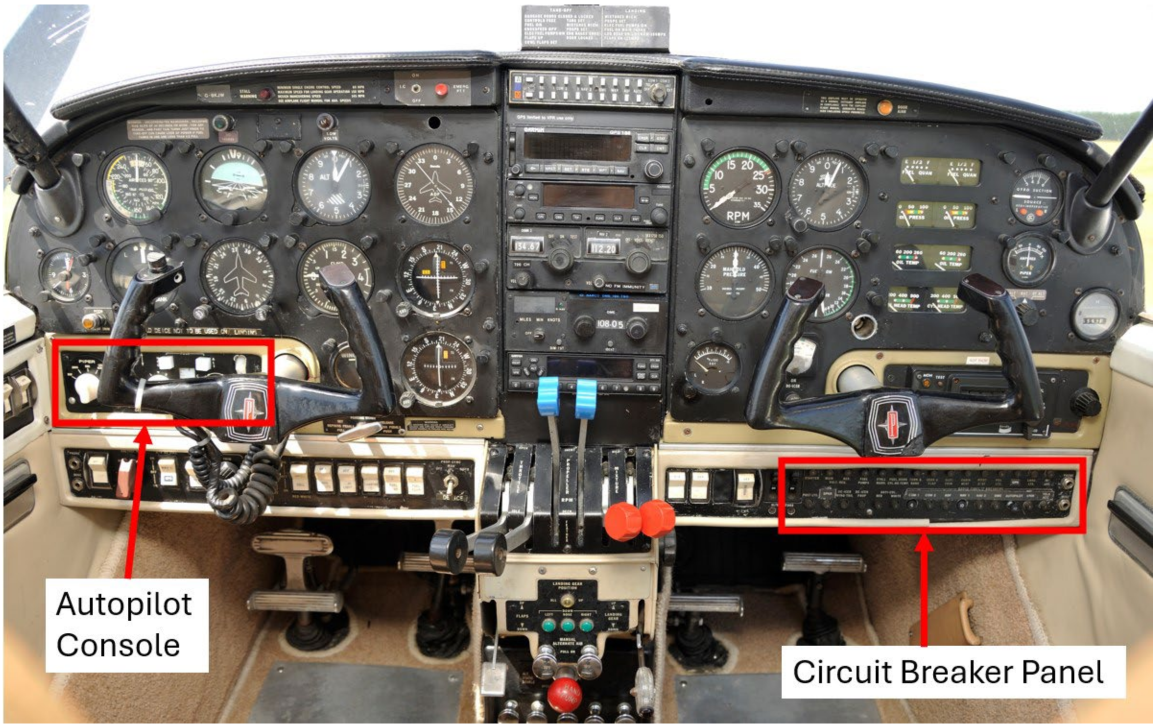

Figure 11

G-BKJW Instrument Panel (October 2020)
(Copyright Keith Wilson/SFB Photographic)

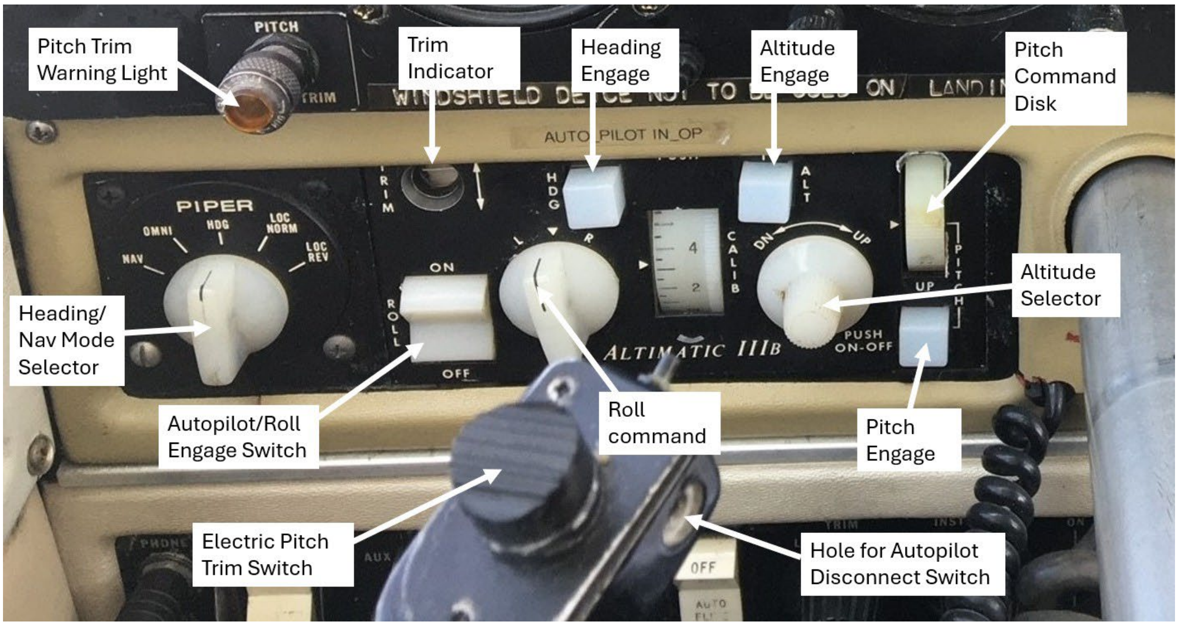

Figure 12

Altimatic IIIB Autopilot Console fitted to G-BKJW

Figure 13 depicts the autopilot disconnect switch fitted to a different PA-23-250 that also had an Altimatic IIIB autopilot. The electric pitch trim switch and the autopilot disconnect switch depicted in this figure are the same type as shown in the Piper Altimatic IIIB Operating Instructions[2]. There is a Piper approved kit[3] to replace the type of pitch trim switch in this figure with the type of pitch trim switch fitted to G-BKJW but it does not mention the autopilot disconnect switch. The trim switch in Figure 13 was subject to a Service Bulletin as it was known to stick. However, the aircraft manufacturer was not aware of issues with the newer type fitted to G-BKJW.

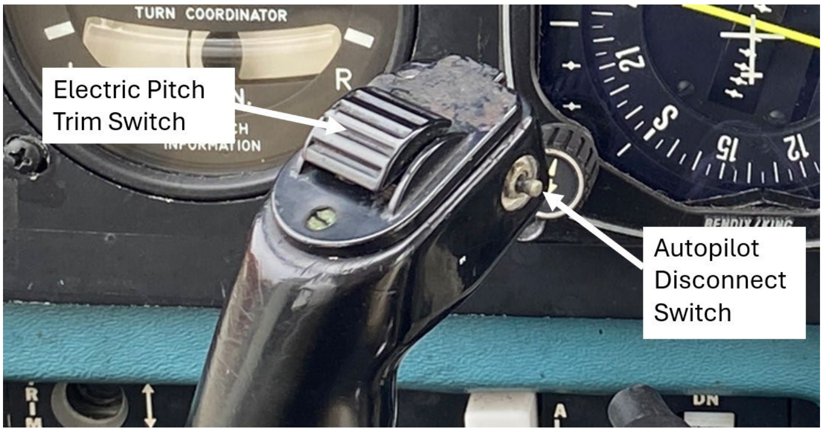

Figure 13

Pitch trim switch and Autopilot Disconnect Switch in another PA-23-250 aircraft fitted with an Altimatic IIIB autopilot

Footnote

2 Piper Altimatic IIIB Operating Instructions, part number 753 781, issued 1968.
3 Piper part number 761 039 KIT – Electric trim switch replacement.

In roll mode, only the roll servo is engaged, which operates the cables connected to the ailerons. In pitch mode both the pitch servo and pitch trim servo are engaged, which operate the cables connected to the stabilator and the pitch trim drum respectively. 'Engagement' means that a solenoid in the servo is receiving power and has engaged the motor to the servo capstan. The servos have internal clutches that allow the control cables to move if the servo were to jam, or if the pilot needed to oppose the autopilot's inputs. The Altimatic IIIB Operating Instructions state that '*approximately nine to fifteen pounds of pressure on the control wheel should override both the roll and pitch functions….[and] it should be checked prior to each flight.*'

Electric pitch trim operation

The electric pitch trim has two modes of operation: (1) manual via the switch on the control yoke when the autopilot is off and (2) automatic when the autopilot is on.

Manual pitch trim mode

In manual mode moving the pitch trim switch forward commands 'aircraft nose-down' pitch trim tab deflection, and moving it aft commands 'aircraft nose-up' pitch trim tab deflection. The switch contains movable and stationary contacts that are connected to four wires: red live, black earth, and a pair of white and green wires which are connected to the pitch trim servo motor and solenoid. When the switch is moved forwards the live wire is connected to the green wire and the earth is connected to the white wire, completing a circuit and causing the solenoid to engage and the motor to be driven in the nose-down direction. The opposite occurs when the switch is moved aft.

A pitch trim runaway is a situation where the electric trim runs nose-down or nose-up uncommanded. With the autopilot turned off, two independent short circuits would be required to cause a trim runaway: the green wire needs to short to live and the white wire needs to short to earth, or vice versa. A single short would not cause the trim to run uncommanded; if only a single wire were either shorted to live or earth then operation of the trim switch in one of the two directions would cause the live to be connected to earth which would trip the electric trim circuit breaker and stop trim movement.

If the autopilot is engaged in pitch mode, moving the pitch trim switch has no effect and does not disengage the autopilot.

Automatic pitch trim mode

When the autopilot is engaged in pitch mode, the pitch trim operates in automatic mode, automatically moving the pitch trim when it senses that the stabilator cables are under tension. This is to ensure that when the pilot disengages the autopilot the aircraft does not suddenly pitch up or down. The stabilator control cables run through a mechanical pitch trim sensor which senses differential cable tension (Figure 14). When there is more tension on one cable than the other, due to an out-of-trim condition, the trim sensor moves sideways and mechanically actuates a set of electrical contacts which send a signal to the pitch trim servo motor (via a trim amplifier) to operate the trim in the direction that will relieve the tension.

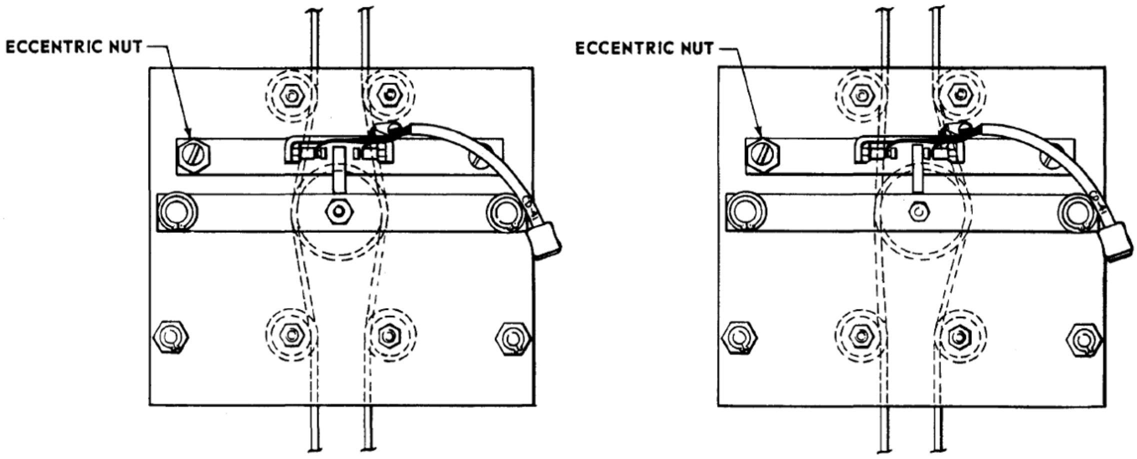

Figure 14

Pitch trim sensor (© Piper Aircraft)

A single fault in the pitch trim sensor, for example the sensor sticking to one side, could cause a pitch trim runaway.

A pitch trim warning system was fitted to G-BKJW. It is not known if it was functional, but the system is active when the autopilot is on in pitch mode. The system consists of an amber warning light on the instrument panel above the Autopilot Console and an electronic timing device that detects the duration of pitch trim servo operation. If the servo operates continuously for more than 3 to 4 seconds then the pitch trim warning light is illuminated. When the sensor contacts open, even momentarily, the electronic timer resets and the warning light goes out. There is no aural tone associated with the pitch trim warning. The system is tested by pressing and holding the light, and the light should illuminate after 3 to 4 seconds.

Electric trim malfunction checklist

The Aztec E Pilot's Operating Manual[4] contains the following Emergency Procedures for the Altimatic IIIB. For a malfunction of the Roll or Pitch modes it states to push the Roll engage switch OFF or push the Autopilot OFF button on the control wheel. It states that the '*Pitch Trim Section may be overpowered manually. In the event of a malfunction in the Pitch Trim Section, pull the Pitch Trim circuit breaker.*'

Footnote

4 The Piper Aztec E Pilot's Operating Manual, part number 761-455, revision 19 December 1990. This document includes the Airplane Flight Manual for Aztec E, serial numbers 27-4426, 27-4574 through 27-7554168.

The separate 'Altimatic IIIB Operating Instructions' document contains the following procedure for a malfunction of the Automatic Pitch Trim System:

a. *'Place the aircraft's trim indicator in approximately correct position by overriding Trim Servo through the use of trim crank or wheel.*

b. *Depress the control wheel button to disengage the Autopilot. Be sure to have manual control of the control wheel.*

c. *Correct trim by hand.*

d. *Pull out Trim Circuit Breaker, check to make certain correct breaker was opened by employing the trim switch on pilot's control wheel. If trim can be activated it would indicate incorrect breaker was opened.*

e. *With Trim Circuit Breaker opened, Altimatic IIIB can be reengaged, however, it will now be necessary to set trim by hand for any altitude changes.'*

The document does not contain a procedure for a malfunction of the manual electric pitch trim system.

Circuit breaker panel

The circuit breaker panel was located on the lower right side of the instrument panel, beneath the right control yoke. Figure 15 shows a pre-accident photo of the circuit breaker panel on G-BKJW, with the location of the electric trim and autopilot circuit breakers highlighted. The maintenance organisation stated that the circuit breakers had been re-labelled during the aircraft's annual inspection with black text on yellow tape to make them clearer, but no photos of this change were available. The circuit breakers automatically open when an overload occurs on the electrical circuit it protects. The circuit breakers can also be manually pulled out to isolate a circuit and manually pushed in to reset it.

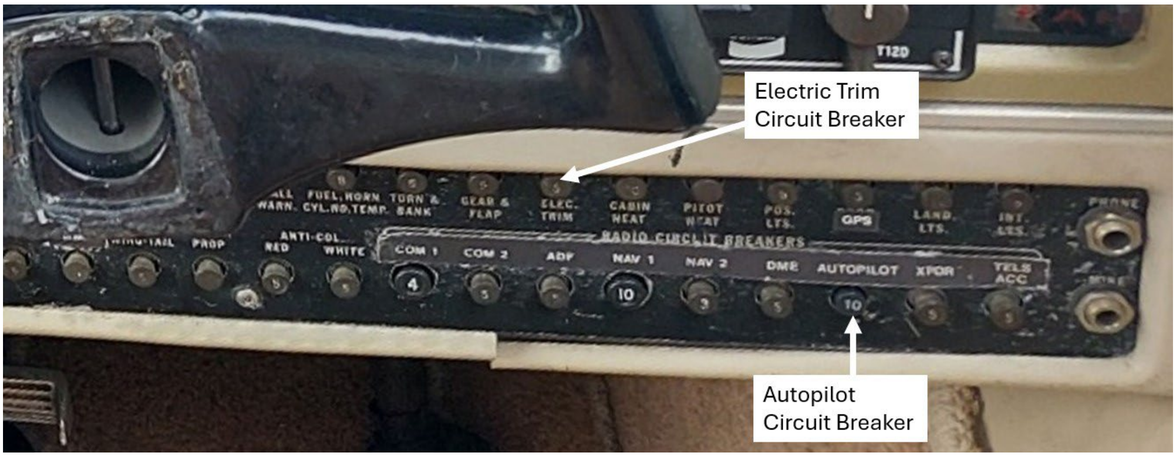

Figure 15

Location of electric trim and autopilot circuit breakers (G-BKJW pre-accident photo)

The autopilot circuit breaker is labelled '10' meaning 10 Amp. According to the circuit load chart in the PA-23-250 Service Manual[5] the Altimatic IIIB should have a 5 Amp circuit breaker. This difference indicates that other equipment may have been added to the circuit since original manufacture.

Seat belts

Each seat was equipped with standard aircraft lap straps secured to either side of the seat – one strap with a metal buckle and one strap with a metal tongue. The strap is fastened by slotting the tongue into the buckle which is held in place by a spring and metal tab within the buckle. The strap is unfastened by lifting the buckle lever which twists the spring and disengages the metal tab from the tongue. The force required to lift the buckle lever and unfasten the strap in normal use is considerably less than when the straps are under load, such as during an impact. The front two seats were also each supplied with an inertial reel shoulder strap. Once the lap strap was secured, the shoulder strap could be pulled out from the reel and attached to a circular hook on the base of the metal tongue from the lap strap.

Fuel

The aircraft had four fuel tanks, two in each wing. Each tank had a capacity of 36 USG with a total capacity of 144 USG (545 Litres), of which 4 USG was unusable. There was a fuel selector for each wing in the cockpit with selections for inner tank, outer tank and off. For flight planning, a fuel consumption of 100 litres/hour was reportedly used. Using this fuel burn rate, fuel uplifts and estimated flight times, the fuel remaining at the time of the accident was estimated to be about 290 litres.

Stall speed

The aircraft's calibrated stall speed at maximum takeoff weight was 64 kt (74 mph) with gear and flaps up, and 59 kt (68 mph) with gear and flaps down. At the aircraft's estimated accident weight of about 3,900 lb (see section Weight and balance) the stall speed was 56 kt (65 mph) with gear and flaps up, and 52 kt (60 mph) with gear and flaps down.

Maintenance history

The last recorded maintenance on the aircraft was an annual inspection which was carried out at Bagby between 7 February 2023 and 26 May 2023. The work involved routine maintenance as well as replacing flexible hoses, repairing both exhaust systems, overhauling all four magnetos, fuel bowl upgrades, replacing all tyres, and other rectification work. No maintenance on the autopilot or electric trim system was recorded.

The licensed aircraft engineer responsible for the annual inspection stated that the inspections would have included running the electric trim to check it worked and would have included examining all the control cables and pulleys. He also thought that the electric trim would have been tested during the post maintenance 'air test'. He did not know why

Footnote

5 Piper Aztec Service Manual PA-23-250, part number 753-564, 31 July 2021.

the autopilot was placarded INOP and said that it was already placarded when the aircraft was bought. He said that the autopilot circuit breaker was not pulled and isolated because he thought it was needed either to run the electric trim or to power the intercom or a radio.

The CAA had conducted an audit of the maintenance organisation nine days before the accident resulting in two non-conformance level 2 findings[6]. Following the accident to G-BKJW the CAA carried out a survey of the maintenance organisation. They found discrepancies in the maintenance of three aircraft by the maintenance organisation, which included G-BKJW. The findings included evidence that some Airworthiness Directives (AD's) had not been complied with on G-BKJW. The survey findings resulted in the CAA provisionally suspending the maintenance organisation's approvals. The CAA investigation is ongoing.

Maintenance by previous organisations

The aircraft had been maintained by a different maintenance organisation from the late 1980s until January 2020. Worksheets from this organisation were available dating back to 1993. No autopilot or electric trim rectification work was detailed in the worksheets apart from a replacement of the attitude indicator in 2000 which was part of the autopilot system. The last time the autopilot was recorded as operating satisfactorily was in December 2011. In a worksheet from January 2012 the autopilot was recorded as being inoperative and placarded as such. A worksheet from March 2019 stated of the autopilot: '*Roll servo not engaging. Radio couple extremely stiff. Autopilot placarded INOP at customer's request.*'

The previous two co-owners of the aircraft had intended to use a different maintenance organisation to carry out an annual inspection of G-BKJW at the end of 2020. One of the co-owners had sent this maintenance organisation a list of defects which included '*Autopilot ALT dial sticks below 4000 ft*', but he told the AAIB that the autopilot was not used. The other co-owner stated that the autopilot did not work well and that it had issues with height hold. He stated that he might use it for a couple of minutes, but it was "not good". He also stated that he had had issues using the electric trim so had stopped using it. He recalled one occasion when trying to troubleshoot the autopilot height function that the trim moved further than would be normal. He could not recall if the autopilot was on or off when this happened. He said it was easily controlled, and he did not consider grounding the aircraft for rectification, but that he intended to have it checked at the next annual inspection.

The engineer who had been approached to carry out the annual inspection informed the AAIB that he had been told by one of the co-owners, as part of the pre-maintenance discussions, that the aircraft had had a trim runaway. As a result, the engineer had been intending to strip and inspect the complete trim tab system; however, this work was never started, because it was decided to sell the aircraft due to the high estimated cost of the annual inspection. The engineer added that, after the accident to G-BKJW, he had spoken to the same person again, who said that his earlier comments had been misinterpreted and

Footnote

6 A level 2 finding is any non-compliance with Part-CAO requirements which may lower the safety standards and possibly hazard flight safety. Part-CAO is a combined Maintenance and Airworthiness Management Organisation Approval for General Aviation Aircraft.

that he had experienced a 'trim overrun' rather than a 'trim runaway'. This information was not recorded in the aircraft paperwork and the engineer working on behalf of the purchasers preparing the aircraft to obtain a Permit to Fly for the ferry flight to Bagby stated that he was not made aware of it.

Information about G-BKJW after the annual inspection in May 2023

One of the owners of the maintenance organisation at Bagby that carried out the last annual inspection said that while the autopilot was placarded INOP he believed the heading function still worked, but that if altitude hold was engaged the aircraft would pitch up or down.

The AAIB interviewed the pilot who flew G-BKJW when it came out from the annual inspection. He had not flown a PA-23 before and had not undertaken differences training with an instructor, as he was not aware of the requirement and did not consider it necessary. He instead self-briefed by reading the Pilot's Operating Manual and speaking to another pilot who had flown the type. He said he used the electric pitch trim and had no issues with it. He tried using the autopilot and got it to follow heading and hold altitude, but he did not use it much. In terms of a pre-flight check he recalled checking the autopilot and seeing the yoke move, but as the autopilot was INOP "it wasn't really part of a pre-flight check". He recalled there being a circuit breaker to pull if there was an issue, but he could not recall if there were separate autopilot and electric trim circuit breakers.

The AAIB also spoke to another pilot who had flown G-BKJW four or five times after the annual inspection. He said that he always used the electric trim in flight and did not experience any issues with it, and that he only used the manual trim wheel on the ground. He used the autopilot in heading mode, but when he tried the altitude hold mode the aircraft started climbing so he did not use the vertical modes. As part of his pre-flight checks he actuated the electric trim and checked the trim had moved by looking on the overhead trim indicator. He did not carry out any pre-flight checks on the autopilot. He was aware of an autopilot circuit breaker but not an electric trim circuit breaker.

Maintenance requirements

The aircraft's maintenance programme stated that it was being maintained in accordance with a Minimum Inspection Programme (MIP) complying with Part-ML.A.302(d)[7]. The programme did not list any autopilot related maintenance. For the annual inspection there was an operational check under *'Flying controls'* for '*primary/secondary flight controls and trim systems for full and free movement in the correct sense'*, a check of control cables for correct tension, and inspections for push-pull rods, bell cranks, control cables and pulleys, and an inspection item called *'pitch trim motors'*. The CAA stated that the maintenance programme should have included a number of additional inspections that are detailed in the Piper PA-23-250 Service Manual[8]. These included a 100-hour inspection of the Piper Altimatic III Autopilot which involved checks of servo bridle cables and servo clutch override tests.

Footnote

7 CAA Part-ML details the airworthiness requirements for 'Light Aircraft'.
8 Piper Aztec Service Manual PA-23-250, part number 753-564, 31 July 2021.

The PA-23-250 Service Manual also lists an inspection to be carried out at every 50 and 100 hour check which states:

> *'If installed, check operation of Autopilot, including automatic pitch trim, and manual electric trim (See Note 13).' Where 'Note 13' states: 'Refer to Airplane Flight Manual or Pilot's Operating Handbook for pre-flight and flight check lists.'*

The Airplane Flight Manual, in its supplement for the Altimatic IIIB, includes operational ground checks of the autopilot and checking that the autopilot can be disengaged. It refers to actuating the electric pitch trim and doing a press-to-test of the pitch trim warning light. It does not refer to checking the servo clutch override, but this is referred to in the previously mentioned *'Piper Altimatic IIIB Operating Instructions'* which state that the ability to override the autopilot's control should be checked prior to each flight[9].

Aircraft wreckage examination

The aircraft wreckage was recovered to the AAIB's facility at Farnborough for a detailed examination. The fuselage and cockpit were severely damaged from the impact and the post-impact fire, both of which resulted in a significant loss of evidence.

Engines and propellers

The right propeller had detached from its engine and was embedded in the right engine impact crater, while the left propeller had remained attached to its engine. Both propellers had suffered similar levels of bending and leading-edge damage consistent with rotation at impact. The wings-level steep nose-down trajectory seen in the CCTV video was not consistent with a single or dual engine power loss, so engine teardown inspections were not carried out. However, there were no external indications of mechanical failure and the oil filters on both engines were clear of debris.

Flight controls

The control cables between the control yoke assembly in the cockpit and the stabilator control arm (balance arm) were intact and attached. The stabilator moved up and down freely when the cables were actuated. There were no foreign objects in the tail assembly, or any obvious damage in the tail area to indicate a control jam of the stabilator.

The pitch trim tab moved freely and in the correct direction (opposite to the direction of the stabilator) when the stabilator was moved up and down, in its function as an anti-servo tab. The pitch trim tab actuating arm was connected to a rod that was actuated by the cable-operated pitch trim drum. The pitch drum translates up or down when the cable is pulled one way or the other. The drum was found to be in position 3 mm from full drum up, which corresponded to 3 mm from full nose-down trim position (Figure 16). The full range of travel was 13 mm and so it was 10 mm away from full nose-up position. The drum moved freely when the cable was pulled in either direction. It was possible that post-impact break-up forces applied some unequal pressure to the cable causing the pitch trim drum to move.

Footnote

9 The aircraft manufacturer was not aware as to why the clutch override pre-flight check was in the *'Piper Altimatic IIIB Operating Instructions'* but not in the Airplane Flight Manual.

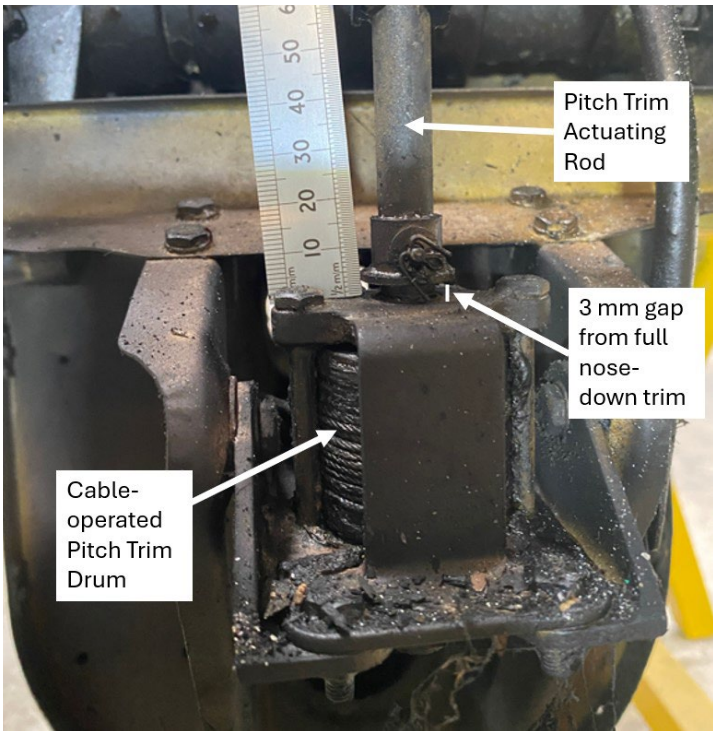

Figure 16
Position of pitch trim drum post-accident

The pitch trim cable was found to be continuous between the pitch trim drum and the trim handle in the cockpit. Attempts were made to check the rigging of the trim tab, with the stabilator in the neutral position, but the tab was warped from the fire and no longer had a flat surface for accurate angular measurement.

Flaps

The flap actuator ram had separated from the flap actuator cylinder due to impact forces and fire damage (Figure 17). Once the ram is detached the flaps are free to move and so it was not possible to determine the flap position at impact. The flap actuating components, including the bell crank, flap push-pull rods, torque tube and the torque tube supporting bearing blocks, had suffered multiple failures. These components, including the actuator ram, were sent to a metallurgical lab for detailed forensic examination. The forensic organisation concluded that all the fractures were the result of overload, and that there was no evidence of any progressive crack growth such as fatigue. They also concluded that:

> *'The overload failure and deformation observed in the flap actuator ram and flap actuator ram rod end is not considered to be consistent with overload which may have occurred if the flaps had been extended while the aircraft was above the maximum permissible speed for flap deployment. If this had occurred, it would be expected that the flap actuator ram would have been in tension, which is not consistent with the degree of deformation/bending observed. This suggests that the failure of the flap actuator ram and rod end was the result of the aircraft impacting the ground.'*

Figure 17

Remains of flap actuator cylinder (left) and flap actuator ram (right)

The bell crank was found to have separated from the torque tube due to overload, but the weld joining these two parts exhibited some degree of lack of fusion between the weld and the tube. It was considered that the lack of fusion was most likely due to poor welding technique, but the forensic organisation concluded that:

> *'Even though the weld was not particularly good on the outboard edge, it may still have been sufficient for the expected in service loads. There was no evidence of any fatigue cracking present in the weld, which would suggest that at the time of the accident, the lack of fusion had not resulted in any problems with normal in-service loading for the life of the aircraft.'*

In addition, deformation of the bellcrank and witness marks on its inboard and outboard faces were considered to be most likely caused when the aircraft struck the ground.

The aluminium flap torque tube had burnt through its centre, so it could not be determined if it was intact prior to impact, but an in-flight failure of the torque tube with flaps extended would have caused the left flap to retract while the right flap remained extended; this would have caused the aircraft to roll left which was not seen in the CCTV video.

Autopilot and electric trim

The autopilot and electric trim components were examined with the assistance of an avionics engineer familiar with the autopilot system. The Autopilot Console had suffered significant impact and fire damage (Figure 18). As the Roll ON/OFF switch was a magnetically-held-on switch, the loss of electrical power at impact would have released it so it was not possible to determine if the autopilot was turned on at the time of impact. There were no tungsten filament remains from the lights inside the HDG, ALT or Pitch ON/OFF buttons, so it could not be determined if these lights had been on at impact. The circuit breaker panel was destroyed with multiple loose circuit breakers so it could not be determined if the autopilot or electric pitch trim circuit breakers were in or out.

The left horn of the left control yoke had detached (Figure 19) and the electric pitch trim wires were broken, and their insulation had vapourised in the fire. The hole for the autopilot disengage switch was empty and an internal examination of the horn did not reveal a switch (this switch was also missing in the instrument panel photo that was taken in October 2020 – Figure 11). A detailed examination of the electric pitch trim switch did not reveal any anomalies. Some of the contact arms were bent but there was no evidence of contact welding.

Figure 18
Remains of Autopilot Console (lower image)

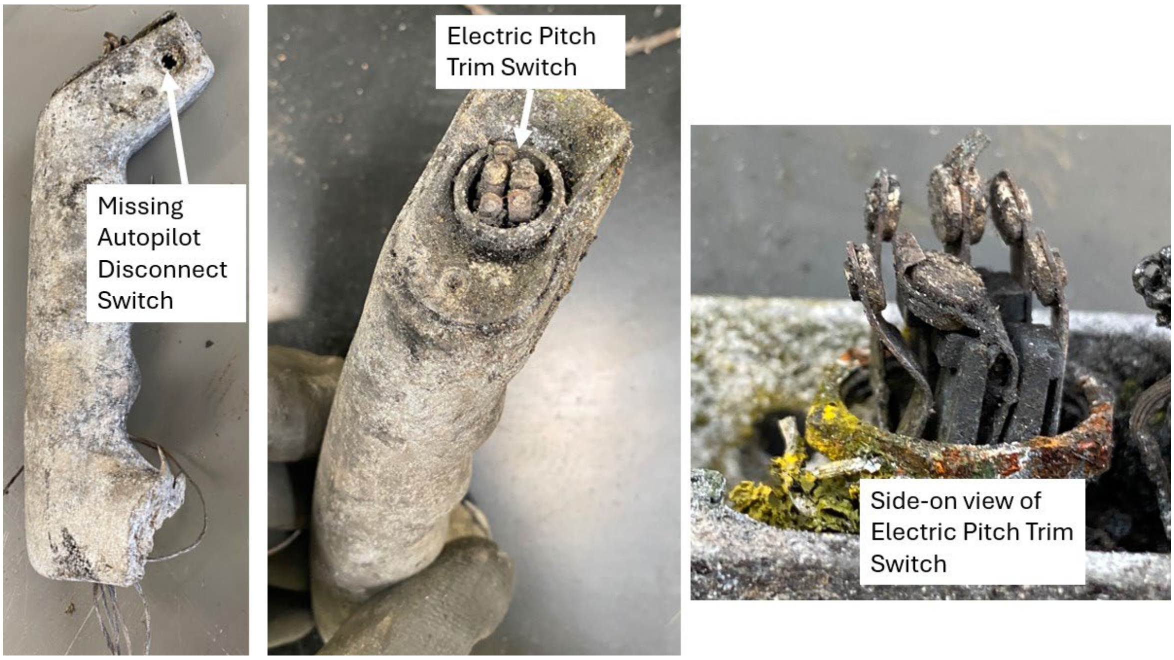

Figure 19

Detached left horn of left control yoke with exposed electric pitch trim switch

The section of instrument panel containing the pitch trim warning light had separated from the cockpit. Most of the instruments had detached from it as had the pitch trim warning light bulb.

The pitch trim servo was destroyed with just molten globules remaining of its casing. The motor and gears had separated, but the pitch trim servo cables were securely connected to the pitch trim cables. The capstan and gear part of the pitch servo was intact with some deformation of components, but the motor and solenoid had detached; the heat that it had been exposed to meant that any measurements of clutch friction would not be reliable. The part number and serial number of the pitch servo were visible and corresponded to the numbers in the aircraft manufacturer's build record, which meant that it was the same servo that was installed in the aircraft when it was new in 1971. The pitch servo cables were connected to the stabilator control cables.

The stabilator control cables had separated from the pitch trim sensor (Figure 20). The central pulley could be moved sideways and contact could be made with each of the electrical contacts on its reverse side. There was some resistance to movement when moving it side to side, but this could have been the result of fire and impact damage, with the panel being slightly bent. The damage meant that it was not possible to determine if the sensor may have stuck in one position.

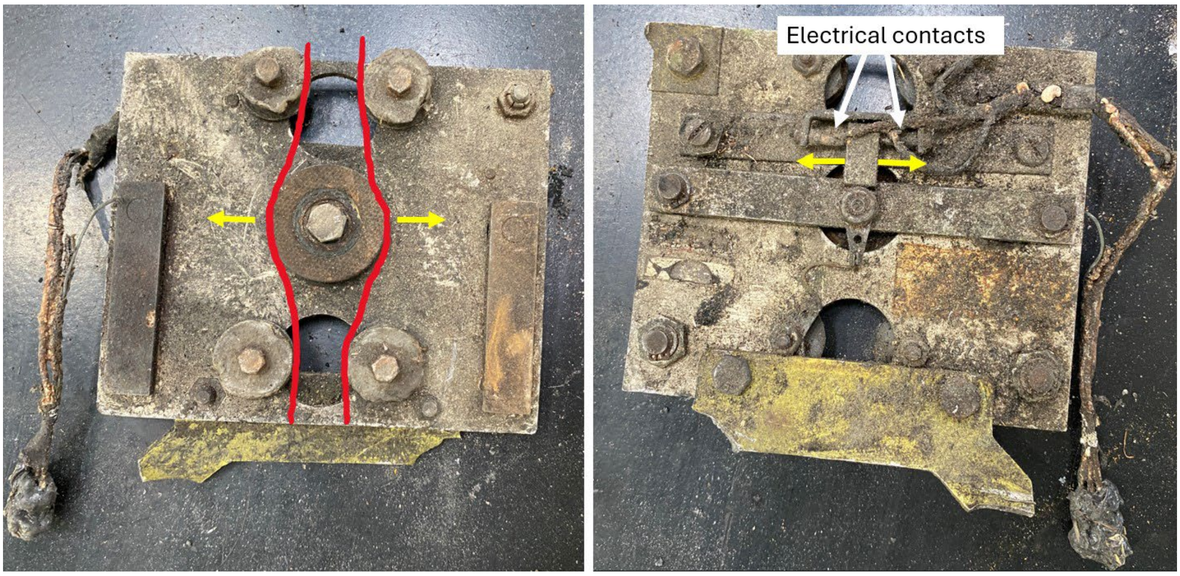

Figure 20

Pitch trim sensor (red lines show path of stabilator control cables)

The autopilot amplifier[10] was destroyed and could not be tested. Some transistors were loose while others were still attached to the heatsink. A short circuit in a transistor can cause a trim runaway but tests of the transistors were inconclusive due to the fire and impact damage.

Seat belts

All the seats had separated from the floor structure, and some were thrown clear of the main wreckage, including the front left pilot seat, which was identified by matching the damage at its base with the damage of the left front seat support structure. The left lap strap, with its buckle, was still securely attached to the left side of this seat. The right lap strap was also securely attached to the right side of the seat, but the strap had burnt through and was missing the part of the strap with the tongue that would be inserted into the buckle (Figure 21). A detached right lap strap was found with a tongue that had a circular hook designed to attach a front seat shoulder harness; however, it could not be determined if this was from the front left or front right seat. Both front seat shoulder harnesses and inertial reels were severely fire damaged.

The lap strap remains shown in Figure 21 were taken to a forensic investigation organisation for detailed examination to determine if there was any evidence that they may have been in use at the time of impact but subsequently came undone. They concluded, based on visual and microscope examinations, that it was likely that the left pilot's seat buckle and the strap with tongue were not in use at the time of impact.

Footnote

[10] The amplifier is an analogue computer that interfaces between the controls, sensors and servos.

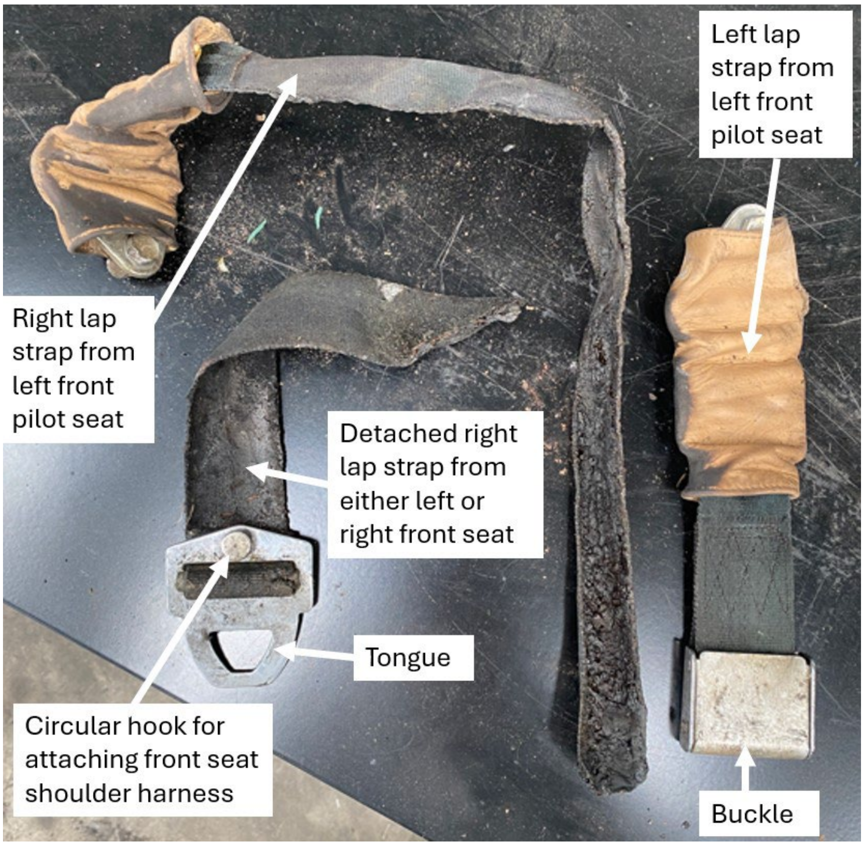

Figure 21

Lap strap remains from left front pilot seat (after removing the bolts attaching them to the seat) and tongue strap from either the left or right front seat

Aircraft documents in the wreckage

Aircraft documents were found at the accident site that were unaffected or only minimally affected by fire. These included the aircraft's Certificate of Airworthiness, Airworthiness Review Certificate, and the aircraft's Flight Manual with the aircraft's registration and CAA stamp. There was also a loose-leaf A4 print-out of the Piper Altimatic IIIB-1 Operating Instructions which had some differences to the Piper Altimatic IIIB Operating Instructions (a IIIB was fitted to G-BKJW). No technical log or paper checklist was found.

Weight and balance

The aircraft's basic weight was 3,317 lb and the pilot's weight was 160 lb. The cabin contents were sufficiently lightweight and their pre-impact locations unknown so they were not included in estimating the weight and balance. The usable fuel remaining at the time of the accident was estimated to be about 290 litres, weighing 460 lb. This gave a total weight of 3,937 lb (under the maximum takeoff weight of 5,200 lb) and a centre of gravity (CG) location of 93.1 inches, placing it slightly forward of a mid CG range.

Meteorology

On the day of the accident, there was an area of low pressure centred to the west of Ireland, extending a south-westerly flow across the UK with a slack pressure pattern over northern France. Frontal systems associated with the low pressure were affecting the west of Ireland and moving across Ireland during the afternoon.

Forecast conditions issued prior to the pilot's departure from Bagby were for good flying conditions for the flight from Bagby to Deauville, ahead of the frontal activity, with good visibility and high cloud bases. The forecast indicated the aircraft would start to enter the frontal zone with thickening and lowering cloud bases and outbreaks of light rain as it progressed west across south-west Wales. As the flight progressed further west towards Abbeyshrule the forecast included occasional visibility reductions to 6 km in rain becoming increasingly widespread near the warm front, with broken or overcast cloud between 1,500 to 3,000 ft. Additionally, the low-level significant weather chart forecast a risk of isolated heavy rain or thunderstorms, reducing visibility to 3,000 m and embedded cumulonimbus cloud with bases around 1,500 to 2,500 ft. Occasional or widespread low-level cloud between 600 to 1,200 ft was also forecast near coasts, lowering to 300 ft within the warm sector. The forecast for the onward flight to Navan airfield would have taken place under similar forecast conditions.

Recorded actual weather conditions were not available for either Abbeyshrule or Navan. Reports were obtained from an automatic weather station at Mulingar, located approximately 5 nm east-southeast of Abbeyshrule. During the period of 1500 to 1900 hrs the wind was reported as being generally southerly at 5 to 8 kt, with broken or overcast cloud initially at 1,000 to 1,200 ft, lowering to 500 ft by 1900 hrs. A witness at Navan described the weather while G-BKJW had been there as being 'not great' with overcast cloud, rain and a visibility of 8km.

Reports for Dublin, approximately 22 nm south-east of Navan, were obtained. During the time that the aircraft was at Navan, Dublin was reporting moderate south-easterly winds of between 12 to 17 kt, greater than 10 km visibility in light rain, with a cloud base initially broken at 2,200 ft, which then lowered to between 1,300 to 1,400 ft with a few patches at 700 ft.

An aftercast obtained from the Meteorological Office stated that the aircraft's final leg from Navan back to Bagby would have been mainly within the frontal zone, with thick layered cloud and a risk of embedded cumulonimbus activity. The photograph sent by the pilot shows the aircraft flying between two layers of broken cloud, although it is not known at what point on the route it was taken.

The flight would have cleared the frontal activity over the North Yorkshire Moors with observations from RAF Topcliffe (located 3 nm west of Bagby airfield) at 1850 hrs, just after the accident occurred, indicating that, even though light rain was present, visibility remained above 10 km, with southerly winds at 10 kt, and a broken cloud base of 5,100 ft. The reported temperature was 19°C with a forecast freezing level of between 6,000 to 8,000 ft.

Visual Flight Rules (VFR)

The flight was conducted under VFR. While flying below FL100 this is defined as requiring a minimum of 5 km flight visibility, 1,500 m horizontal separation from cloud and 1,000 ft vertical separation from cloud. Outside controlled airspace for fixed wing aircraft when flying at or below 3,000 ft and below 140 kt, this is reduced to 1,500 m visibility, remaining clear of cloud and in sight of the surface.

Airfield information

Bagby is an unlicensed airfield with a 690 m long grass runway (06/24). The airfield elevation is 160 ft amsl. It has an Air/Ground radio operator for passing airfield information to arriving and departing aircraft.

Organisational information

The aircraft was owned by an Irish business, specifically set up to purchase and operate the aircraft on behalf of its four directors, and was based at Abbeyshrule airfield, Ireland. The purchase was organised by a brokerage company, based in Ireland, one of the two directors of which was also a director of the maintenance company at Bagby which had conducted the post-purchase maintenance work on the aircraft.

The aircraft owners were involved in the horse racing industry and had no knowledge of operating aircraft. It has not been possible to confirm the exact arrangements under which the aircraft was operated, but a commercial pilot had advised and assisted in the insurance, hangarage and refuelling arrangements. Other authorities are investigating the financial arrangements in place for the provision of pilots to operate the aircraft. Evidence exists that the flights conducted by the pilot of G-BKJW on 6 July 2023 had already been offered to another private pilot with little twin-engine experience, and no experience on a PA-23, in return for payment. This pilot had turned the offer down.

None of the passengers on board the aircraft from Deauville to Abbeyshrule had paid for the flight. As such, it was considered a private flight, although any pilot being paid to conduct the flight would have needed to hold a commercial pilot's licence to receive payment.

Ongoing maintenance of G-BKJW was intended to be carried out by the same maintenance organisation that had conducted the annual maintenance inspection at Bagby airfield.

Pilot background

The pilot had started flying gliders in 2014 at the age of 12. He commenced training for a Private Pilot's Licence (PPL) in 2018, later being awarded a flying training scholarship and gaining his licence in October 2019. The pilot had then begun building his flying hours, mainly on the single-engined Piper PA-38 Tomahawk, which included buying blocks of hours from a company based at Bagby airfield, as well as some time flying in Ireland.

From 31 July 2021 onwards, the pilot's logbook listed a significant number of flights being flown, some of which were recorded as being on behalf of the maintenance organisation at Bagby and the aircraft brokerage company in Ireland involved with the purchase of G-BKJW. These flights included delivery flights, including one to Poland, and flights recorded in his logbook as demonstration flights. During this time the pilot had been working as a contractor for the maintenance company in various roles, including IT, technical and secretarial work, although the company stated that they never paid contractors or staff for flying services. They added that the pilot was able to fly aircraft in a flying group, that they provided maintenance for, at a discounted rate as a “perk of his position”. They also stated he was able to fly aircraft, owned by the brokerage company that were based at Bagby for sale, paying only for the fuel used.

In December 2022, the pilot completed a multi engine piston (MEP) rating. His logbook recorded this took seven flying hours, flown on a Cessna 310. Two months later, in February 2023, he started a CPL flying course, but before he was able to complete it the flying school went into administration. His last flight with the school was on 22 April 2023, at which time he had completed approximately 23 hours flying, including seven hours dual and one hour solo on the twin-engined Diamond DA42. He had needed to complete two further training flights and a successful test flight in order to have gained his CPL qualification. His training reports reflected he was a competent pilot.

The pilot returned to flying a variety of single engine aircraft based out of Bagby airfield while making arrangements to complete his CPL at a different flying school. At the time of the accident, he did not hold either a CPL or an instrument rating. He had a total of 4 hours 50 minutes instrument flying on a DA42 simulator and 6 hours 50 minutes instrument flying on single engine aircraft.

The two flying schools involved in the multi engine and CPL training reported that students were taught the basic functions of any autopilot fitted to the aircraft, but that the autopilots were not used during flight. They could not provide details on specific training given to students on what to do in the event of a trim runaway or autopilot malfunction.

The pilot’s logbook first records a flight on G-BKJW on 25 May 2023. This recorded a 15-minute flight from Bagby airfield as pilot in command. Three further flights on G-BKJW were recorded from Bagby on 26 May totalling 2 hours 20 minutes, again, with the pilot recorded as being the pilot in command. There was no record of what the purpose of the flights was.

Another pilot stated he had flown with the accident pilot on the flight in G-BKJW on 25 May and the first two flights on 26 May. He too had recorded that he was the pilot in command for the flights and added that he was in the left seat (as normally occupied by the pilot in command). His recorded total flight time for the three flights was 25 minutes less than that recorded by the accident pilot for the same flights.

None of the flights by the accident pilot in G-BKJW were recorded as training flights and there was no evidence of the pilot having received instruction from a qualified flying instructor on the PA-23.

The last entry in the logbook was on 2 June 2023, recording a flight on a Cessna 172. It is known from information provided by others that the pilot had, however, conducted other flights on G-BKJW after this date. This included a flight on 3 July 2023, three days before the accident, when the pilot flew the same five passengers from Abbeyshrule, where G-BKJW was based, to Deauville. He had then continued in the aircraft to Bagby airfield where it remained parked until the day of the accident.

Pathology

The pilot's medical history and post-mortem examination did not reveal any evidence of a natural disease or medical factor which may have caused a medical collapse or physical debilitation. This included a toxicology test which showed that the pilot had not been exposed to carbon monoxide.

There were no injuries associated with wearing a lap strap or shoulder harness, but these might have been obscured by other injuries. Therefore, the pathologist could not exclude the possibility of the straps having been worn. A passenger onboard for the flight from Deauville to Abbeyshrule reported that the pilot had been wearing a seat belt for that flight. However, the physical evidence from the pilot's lap strap examination indicated that it had probably not been worn at the time of the accident.

Survivability

The damage to the aircraft from the steep, high-energy, impact meant that surviving the accident was considered unlikely, irrespective of the lap strap and harness having been worn.

Tests and research

Flight trial

A flight trial was carried out using a PA-23-250 'E' model aircraft to obtain information about the pitch control forces that can be experienced in an out-of-trim situation, the ability to reach and pull the electric trim circuit breaker, and the aircraft's response to a sudden flap retraction. A qualified test pilot was used to fly the aircraft from the left seat and an experienced instructor on the type assisted from the right seat. After an initial familiarisation flight, the flight trial was carried out using two cameras strapped to the pilots' chests to record the control inputs, instruments and intercom audio. A portable g-meter and a data logger that recorded GPS position and attitude data were also installed. The aircraft was ballasted such that, during the mid portion of the flight, it was representative of G-BKJW's estimated final CG. The pilot used a portable stick force gauge to measure the control forces which had a maximum range of 30 daN[11] (67 lb).

Footnote

[11] Newton (N) is a measurement of force. daN is the unit of dekaNewton. 1daN = 10 N. 1daN is a force equivalent to that applied by a weight of mass 1.02 kg, or 2.25 lb.

The test aircraft was fitted with a different autopilot to the autopilot fitted to G-BKJW so no autopilot tests were carried out. However, the time to move the electric pitch trim full travel was measured at 38.4 seconds which compared with 38.5 seconds measured on a different PA-23-250 that was fitted with the same Altimatic IIIB autopilot as G-BKJW, so the trim movement timings used during the test were representative.

Control forces with 'as found' pitch trim position

The pitch trim drum was set on the ground to the same 3 mm position as found at the accident site. A mark was then placed alongside the pitch trim indicator in the cockpit – this position was called the 'as found' trim position. The aircraft was then flown at the minimum and maximum airspeeds that were determined from the CCTV video, 93 KIAS[12] and 130 KIAS, and also at a midrange speed of 112 KIAS, in the flaps up and ¼ flap configurations, and at lower maximum speeds at ½ flap and full flap so as not to exceed the flap limiting speeds (Table 1). During the test pilot's familiarisation flight he had established that the landing gear position had little effect on pitch trim position, except during gear transition, so all test points were flown landing gear up.

At each speed and flap configuration shown in Table 2 the electric trim was used to set the aircraft 'in trim'. When 'in trim' the pilot can release their hands from the control yoke and the aircraft will not pitch up or down in smooth air. The electric trim was then actuated in the nose-down direction until the trim indicator reached the marked 'as found' trim position. During this period the pilot held the control force required to maintain pitch attitude and altitude. The stick force gauge was then applied to the control yoke to measure the out-of-trim push force at the 'as found' trim position – these figures are recorded in daN and lb in Table 2. The electric trim was then actuated in the nose-up direction and the time to return to 'in trim' was measured. Ground tests had revealed that the trim operated at the same speed in both directions, so these figures are entered in Table 2 as the 'Time to 'as found' nose-down trim position' in seconds.

Footnote

12 KIAS is 'Knot Indicated Airspeed'. The aircraft's indicated airspeed was in mph and these were converted post-flight to kt.

Flap	Speed (KIAS)	Time to 'as found' nose-down trim position (sec)	Out-of-trim force (daN)	Out-of-trim force (lb)
UP	93	22	29	65
	112	22	30	67
	130	17	30+	67+
1/4 Flap	93	20	25	56
	112	15	28	63
	130	12	30	67
1/2 Flap	93	11	14	31
	112	8	16	36
Full Flap	93	10	11	25
	109	10	10	22

Table 2

Using electric trim, the time from in-trim to the ‘as found’ trim position and the resultant out-of-trim force at the yoke for different airspeeds and flap configurations with power for level flight (the ‘+’ symbol indicates that the force exceeded the gauge limit of 30 daN)

It was noted during ground tests that the trim indicator only moved through part of the indicated range from full nose-up to full nose-down. As the range of movement was limited the trim could not be said to have been set precisely to the ‘as found’ trim position each time.

As well as revealing the high control forces that could be expected following a trim runaway, the results also showed that in none of the flap configurations or airspeeds, was the ‘as found’ trim position an ‘in-trim’ position. It was closest to in-trim at ½ flap and 112 KIAS, with 8 seconds of trim travel.

Aircraft response to sudden release of controls when out-of-trim

Tests were also carried out to look at the aircraft’s response when a small amount of nose-down trim was applied, while holding the controls, and then suddenly releasing the controls. This simulates the situation where a trim runaway has started while the autopilot is engaged which initially masks the runaway by compensating with the pitch servo, until the pitch servo clutch slips. The duration of the trim inputs were limited so as not to risk exceeding aircraft limits. In the flaps up configuration at 130 KIAS after applying a 5 second nose-down trim input and releasing the controls the minimum g reached was 0.5 g and the nose dropped 5 degrees. At 87 KIAS with full flap, after applying a 10 second nose-down trim input and releasing the controls, the minimum g reached was 0.2 g and the nose dropped to -12° nose-down.

Visibility of, and ease of reach to, the electric trim circuit breaker

The electric trim circuit breaker was in the same location on the test aircraft as on G-BKJW. The test pilot, who was 1.68 m tall, stated that the circuit breaker was difficult to identify, because it was not visible from a normal seating position (Figure 22); he had to lean to see it and reach it. He found that it was not possible to hold any control force on the control yoke while simultaneously reaching for and pulling the electric trim circuit breaker. Another pilot, 1.88 m tall, sat in the left seat, also had to lean to reach the electric trim circuit breaker. The height of the accident pilot was 1.83 m.

Figure 22

View of location of Electric Trim Circuit Breaker from the left pilot's seat head position in test aircraft – same location as on G-BKJW. Control yoke is being held in a normal in-flight position.

The test pilot considered that it was very unlikely that a pilot in a trim runaway event, under the circumstances described in this accident, would have sufficient time or capacity to find and pull the electric trim circuit breaker. And combined with the high control forces that can be experienced he did not think the aircraft would meet the current requirements for trim runaway in CS 23.677 (see next section on certification requirements).

Effect of lapstrap being undone

The test pilot assessed whether having the lap strap undone would have affected his ability to pull high control forces. He reported that all the force he was pulling on the yoke was reacted through his feet on the rudder pedals and that there was no load on his lap strap. He stated, however, that having the lap strap undone could have had an impact on the pilot's ability to control the aircraft if the aircraft had gone to zero g or negative g.

Flap retraction tests

Extending the flaps causes the PA-23 aircraft to pitch nose-up and requires the pilot to trim nose-down to remain in trimmed level flight. If a failure were to cause the flaps to retract suddenly, then the aircraft would pitch nose-down and the pilot would need to pull on the yoke and trim nose-up to recover.

The AAIB spoke to an experienced instructor on the PA-23. He reported that during a handling exercise at 5,000 ft, with full flap set, with the aircraft in-trim, at about 100 KIAS, he selected the flap up, which retracted in about 4 seconds. He reported that without input on the controls, within 3 seconds the aircraft had reached a nose-down attitude of -50° and lost 500 ft of altitude. He had then initiated a gentle recovery resulting in a total height loss of about 2,000 feet. A similar exercise conducted with ½ flap was less severe but still with a nose-down attitude of about -30°.

The test flight aimed to repeat these findings, but also by simulating a more rapid flap retraction that might occur if there was a structural failure of the flap mechanism or if the flaps lost hydraulics. To simulate this, the test pilot maintained altitude (the plan had been to maintain attitude) while the right seat pilot retracted the flaps. Then the controls were released to see the aircraft response. The first test was conducted with ½ flap at 104 KIAS. After flap retraction the controls were released while the aircraft was pitched up to +5°. The aircraft pitched down to -5° within 2 seconds, and a minimum of 0.3 g was recorded, before recovery was initiated. There was negligible height loss. The plan was to repeat the test with full flap, but after setting up the condition and feeling the high control forces of 14 daN necessary to hold altitude, the test was aborted due to concerns that the aircraft might go negative g.

6° nose-down test

The autopilot fitted to G-BKJW had a 6° nose-down pitch limit. A test was conducted at 172 kt and 6° nose-down pitch to determine the rate of descent that could be achieved (168 kt was the approximate average descent speed of G-BKJW prior to the turn on to base). The test, with slightly more than idle power, produced a descent rate of between 1,200 and 1,300 ft/min.

Flight control force and trim runaway certification requirements

The Piper PA-23-250 was certified to the US Civil Air Regulations (CAR) 3, dated 1 November 1949, including amendments 3-1 to 3-9, dated 15 December 1952. These requirements did not include a controllability requirement following a pitch trim runaway. However, there was a general controllability requirement (3.106) which stated that control forces in pitch shall not exceed:

- 10 lb (4.45 daN) for prolonged control application on a stick or control wheel
- 60 lb (26.7 daN) for temporary application on a stick
- 75 lb (33.4 daN) for temporary application on a control wheel

These control force requirements still apply in EASA Certification Specification 23.143 (Amendment 4)[13], with a change in that the 75 lb force requirement is with two hands on the control wheel, and that for one hand on the control wheel the requirement is reduced to 50 lb (22.2 daN) temporary force application.

In 1991 the US introduced Federal Aviation Regulation[14] (FAR) 23.677(d) (Amendment 23-42) which introduced a requirement on trim runaway which stated:

> *'It must be demonstrated that the aeroplane is safely controllable and that the pilot can perform all the manoeuvres and operations necessary to effect a safe landing following any probable powered trim system runaway that reasonably might be expected in service, allowing for appropriate time delay after pilot recognition of the trim system runaway. The demonstration must be conducted at the critical aeroplane weights and centre of gravity positions.'*

This text was subsequently incorporated into the EASA Certification Specifications for Part 23 when they were first introduced in 2003 and is in CS 23.677 (Amendment 4).

CS 23 (Amendment 4) contains a Flight Test Guide which is referred to as Acceptable Means of Compliance in CS 23 (Amendment 6). The Flight Test Guide contains the following information on 'Temporary Control Forces':

> *'Temporary application, as specified in the table, may be defined as the period of time necessary to perform the necessary pilot motions to relieve the forces, such as trimming or reducing power. The values in the table under 23.143 of CS 23 are maximums. There may be circumstances where a lower force is required for safety.'*

Footnote

[13] EASA Certification Specification (CS) 23 (Amendment 4) was issued on 15 July 2015 and applied to Normal, Utility, Aerobatic and Commuter Category Aeroplanes. The current CS 23 (Amendment 6) was issued on 27 February 2023 and contains CS 23.2135 on Controllability which cross refers to CS 23.143 (Amendment 4) as Acceptable Means of Compliance. The UK CAA adopted all the EASA Certification Specifications on EU Exit Day and CS 23 (Amendment 6) was adopted on 20 December 2023.

[14] The full regulation title is Title 14 CFR Part 23 – Airworthiness Standards: Normal Category Airplanes.

Part 139 of the Flight Test Guide states that '*For a system in which the fault analysis indicates a single failure will cause a runaway, flight test should be conducted*.' It states that appropriate pilot recognition times are 1 second for takeoff, approach and landing, and 3 seconds for climb, cruise, and descent. It states that a '*Disconnect Switch*' is:

> *'A switch which is located within immediate reach and readily accessible to the pilot, which has the primary purpose of stopping all movement of the electric trim system. A circuit breaker is not considered to be a disconnect switch.'*

It states that the reaction times previously mentioned should be applied prior to corrective action with the primary flight controls, and that an additional appropriate reaction time should be added to disconnect the system. And that when there are other switches in the vicinity, a time increment should also be added for identifying the switch. Appropriate reaction times for these are not provided in the Flight Test Guide.

Muscular force that can be applied to flight controls

In 2019 a report was published on '*Evaluation of Muscular Forces that can be Applied to Flight Controls*'.[15] The study involved 300 participants, including males and females, pilots and non-pilots and different age ranges. A cockpit seating mockup was constructed (Figure 23) to measure the control forces that could be applied to a control yoke, stick and rudder pedals. Both prolonged and temporary application of control forces were measured. For temporary application a time period of 3 seconds was used. The results were then compared to the certification requirements.

The results showed that 68% of participants could not pull and hold 50 lb (22.2 daN) for 3 seconds with one hand on the control yoke. And 56% of participants could not pull and hold 75 lb (33.4 daN) for 3 seconds with both hands on the control yoke. There was a small difference between pilots and non-pilots and a large difference between male and female participants. More than 90% of female participants could not hold 50 lb (22.2 daN) for 3 seconds with one hand, and more than 70% of female participants could not hold 75 lb (33.4 daN) for 3 seconds with both hands. For male pilot participants 34% could not hold 50 lb (22.2 daN) for 3 seconds with one hand, and 25% of male pilot participants could not hold 75 lb (33.4 daN) with both hands.

Footnote

[15] Beringer, D.B. and Joslin R.E. (2019) 'Evaluation of Muscular Forces that can be Applied to Flight Controls'. *Proceedings of the Human Factors and Ergonomics Society 2019 Annual Meeting*. Abstract at https://www.faa.gov/data_research/research/med_humanfacs/oamtechreports/2010s/2019/201905 [accessed 13 June 2025].

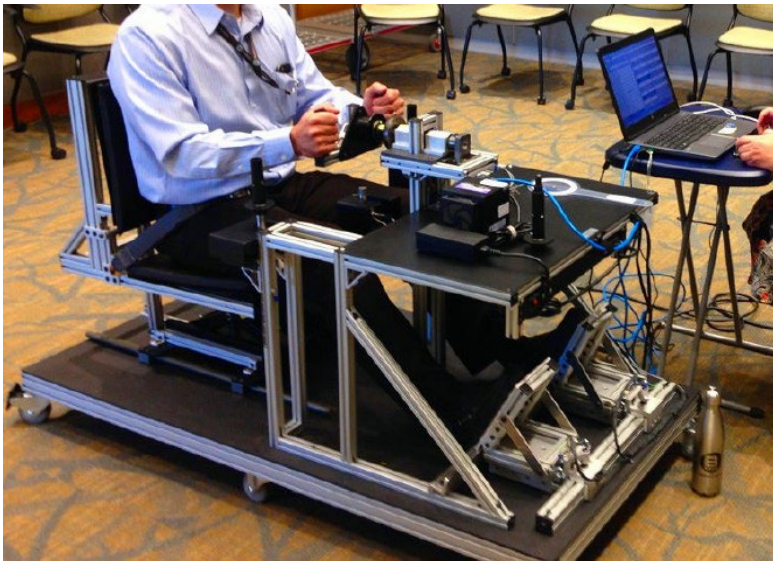

Figure 23

Muscular force measurement apparatus
(Copyright Beringer, D.B. and Joslin R.E.)

The report recommends that the force values in the regulations and in advisory guidance are re-evaluated in light of the study findings and other studies with similar findings. It states that: '*A prudent approach would be to adopt lower values that are both consistent with measured human performance and with policy determining what percentage of the pilot population should be accommodated by the subsequently determined revised reference values.*'

According to the Federal Aviation Administration (FAA), the pilot force work is being progressed as part of a series of changes called TACAM (Transport Airplane Certification Modernization).

Other information

Tests carried out on a PA-23-250 fitted with an Altimatic IIIB autopilot

Some ground tests were carried out on a PA-23-250 that was fitted with an Altimatic IIIB autopilot. The electric trim switch operated the trim and pulling the electric trim circuit breaker caused the trim to stop moving. Pulling the autopilot circuit breaker did not prevent the trim switch from operating the trim. When the autopilot was engaged pressing the trim switch did not cause it to disengage.

Pitch servo clutch forces

The type of pitch servo fitted to G-BKJW (p/n 1C508-4-184P) was required to have a clutch setting of 17 ±3 lb when installed in a Piper PA-23 (equivalent to a torque of 17 ±3 in-lb). This is the force that the pilot must apply at the capstan to override the autopilot's commands to the pitch servo; once this force is exceeded the clutch inside the capstan slips and the pilot has full control of the stabilator.

An autopilot repair organisation in the US that services these type of servos stated that their repair records for the previous two years showed that 25 servos out of 107 servos had a breakaway torque in excess of 20 in-lb which (equivalent to a force of 20 lb). And six servos had a breakaway torque in excess of 100 in-lb. The organisation stated that it was doubtful a pilot could override a servo with that type of torque. They stated that factors that can cause the clutch to bind are: age, corrosion, contamination from oil and dirt, and when the clutch has not been over-ridden in a long time. The Altimatic IIIB Operating Instructions state that the ability to override the clutch should be checked prior to each flight[16].

Trim disconnect switch on the control yoke

The Operating Instructions for the later model Altimatic IIIB-1 show an electric trim ON/OFF switch fitted to the control yoke on the Piper PA-31-350 model aircraft (Figure 24). It also shows a different type of electric trim switch fitted to the PA-23-250 that incorporates an autopilot disengage switch that must be pressed before the trim switch operates.

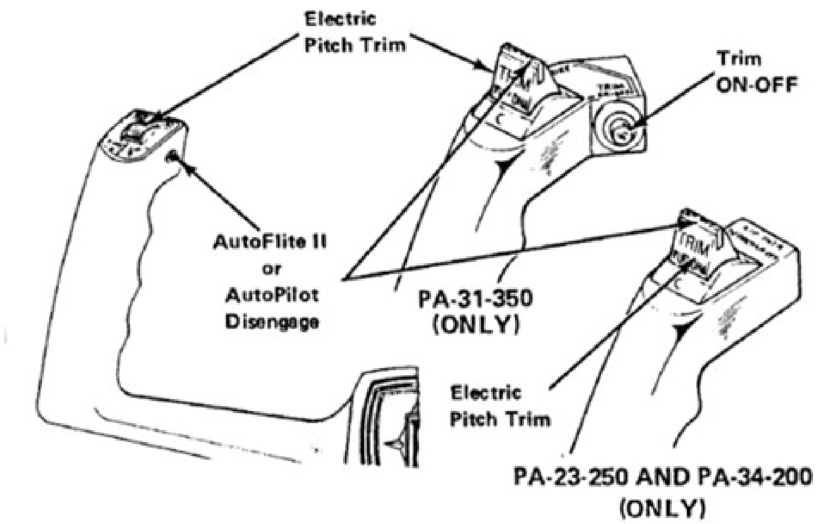

Figure 24

Electric trim ON/OFF switch fitted to Piper PA-31-350

The PA-31-350 (Navajo Chieftain) was first certified in 1972. The aircraft manufacturer could not find records to reveal the reason why an electric trim switch was added to the control yoke on this aircraft type. The PA-31 also had the circuit breaker panel located on the pilot's left side.

A PA-23-250 with an Altimatic IIIC autopilot system was found that had an electric trim disconnect switch below the autopilot console, next to the battery master switch.

Footnote

16 A paper copy of the Operating Instructions for the later model Altimatic IIIB-1 autopilot was found within the G-BKJW wreckage. It contained the same statement that 'The override should be checked prior to each flight'.

Study on automation failures including pitch trim runaway

In 1997 the FAA published a research paper on *'Automation in General Aviation: Two Studies of Pilot Responses to Autopilot Malfunctions'*[17]. In this study the responses of general aviation pilots to a number of different autopilot malfunctions were examined. The FAA's Advanced General Aviation Research Simulator, configured as a Piper PA-46 Malibu, was used with a Bendix/King KFC-150 autopilot. The study involved 24 pilots who were instrument rated, had experience with complex aircraft and autopilot systems, and all had more than 300 hours flight experience. One of the malfunctions evaluated was a pitch trim runaway in the nose-down direction with the autopilot engaged. Only pulling the pitch trim circuit breaker would correct the problem. The time to detect a malfunction and initiate an initial action, such as using autopilot disconnect, control wheel steering, panel-mounted autopilot engage switch or circuit breaker was measured, as was the time between the initial action and pulling the pitch trim circuit breaker. The average time to initial action was 12.2 seconds (median of 6.14 seconds). The subsequent time to pulling the pitch trim circuit breaker averaged 36.4 seconds (median 16.1 seconds). 13 of the 24 pilots encountered 'flight-terminating circumstances', where the simulator was deliberately frozen. This was done when high descent rates persisted within 100 feet of the ground or overspeed conditions were reached.

In the *'Post-test Questionnaire/Interview'* section, the paper stated:

> *'When asked to report on the difficulty or ease of diagnosing and recovering from autopilot failures experienced during their experimental session, our subjects unanimously agreed that runaway pitch trim was the most difficult from which to recover.'*

The paper cited two accidents where the elevator trim was found in the full nose-down position and a pitch trim runaway was implicated, one involving a twin-engined aircraft and one involving a Beechcraft Bonanza. In the case of the Bonanza it was determined that 45 lb (20 daN) of force would have been required to maintain level flight.

Other accidents and incidents involving pitch trim runaway

In 2019 the AAIB published a report on an accident to a Piper PA-31 Navajo (N250AC)[18], where fire damage and limited recorded information made it difficult to determine the cause of the accident, but a possible scenario was a pitch trim runaway. The aircraft struck the runway at Caernarfon Airport with landing gear and flaps retracted, at high speed, and with no noticeable flare manoeuvre. The pilot had reported over the radio having pitch control problems and the elevator trim was found close to the full nose-down trim position.

Footnote

[17] Beringer, D.B. and Howard H.C. (1997) 'Automation in General Aviation: Two Studies of Pilot Responses to Autopilot Malfunctions'. Civil Aeromedical Institute, Federal Aviation Administration. DOT/FAA/AM-97/24. https://www.faa.gov/sites/faa.gov/files/data_research/research/med_humanfacs/oamtechreports/AM97-24.pdf [accessed 13 June 2025].

[18] AAIB Bulletin: 3/2019 on accident to Piper PA-31, N250AC, on 6 September 2017. https://www.gov.uk/aaib-reports/aaib-investigation-to-piper-pa-31-n250ac [accessed 13 June 2025].

In another case, the AAIB spoke to an instructor who had experienced a pitch trim runaway on a PA-23-250 Aztec many years ago. He could not recall many details but he reported that the aircraft started pitching up during departure. He recalled that the control loads to push and bring it back under control were very heavy. On this model he recalled there being a disconnect switch on the control yoke that he used to stop the trim. He stated that an alternative would have been to turn off the electrical master switch which is within close reach.

In addition, the AAIB spoke to an aircraft engineer, who was also a pilot, who had experienced a pitch trim runaway in a PA-23-250 Aztec about 20 years ago. He was conducting an air test following maintenance work when at about 3,000 ft he engaged the autopilot and the aircraft "suddenly went into a nose-dive". He noticed the trim handle going round and instantly pulled back on the controls. He had an observer in the right seat who assisted with pulling on the control yoke. There was no trim disconnect switch on the control yoke and he could not recall if there was an autopilot disconnect switch on the yoke. His observer was trying to locate the electric trim circuit breaker, but in the meantime the pilot decided to switch off the electrical master switch. This stopped the trim runaway and he was able to re-trim and regain control. They levelled out at about 2,200 ft after having lost about 800 ft. They then pulled the electric trim circuit breaker and turned the master switch back on. He could not recall the cause of the fault, but thought it was an Altimatic III autopilot that was fitted.

There are more PA-23-250 aircraft operating in the US than in the UK, so the National Transportation Safety Board's (NTSB) accident database was searched to try and identify any pitch trim runaway accidents. One report[19] detailed a fatal accident involving a rapid descent which destroyed the aircraft. The pitch trim was found in the full nose-down position, but the cables were fractured. It had an Altimatic IIIB autopilot but no autopilot system components were recovered. The aircraft owner had reported that the electric pitch trim switch was either inoperative or intermittent. The probable cause was stated as '*in-flight loss of control for undetermined reasons resulting in the in-flight collision with terrain*.'

Another NTSB report[20] about a fatal PA-23-250 accident describes the pilot requesting a return to land after takeoff. On downwind the aircraft was seen to descend below surrounding terrain in a wings-level attitude. The pitch trim was found in the full nose-down position. No further details on what might have caused the pitch trim to be found in that position are in the report, but the probable cause was stated as '*The pilot's inability to maintain aircraft control due to a full nose-down trim condition, which resulted in a loss of control and collision with terrain*.'

Footnote

[19] NTSB Aviation Investigation Report. Accident Number: MIA02FA079. https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/54467/pdf [accessed 16 June 2025].

[20] NTSB Aviation Investigation Report. Accident Number: NYC96FA073. https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/39082/pdf [accessed 16 June 2025].

Incidents involving flap retraction

The NTSB's accident database was also searched for any incidents or accidents involving the PA-23-250 with an uncommanded symmetric flap retraction, but none were found. The FAA's Service Difficulty Reporting System database was also searched and there was one report of an event involving a PA-23-250 where the '*actuator rod end fell off during approach causing the flaps to retract*', but it stated that the landing was completed without incident. The extent to which the flaps had been extended was not reported and no details on the failure cause were provided.

Circuit breaker identification

Some aircraft owners fit coloured caps or collars to autopilot and trim circuit breakers to make them easier and quicker to identify in an emergency (Figure 25). A coloured circuit breaker cap can be purchased from aviation suppliers for less than £4.

Figure 25

Coloured circuit breakers caps/collars on a Cirrus SR20 (left) and a Cessna 210 (right)

When the AAIB examined a PA-23-250 that was fitted with an Altimatic IIIB autopilot, it was noticed that the electric trim circuit breaker was fitted with a cloth lanyard (Figure 26). This would have enabled the circuit breaker to be easier to identify and easier to pull. This aircraft had not flown since a change of ownership, and despite a few attempts to contact the previous owner, no contact could be made so the reason they decided to install the lanyard could not be established.

Figure 26

Lanyard found installed on the electric trim circuit breaker of a PA-23-250

There are no requirements to fit such devices to general aviation aircraft.

Coloured circuit breaker caps are required to be installed on the stick shaker circuit breakers of Boeing 737 MAX aircraft following two fatal accidents involving the aircraft type and its Manoeuvring Characteristics Augmentation System (MCAS)[21].

Requirements to deactivate defective equipment

The autopilot on G-BKJW was placarded INOP, but the autopilot circuit breaker had not been pulled or locked out. Pulling a circuit breaker on inoperative or malfunctioning equipment can prevent its inadvertent use, while locking the circuit breaker can help prevent deliberate use. An inexpensive method of locking a circuit breaker is to pull it out and fit a plastic tie wrap around its narrowest part. Discussions with some UK-based avionics shops revealed that some might pull and lock the circuit breaker but that there was no requirement to do so. Discussions with a US-based avionics shop revealed that they considered it a requirement to pull and lock a circuit breaker on inoperative equipment. They cited US Federal Aviation Regulation 91.213[22] on *'Inoperative instruments and equipment'* which states:

> *'(3) The inoperative instruments and equipment are-*
>
> *(i) Removed from the aircraft, the cockpit control placarded, and the maintenance recorded in accordance with § 43.9 of this chapter; or*
>
> *(ii) Deactivated and placarded "Inoperative". If deactivation of the inoperative instrument or equipment involves maintenance, it must be accomplished and recorded in accordance with part 43 of this chapter;'*

Footnote

[21] CAA Airworthiness Directive G-2021-0001 R1 on Boeing 737-8 and 737-9 aeroplanes. G-2021-0001 R1: Boeing 737-8 MAX and 737-9 MAX: Return to Service | Civil Aviation Authority [accessed 13 June 2025].

[22] Title 14 CFR Part 91 – General Operating and Flight Rules. https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-91#91.213 [accessed 13 June 2025].

They interpreted deactivating to include pulling and locking a circuit breaker – placarding alone was not sufficient to meet the requirement. No similar requirement for light aircraft maintenance could be found in any CAA or EASA regulation. However, the CAA's regulation for light aircraft maintenance Part-ML[23] states the following in relation to aircraft defects (section ML.A.403):

> *'(a) Any aircraft defect that seriously endangers the flight safety shall be rectified before further flight.*
>
> *(c) Any aircraft defect that does not seriously hazard flight safety shall be rectified as soon as practicable from the date on which the defect was first identified and within the limits specified in the maintenance data.'*

Trim runaway safety information

Following the AAIB's investigation into the accident involving the Piper PA-31 Navajo (N250AC) that may have been caused by a pitch trim runaway, the CAA published some information on the topic.

In the Summer 2019 edition of *'Clued Up'*, the CAA included an article on *'Trim Runaway*[24]'. It describes a nose-up trim malfunction in a light aircraft after takeoff where the pilot stated that '*the amount of forward pressure needed to maintain control, inconsequential at first, had become exhausting by midfield on the downwind leg*.' He stated that he was lucky he had someone in the right seat who handled the throttles, radio and landing gear, and then also helped on the control yoke.

The article states that the '*problem with electric trim malfunctions is that, as more and more weight suddenly and progressively comes onto the yoke, some pilots will initially be confused while trying to understand what's happening. As the situation quickly worsens, coping with the problem becomes harder by the second – it's an issue that needs immediate action*.'

To see how a pilot would cope they gave a trainee commercial pilot, who was flying straight and level in a simulator, a runaway trim in the nose-up sense. The pilot reacted instinctively by pushing the yoke forwards and then tried to use the trim switch on the yoke to trim nose-down but realised this was having no effect. The pilot then pressed the red 'electric trim disconnect' button on the control yoke. This solved the immediate issue before they then pressed the 'electric trim off' button on the panel and manually retrimmed. The article stated that the event took the '*best part of a minute' to resolve and there was 'a clear 15-20 seconds of "what's going?" confusion*'. It stated that it was a relatively quick response by a pilot undergoing training who had already learned about this type of malfunction.

Footnote

[23] UK Regulation (EU) No 1321/2014 Annex Vb Part-ML Airworthiness requirements for 'Light Aircraft'. https://regulatorylibrary.caa.co.uk/1321-2014/Content/map2/03700_Annex_Vb_Part-ML.htm [accessed 13 June 2025]. 'Light Aircraft' includes aeroplanes of 2,730 kg maximum take-off mass or less that are not in the air operator certificate of an air carrier.

[24] CAA 'Clued Up' Summer 2019. https://www.caa.co.uk/media/xy1off0x/cluedupsummer19.pdf [accessed 13 June 2025].

The article recommends that pilots: '*Prepare for a trim malfunction by thinking through the actions you'd take and practising them for each type you fly*.'

Some of the same information was published in the CAA's CAP1774 *'In Focus Special: Handling a trim runaway'*[25]. It states that: '*In some types it can be essential to know from memory which circuit-breaker to pull to stop the trim motor before the loads become too high. Some owners make the relevant circuit breaker identifiable, to ensure it is easy to locate*.'

The CAA also published a video on their website on 'Handling a trim runaway'[26]. This video and CAP1774 can be found under the 'Safety Topic' 'Trim runaways' on the CAA's website.

Differences training requirements

An MEP rating does not immediately give a pilot the privilege to fly any MEP aircraft. Apart from some exceptions, differences training is required before a pilot can fly another variant of an MEP aircraft. The requirements on differences training are published in the *'UK Aircrew Regulation*[27]*'* parts FCL.700 and FCL.710. It states that '*Pilots shall complete differences training or familiarisation in order to extend their privileges to another variant of aircraft within one class or type rating.*' It also states that the differences training '*shall be entered in the pilots' logbook or equivalent record and signed by the instructor or examiner as appropriate*.'

To work out which MEP variants require differences training requires referring to the *'UK Class & Type Rating Endorsement List – Aeroplanes'*[28]. On page 2 under MEP (land) it states: '*Aircraft within the class rating MEP (land) are not listed individually in this table, unless specific provisions have been established. All aircraft within the same class rating MEP require differences training, unless indicated otherwise in the list*.' The Piper PA-23-250 is not listed in the table which means that differences training is required before you can command it.

The above requirements have not changed since the UK exited the European Union and are the same as those published in EASA Part-FCL[29].

Footnote

[25] CAA CAP1774 'In Focus Special: Handling a trim runaway', published 14 March 2019. https://www.caa.co.uk/publication/download/17249 [accessed 13 June 2025].

[26] CAA Safety Topics, Trim runaways, videos on 'Handling a trim runaway'. https://www.caa.co.uk/general-aviation/safety-topics/trim-runaways/ [accessed 13 June 2025].

[27] UK Aircrew Regulation. UK Regulation (EU) No. 1178/2011, first published 2023, 2nd edition Amendment 1 December 2024. Aircrew UK Reg (EU) No. 1178/2011 [accessed 13 June 2025].

[28] CAA website, UK class and type rating lists. https://www.caa.co.uk/general-aviation/pilot-licences/uk-class-and-type-rating-lists/ and https://www.caa.co.uk/Documents/Download/10032/a1b19b0e-eff0-4762-b689-bb310ce7c99c/12 (Version 3) [accessed 13 June 2025].

[29] European Union Aviation Safety Agency (EASA) Part-FCL 'Easy Access Rules' (August 2020). https://www.easa.europa.eu/sites/default/files/dfu/Easy_Access_Rules_for_Part-FCL-Aug20.pdf [accessed 13 June 2025].

The CAA's website has two pages titled 'Multi engine piston rating for aeroplanes' which both existed prior to the accident. One of them is under the 'Commercial Industry' section of the website[30] and is more detailed and states that '*In order to extend the privileges to another variant of aeroplane within one class or type rating, the pilot must undertake differences or familiarisation training*.' It does not reference the Class & Type Rating Endorsement list. The other page is under the 'General Aviation' section of the website[31] and makes no reference to differences training requirements.

In June 2024 the CAA published a page on their website titled 'Differences Training in Single Pilot Piston Engine Aeroplanes'[32], which included the following sentence: '*For Multi Engine Piston (MEP) Class aeroplanes, differences training with a FI or CRI is always required when converting to another type or variant within the class.*' The page does not refer to the Class & Type Rating Endorsement list which provides for some exceptions.

The AAIB talked to a number of pilots with MEP ratings, of whom some were not aware of the differences training requirement. One MEP examiner thought it was a recommendation rather than a requirement. An MEP pilot who had flown in G-BKJW with the accident pilot was also not aware of the requirement.

Analysis

Background to the flight

The pilot was focussed on gaining a commercial pilot's licence and embarking on a professional flying career. He was self-motivated and his CPL training records suggested he was a competent pilot. In the process of building hours, the pilot had worked with others who provided him with opportunities to fly, although they stated he had not been paid for conducting flights on their behalf. The fact that he had almost completed his CPL training, which included some instrument flying, might have instilled in him the belief that he had the skills required to fly commercially and under IFR conditions, despite not holding the actual licence and ratings required.

From the evidence that is available it is known that the pilot had little experience flying twin-engine aircraft in general, and specifically the PA-23. No records can be found of him receiving any formal instruction on the PA-23, despite differences training being required. It is possible that he was not aware of this requirement, as was found to be the case with other MEP pilots interviewed by the AAIB, including an examiner, and an MEP pilot who had flown with the accident pilot. The information about these requirements could have been clearer on the CAA's website (see safety action 5). In addition, there were no records

Footnote

30 CAA website. 'Multi engine piston rating for aeroplanes'. https://www.caa.co.uk/commercial-industry/pilot-licences/aeroplanes/multi-engine-piston-rating-for-aeroplanes/ [accessed 13 June 2025].

31 CAA website. 'Multi engine piston rating for aeroplanes'. https://www.caa.co.uk/general-aviation/pilot-licences/part-fcl-requirements/ratings/multi-engine-piston-rating-for-aeroplanes/ [accessed 13 June 2025]

32 CAA website. 'Differences Training in Single Pilot Piston Engine Aeroplanes'. https://www.caa.co.uk/general-aviation/pilot-licences/part-fcl-requirements/ratings/differences-training-in-single-pilot-piston-engine-aeroplanes/#:~:text=For%20Multi%20Engine%20Piston%20%28MEP%29%20Class%20aeroplanes%2C%20differences,new%20MEP%20type%20to%20those%20already%20being%20flown [accessed 13 June 2025].

available to identify the extent of any training the pilot might have received, if any, during either his twin-engine rating or CPL training, on managing autopilot or trim failures (see safety actions 4 and 6).

The weather conditions for the flights to and from Ireland, were accurately forecast and it should have been obvious, prior to the pilot's departure from Bagby, that they would have been challenging to operate under VFR. It is considered that the pilot involved did not have the necessary experience or qualifications to be flying under such conditions. This is borne out by the comments of the owner of the airfield at Navan who had been impressed that the pilot had been able to land there in the prevailing conditions. The owner had also been sufficiently concerned that the pilot thought it necessary to text him during the flight back to Bagby to provide reassurance of the weather conditions en route.

Flight profile

During the cruise portion of the final flight the altitude and ground track were steady which could either indicate that the autopilot was being used, or that the pilot was flying accurately. His radio call to Bagby when he had "4 miles to run" was reportedly normal and he stated his plan to join right base for Runway 06. When the aircraft was 4 nm from Bagby, the aircraft was passing through an altitude of about 2,800 ft, and descending at a moderate rate of about 750 ft/min. At this rate of descent, the aircraft would have been left above the circuit altitude of 960 ft. The aircraft's subsequent increase in descent rate reaching 2,000 ft/min over a 30 second period could have been due to the pilot trying to rectify the fact he was too high, but the high rate at such a relatively low altitude could also be indicative of a control problem. Part way through this rapid descent the aircraft started its left turn to join base and passed through the circuit altitude of 960 ft, at a reduced rate of descent, about 17 seconds after completing the turn onto base.

After radar coverage of the aircraft was lost, after it descended below an altitude of about 740 ft, the aircraft was seen in the CCTV video flying in a shallow descent. At this stage the aircraft appeared to be flying under control. The descent subsequently started to steepen as seen in the CCTV at about 18:43:56 hrs (Figure 4). There was then a slight reduction in descent angle starting about 3 seconds later (above pylon 3 in Figure 4), before the descent angle steepened sharply about 2 seconds after that. The descent angle then appeared to steepen almost continuously until ground impact at 18:44:04 hrs. The fact the angle was steepening was evidence that the aircraft was not starting to recover.

The aircraft was wings-level throughout the descent which made issues with roll control or an engine failure very unlikely. The aircraft's airspeed was determined from the CCTV and the reported wind to have been between 94 kt and 130 kt, which was significantly higher than the aircraft's 56 kt stall speed with flaps up for the estimated weight. It could also be seen in the close-up image of the CCTV (Figure 5), that the aircraft's angle of attack[33] was

Footnote

[33] The aircraft angle of attack is the difference between the aircraft's pitch angle and flight path angle. The pitch angle is the angle of the aircraft's longitudinal axis relative to the horizon, while the flight path angle is the angle that the aircraft's centre of gravity is tracking through the air relative to the horizon. When the pitch angle is greater than the flight path angle, the angle of attack is positive. At high angles of attack the wing stalls and in most aircraft types this causes the nose to drop.

low or negative, far away from a stalling angle of attack. No large objects could be seen separating from the aircraft in the CCTV and all major aircraft components were accounted for at the accident site.

Wreckage evidence

The post-impact fire destroyed a significant amount of physical evidence, but that which remained contained no identifiable defects that could have caused or contributed to the nose-dive. The aircraft was intact at impact and there were no control cable failures in the pitch system. The flap component failures were considered to be most likely caused when the aircraft struck the ground.

The one anomaly found was the position of the pitch trim drum which was 3 mm from the full nose-down position. The flight trial evidence revealed that this was more nose-down than would be expected for any flap configuration in the speed range determined from the CCTV video. This would indicate that the aircraft had probably had a pitch trim runaway, but the possibility of the trim having moved during the post-impact break-up could not be discounted, therefore other potential theories that could have caused the final nose-dive were also considered.

Possible reasons for the nose-dive

1. Aircraft stalled

A stall was considered but discounted for the aforementioned reasons.

2. Ice on the stabilator

If ice had formed on the stabilator during the cruise this could have led to an aerodynamic stall of the stabilator causing the aircraft to pitch nose-down. The forecast freezing level was between 6,000 ft and 8,000 ft and the aircraft had been flown across the Irish Sea at 7,000 ft, possibly entering cloud where ice could have formed. However, the temperature at Bagby was 19°C and the aircraft had already spent a significant amount of time below the freezing level so ice being present at the time of the nose-dive was considered to be unlikely.

3. Shift in the aircraft's centre of gravity

If cargo moves forwards in an aircraft this can cause the aircraft to pitch nose-down. However, negligible contents were found within the wreckage and the items that the aircraft had reportedly been carrying were of negligible mass, so this theory was considered to be unlikely.

4. Flight control restriction

The cable connecting the stabilator to the pilot's control yoke was intact and the stabilator was free to move up and down. There were no foreign objects found in the tail assembly, or any obvious damage in the tail area to indicate a control jam of the stabilator. This possibility is, however, difficult to discount from physical evidence alone as most of the structure between the tail and the cockpit was destroyed. However, a control restriction would not have caused the aircraft to pitch nose-down, only prevent a recovery, and therefore this theory would not explain the initial nose-dive itself.

5. Pilot incapacitation

The pilot's medical history and post-mortem examination did not reveal any evidence of a natural disease or medical factor which may have caused a medical collapse or physical debilitation, and there was no evidence of carbon monoxide exposure. However, if the pilot had become incapacitated, he could have slumped against the control yoke, causing the aircraft to pitch nose-down. If this had happened, it is likely that this would have introduced a roll input as well, but the CCTV video shows the aircraft descending wings-level. In addition, the slight reduction in the aircraft's descent angle, just prior to the final descent before impact, is considered likely to be the result of an active input on the controls.

6. Deliberate act by the pilot

The AAIB has reported on accidents where there was evidence that the pilot had intentionally flown the aircraft into the ground. There was nothing to suggest it in the pilot's medical history or background. The pilot made a reportedly normal radio call. Therefore, a deliberate act by the pilot causing the nose-dive was considered unlikely.

7. Pilot distraction

The pilot might have been distracted and unintentionally pushed against the control yoke, causing the steep nose-down pitch. The pilot's lap strap was found undone which raised the possibility that he might have been reaching for something. To create the sustained nose-down pitch seen, the yoke would have needed to have been pushed and held forwards, which is unlikely to occur in a distraction event. And as in an incapacitation scenario it is also likely to introduce a roll input which was not seen. Therefore, a distraction leading to an inadvertent flight control input causing the nose-dive was considered unlikely.

8. Sudden uncommanded flap retraction

If a failure had caused the flaps to retract suddenly, then the aircraft would have pitched nose-down. The instructor who had flown this scenario reported that the aircraft pitched nose-down to -50° and rapidly lost 500 ft when the flaps were retracted from full. It also reportedly reached -30° nose-down pitch when the flaps were retracted from half. The flight trial had aimed to replicate these findings, but it did not see such steep nose-down attitudes; however, the aircraft was not configured or flown in the same manner, and the test with a retraction from full flap was aborted due to concerns about reaching negative g.

The examination of the flap components indicated that all the failures were probably the result of the aircraft striking the ground. Another mechanism by which the flaps could have retracted uncommanded was if there had been a hydraulic leak at the flap actuator or in the hose to the actuator. As these components had suffered fire damage, a hydraulic leak could not be ruled out. Following an uncommanded flap retraction the aircraft would still have been controllable, but the degree of height loss would have been dependent on how quickly the pilot reacted to the upset. The slight reduction in descent angle seen in the CCTV video prior to the final descent suggested that the pilot may have already reacted to something, but since the aircraft descent angle did not continue to reduce, the lack of recovery suggests that it was not due to an uncommanded flap retraction.

9. Inadvertent autopilot engagement

If the pilot had inadvertently pressed or knocked the Autopilot/Roll engage switch then this could have caused an unexpected nose-down pitch. For this to occur the Pitch Engage switch would have needed to have been left on from a previous engagement. Pitch excursions are known to occur when the pilot has not centred the autopilot trim indicator prior to engaging the Pitch mode. Such a pitch change could be startling, but the pilot should be able to override the pitch servo input and regain control. However, if the pitch servo clutch had not been checked in a long time, then the force to override the clutch could have been significantly greater than the 9 to 15 lb force specified at the control yoke, making it more difficult to stop the nose-down pitch. The clutch had not been checked during the annual inspection because the autopilot was placarded INOP, and although some pilots were known to have used the autopilot anyway, they were doing so without conducting a pre-flight clutch override check.

As the Autopilot/Roll engage switch is located behind the control wheel, it would seem unlikely that it would be knocked inadvertently. It is similarly unlikely that it would have been selected accidentally as the adjacent switches were also related to the autopilot and there would have been no reason to select them during the approach if flying without the autopilot. In addition, the autopilot nose-down pitch limit is -6° so would not explain the steep nose-down attitude seen in the CCTV video, unless there was a fault with the autopilot which caused it to exceed this limit.

10. A pitch trim runaway event

A pitch trim runaway event, causing the stabilator to move in the aircraft nose-down direction and increasing the control forces required to recover, with either the autopilot on or off, could have been the cause of the nose-down pitch and this theory is discussed in detail in the next section of the report.

Pitch trim runaway

A pitch trim runaway is a situation where the electric trim runs uncommanded, nose-down or nose-up. The pitch trim drum was found to be 3 mm from the full nose-down position, out of a full range travel of 13 mm. Although there might have been some movement of the drum during the post-impact break-up sequence, the finding raised the possibility that a pitch trim runaway had caused or contributed to the nose-dive.

The flight trial evidence revealed that the trim position as-found was more nose-down than would be expected for any flap configuration in the speed range determined from the CCTV video, which would have resulted in the aircraft pitching nose-down unless countered by a pull force on the control yoke. If the flaps had still been up then it would have taken between about 17 and 22 seconds for the electric trim to reach the 'as found' position, resulting in the pilot needing to pull on the control yoke with a high force of about 30 daN (67 lb). This is close to the two-handed temporary application force limit of 33.4 daN (75 lb) that existed at the time of the PA-23-250 certification, and in excess of the current 22.2 daN (50 lb) force limit for one-handed temporary application on a control yoke. However, the report on '*Evaluation of Muscular Forces that can be Applied to Flight Controls*' indicates that the certification figures are not sufficiently conservative: 68% of participants in the study could not pull and hold 22.2 daN (50 lb) for 3 seconds with one hand on the control yoke. Research studies also show that in a pitch trim runaway situation it is likely that the control forces will need to be held far in excess of 3 seconds to diagnose the problem and isolate the trim. In the FAA study on automation failures, the time to pull the pitch trim circuit breaker averaged 36.4 seconds after the initial action in a pitch trim runaway situation.

If the pilot had already selected half-flap, as would be normal on base leg, then the out-of-trim control forces would have been about half as much, 14 to 16 daN (31 to 36 lb). It should have been possible to hold this force for longer, but possibly not long enough to prevent an accident from a low height.

The specified action in the event of a pitch trim runaway on the PA-23-250 was to pull the trim circuit breaker. The more quickly it was pulled the less time the control forces would have to build up. Pulling the circuit breaker requires removing one hand from the control yoke which would have reduced the force the pilot could apply. The test pilot found that it was not possible to hold any control force on the control yoke while simultaneously reaching for and pulling the electric trim circuit breaker. The circuit breaker was also difficult to visually identify. The test pilot considered that it was very unlikely that a pilot in a trim runaway event, under the circumstances described in this accident, would have had sufficient time or capacity to find and pull the electric trim circuit breaker.

If a pitch trim runaway had occurred and was the result of the autopilot being engaged, then disengaging the autopilot could have stopped it. However, the autopilot disengage switch on the control yoke was missing for unknown reasons, so the pilot would have needed to remove his hand from the yoke to disengage the autopilot on the Autopilot Console which would have increased the difficulty in maintaining or regaining control.

Mechanisms that could have caused a pitch trim runaway

If the autopilot had not been engaged, then a pitch trim runaway could have been caused by two independent short circuits in the wiring between the electric trim switch on the control yoke and the pitch trim servo. Wiring insulation deteriorates with age, so it is a possible failure mode, but for two independent short circuits to occur in a short space of time is unlikely. There were reports from two pilots who stated that they used the electric trim after the annual inspection. If one wire had short circuited to live or earth, then activating the trim switch would have caused the electric trim circuit breaker to trip. Therefore, the problem would likely have been detected before a second wire had a chance to short. Another possibility is that the trim switch stuck in the nose-down position after being actuated. This was a known problem with the older type of trim switches fitted to the PA-23 (Figure 13), but not a known problem with the type fitted to G-BKJW; however, this possibility could not be discounted. One of the previous co-owners had experienced an issue with the trim moving further than would be normal so had stopped using it. It is possible that this was an indication of the start of a problem which subsequently worsened.

If the autopilot had been engaged, then a single fault could have caused a pitch trim runaway. The pitch trim sensor (Figure 20) moves mechanically from side to side as the cable tension is varied. If this sensor sticks to one side, then the pitch trim will be commanded to run continuously. Single faults in the autopilot amplifier such as a shorted transistor could also have caused a pitch trim runaway. If any of these faults had caused a trim runaway then there is a pitch trim light that is designed to illuminate just above the Autopilot Console; however, as the autopilot had been placarded INOP, this light had not been tested during the annual inspection, or as part of any known pre-flight checks. Furthermore, the light is low on the instrument panel and is not accompanied by an aural alert so could be missed, especially in a high workload situation.

The final descent manoeuvre

A pitch trim runaway on the PA-23-250 is more likely to occur with the autopilot engaged due to it only needing a single failure. As the pilot was considered more likely to have been hand flying the aircraft during the manoeuvre onto the base leg, the autopilot would have probably been turned off. However, it is possible that the pilot was using the autopilot in the descent just before this. The flight test revealed that a descent rate of 1,200 to 1,300 ft/min could be achieved at the -6° attitude limit. If a trim runaway had occurred during this descent, then it would have been initially masked by the autopilot pitch servo compensating for it and holding the stabilator in the desired position. In this case, once the pitch servo clutch slipped there would be a sudden unexpected nose-down pitch. If the servo clutch force was higher than the required 17 ±3 lb setting (which is possible as it had not been checked), then the duration of masking would have been longer and the nose-down pitch greater. The flight trial revealed that at 130 KIAS with the flaps up, a 5 second nose-down trim input that was held on the controls and then released caused the pitch to reduce suddenly by 5° and the g to reduce to 0.5 g. Longer duration trim inputs were not attempted at this speed due to the fear of going into negative g. At higher speeds, such as those during the final descent (about 168 kt), before the aircraft turned onto base, the effect would have been greater. If the aircraft had gone into negative g, then recovery could also have been made more difficult by the fact the pilot was likely not wearing his lap strap, so could have floated out of his seat.

If a trim runaway had started prior to the turn on to base then the muscular fatigue from having to hold the controls would have been greater by the time the aircraft reached the start of the final nose-dive, than if the trim runaway had started on the base leg. The slight reduction in descent angle (between pylons 3 and 4 in Figure 4), before the descent angle steepens sharply, might indicate a final attempt to pull and recover before muscle fatigue reduced the force that could be applied.

Accidents and incidents involving pitch trim runaway

The search of the NTSB database revealed two fatal PA-23-250 accidents that might have been caused by a pitch trim runaway, although there was insufficient evidence for this to have been determined as the 'probable cause'. Without recorded data of the control positions, it is difficult to determine pitch trim runaway as the probable cause of an accident, so it is possible that there have been more like it. In recent years the AAIB has investigated one fatal accident where pitch trim runaway was a possible cause (N250AC). However, the AAIB has spoken to two pilots who had separately experienced pitch trim runaways in a PA-23-250. In one of these events the trim runaway was in the nose-down direction, with the aircraft losing 800 feet before it was recovered despite the pilot having the assistance of an observer in the right seat who was also pulling on the controls. Although not in the checklist, the pilot had switched the electrical master switch off which immediately stopped the trim. If he had tried to find and reach for the electric trim circuit breaker the altitude loss would probably have been greater.

Pitch trim runaway summary

As with the aforementioned accidents, there was insufficient evidence to determine that a pitch trim runaway was the cause of the accident to G-BKJW. No physical evidence of a wiring short or autopilot component failure could be identified to prove the theory. However, the position of the pitch trim drum, the steep nose-down pitch, and the results from the flight trial all supported this as a possible cause. Further weight to this theory was provided by research studies and anecdotal reports from pilots who have experienced pitch trim runaways and lost significant height.

Summary of the possible causes considered

There was insufficient evidence to determine a definitive cause of the accident, but in considering the available evidence and possible causes, a pitch trim runaway was the most likely of these.

Maintenance

The wreckage examination did not reveal any defects that could have caused or contributed to the nose-dive. The autopilot disengage switch on the control yoke was found to be missing, and a photograph from October 2020 showed it missing then, but no maintenance record concerning its removal could be found. As the autopilot was placarded INOP it would not have been a requirement to have the autopilot disengage switch installed, so the missing switch did not constitute a defect, although this could have contributed to the accident if the cause was a pitch trim runaway while the autopilot was engaged.

The autopilot should not have been operated as it was placarded INOP, but the AAIB has information from three pilots who said they had done so. If the autopilot circuit breaker had been pulled and locked out with a tie wrap then this would have prevented pilots using the autopilot.

The maintenance engineer who oversaw the aircraft's last annual inspection said the autopilot circuit breaker had not been pulled because he thought it provided power to the intercom, a radio or the electric trim (although it was unlikely to be electric trim as there was a separate circuit breaker for it). The circuit breaker labelled 'Autopilot' was 10 Amp instead of the expected 5 Amp which indicates there may have been a modification for it to power something it was not originally intended to. By doing this it prevents the autopilot being easily isolated without also losing the function of other equipment sharing the same circuit breaker. When considering the importance of the ability to isolate an autopilot when it is placarded inoperative, such modification would seem undesirable. There is no requirement for a circuit breaker to only power one system. However, when an aircraft has a dedicated autopilot circuit breaker this breaker should be pulled and locked if the autopilot is inoperative. If the autopilot is intended to remain inoperative for a prolonged period, then it should be deactivated by other means or removed (see safety action 7). In the US, regulation FAR 91.213 requires that inoperative equipment is deactivated but there is no such equivalent requirement in the UK. However, according to Part ML the autopilot should have been repaired 'as soon as practicable' and yet there was evidence that it had been inoperative since 2012.

Risk of using an autopilot that is placarded inoperative

The AAIB is aware of three pilots who used the autopilot on G-BKJW. One of the owners of the maintenance organisation at Bagby said that while it was INOP he believed the heading function still worked, so there was an awareness that the autopilot was being used. This implied that it may have been considered an acceptable practice. Pilots may not appreciate the risk of using an autopilot that has not undergone any maintenance, such as having the bridle cables, the clutch override, the trim operation, and any pitch trim warning light checked and tested. The autopilot repair organisation in the US had experience of finding six pitch servos with a breakaway torque in excess of 100 in-lb, almost six times the required torque setting of 17 in-lb. The Altimatic IIIB Operating Instructions state that '*approximately nine to fifteen pounds of pressure on the control wheel should override both the roll and pitch functions*'. So, with a torque in excess of 100 in-lb the force at the yoke to override the pitch servo could have been in excess of 88 pounds or 39 daN. If the autopilot started to malfunction in pitch the pilot would need to immediately push or pull with this level of force to regain control and hold it until they had disengaged the autopilot. In addition, with such a high clutch override force a pitch trim runaway, with the autopilot engaged, could be masked until it has reached almost full nose-down trim.

Therefore, pilots should not use autopilots that are placarded INOP.

Differences training

There was no evidence that the accident pilot had undertaken the required differences training before flying G-BKJW. Such training could have potentially assisted him in handling an emergency. The AAIB has talked to a number of pilots with MEP ratings, of whom some were also not aware of the differences training requirement. The information on the CAA's website at the time of the accident about the differences training requirement was not as clear as it could be. Improved information was added in June 2024, but as this was only within a section about SEP differences training it could have been missed by MEP pilots; it also did not refer to the *'UK Class & Type Rating Endorsement List – Aeroplanes'* which a pilot must read to determine if the MEP variant or type they want to fly requires differences training. The CAA intends to update the information on their website to rectify these points (see safety action 5).

Ways to reduce the risk of a pitch trim runaway event

Irrespective of whether the accident to G-BKJW was caused by a pitch trim runaway, the investigation revealed that although occurrences appear to be rare, when they do occur the results can easily be catastrophic, particularly if it occurs at low altitude where there is limited time to respond. The investigation considered that the following measures could help mitigate the risk of a pitch trim runaway event on any aircraft type:

1. *Training for a pitch trim runaway*. There was no evidence that the pilot had received any in-flight training on autopilot or trim runaway failures. Training for such failures in flight and going through the actions, such as pulling circuit breakers, helps to build muscle memory that can be quickly employed in an emergency. Training also helps with faster identification of the cause. The CAA has safety action plans to address such training (see safety actions 1, 2, 3, 4 and 6).
2. *Tagging the autopilot and electric trim circuit breakers*. Some aircraft owners fit coloured caps or collars to autopilot and trim circuit breakers to make them easier to identify in an emergency (Figure 26). Combined with training, colour tagging these circuit breakers would help a pilot more effectively deal with a pitch trim runaway (see safety action 8).
3. *Deactivating inoperative autopilots*. As previously discussed, deactivating inoperative autopilots would prevent pilots from using them (see safety action 7).
4. *Designing aircraft with trim disconnect switches on the control yoke*. Later models of the PA-23-250 have an electric trim switch that incorporates an autopilot disengage switch that must be pressed before the trim switch operates. The Piper PA-31-350 has a trim on-off switch on the control yoke when the Altimatic IIIB-1 is installed. Removing the need to reach for and pull a circuit breaker, particularly if in a difficult to reach location, will improve safety. The current certification requirements on trim runaway in CS 23.677 should help to address this for new aircraft.

5. *Carrying out pre-flight checks of the autopilot*. If an autopilot is fitted, then it is important to carry out the appropriate pre-flight checks. This may include: the override clutches, any pitch trim warning light, and checking that the autopilot can be disengaged.

Safety actions

As a result of the findings of this investigation and discussions with the CAA, the CAA has agreed to the following safety actions:

1. The CAA plans to produce a new video/webinar on trim runaways. The video will feature targeted advice on managing trim runaways including mitigations to prevent an occurrence. This action is planned for later in the 2025/2026 financial year. In the interim period, the CAA plans to review their existing website content related to trim runaways and promulgate a reminder to industry through their Skywise communication channels.

2. The CAA aims to produce safety material regarding autopilots in General Aviation aircraft which could include a section on trim runaways. The CAA stated that this could feature autopilots/trim runaway in a wider Safety Sense Leaflet focusing on the various elements of differences training available or this might be addressed through another short form publication such as a Clued Up Article, Aeronautical Information Circular, or Safety Notice. This action is intended to be completed in the 2025/2026 financial year.

3. The CAA plans to develop new guidance material on the dual refresher flight training requirement[34] which will include electric trim. This would only apply if the aircraft being used for the flight training had electric trim fitted. The CAA is also looking to make better use of this training flight by focusing on key safety risks such as unstable approaches, loss of control in flight, controlled flight into terrain and inadvertent entry into IMC.

4. The CAA plans to update '*Standards Document 14 – Guidance for Examiners*[35]' to include reference to failure of the autopilot and electric trim or trim runaways. The CAA noted that this document already includes demonstrating the '*correct procedure for pre-flight functional check of autopilot*'.

Footnote

[34] To renew a Single Engine Piston (SEP) class rating pilots are required to either pass a proficiency check or skills test every two years, or carry out dual refresher flight training with an instructor if they have completed 12 hours of flying in the previous year of the two-year period. To renew a MEP class rating pilots are required to pass a proficiency check or skills test every year.

[35] Standards Document 14, version 7. Guidance for Examiners and Information for Pilots of Single Pilot Aeroplanes. https://www.caa.co.uk/publication/download/12926 [accessed 13 June 2025].

5. The CAA plans to review and update where necessary the pages on their website for both commercial and general aviation pilots in relation to MEP differences training. In addition, the CAA will amend the 'UK class and type rating lists' to set out in clearer terms when pilots moving between specific aeroplanes that come within the MEP class rating require differences training delivered by an appropriately qualified instructor.
6. The CAA is consulting on proposals to amend the guidance material in the UK Aircrew Regulation on differences training that will incorporate specific elements for autopilots and electric trim. For further detail refer to General Aviation Licensing Review CAP 3094[36].
7. The CAA plans to publish a Safety Notice recommending that inoperative autopilots or electric trim systems are deactivated. The CAA will consider future rulemaking to require it if necessary.
8. The CAA will evaluate and consider the potential of a Safety Notice recommending that aircraft owners, operators and maintenance organisations fit coloured caps or other clearly identifying features to autopilot and electric trim circuit breakers to make them easier and quicker to identify and pull in an emergency.

Conclusion

While on base leg to land on Runway 06 at Bagby, the aircraft entered a steep descent. There was a slight reduction in descent angle before the descent angle steepened sharply and the aircraft struck trees and then the ground at an angle of about 35° to 40° nose-down, with no indication that the aircraft was starting to recover. The key findings from the investigation were as follows:

- The pilot made a normal radio call when he was 4 miles from the airfield, indicating that there were probably no significant anomalies at this stage of the flight.
- The CCTV video showed a wings-level steep descent, indicating there were probably no issues with maintaining roll control.
- The airspeed determined from the CCTV, and an analysis of the flightpath and pitch angles, indicated that the aircraft had not stalled.
- The physical evidence showed that there were no control cable failures in the pitch control system, there was no in-flight break-up and the pitch trim position was found in the near full nose-down position.
- There was no evidence to suggest pilot incapacitation or a deliberate act.

Footnote

[36] CAA General Aviation Pilot Licensing Review. AMC and GM to the UK Aircrew Regulation. A consultation. CAP 3094. First published March 2025. Chapter 2 refers to 'Differences training'. cap3094-aircrew-ga-licensing-phase3-amc-consultation-march-2025-1.pdf [accessed 13 June 2025].

- A failure resulting in a sudden flap retraction, from half-flap or full flap, can produce a significant nose-down pitch and height loss on earlier model PA-23-250's that are not fitted with a flap-to-trim-tab interconnect system, such as the accident aircraft.
- A pitch trim runaway could have produced control forces in excess of 30 daN (67 lb) which is beyond the force that most people can hold with one hand on the control yoke for more than 3 seconds.
- Studies and anecdotal evidence show that it can take a long time for pilots to react, diagnose and then correctly respond to a pitch trim runaway, resulting in significant height loss.
- A pitch trim runaway on the accident aircraft would have required either disengaging the autopilot using the switch on the panel (as the switch on the yoke was missing) or pulling the electric trim circuit breaker which was difficult to see and reach. Turning the master switch off would also have stopped the trim, but this was not on the checklist for a trim runaway.
- The pilot had not conducted differences training with an instructor on the PA-23-250 and probably was not aware of the requirement to do so.
- There was no evidence that the pilot had received any in-flight training on autopilot or trim failures during his MEP class rating or CPL licence training.
- Pilots had been using the autopilot on the accident aircraft despite it being placarded inoperative and were probably unaware of the risks of doing so.

A number of possible causes for the final nose-dive were considered. Of all the causes reviewed, a pitch trim runaway was considered to be the most likely, but there was insufficient evidence to determine that it was the definitive cause of the accident. The CAA is planning eight safety actions to help reduce the risk of an accident involving a pitch trim runaway.

Published: 26 June 2025.

Accident

Aircraft Type and Registration:	Guimbal Cabri G2, G-FICH
No & Type of Engines:	1 Lycoming O-360-J2A piston engine
Year of Manufacture:	2015 (Serial no: 1131)
Date & Time (UTC):	27 September 2024 at 1559 hrs
Location:	Leicester Airport
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Rotor blades destroyed and tail boom damage
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	40 years
Commander's Flying Experience:	314 hours (of which 212 were on type) Last 90 days - 40 hours Last 28 days - 25 hours
Information Source:	AAIB Field Investigation

Synopsis

During a period of hovering at the end of an instructional flight, the helicopter began to yaw to the left. This yaw rapidly accelerated and G-FICH completed four rotations before striking the ground. Whilst the commander reported no injuries after the accident, he died seven days later from an unrelated medical condition.

The helicopter examination did not reveal any technical faults that could have caused or contributed to the accident. Evidence from the manufacturer and operator demonstrated that applying and maintaining full opposite pedal will stop rotation in the situation encountered on the accident flight. It is likely that full pedal was not applied and/or not held long enough to effect a recovery.

The helicopter was equipped with adjustable pedals on the right side but not on the left where the commander was sat. The manufacturer has taken safety action to install adjustable pedals in the left seat of all new models of the Cabri G2 as well as to add a pre-flight check of the travel of the fenestron.

History of the flight

The flight was an instructional sortie for a student who had not flown for some time. The commander was sat in the left seat and the student on the right. Having departed Leicester Airport, the commander and student conducted a number of revision exercises at altitude before returning to the airport for some hovering practice. Whilst the helicopter was moving forward very slowly it began to yaw to the left which was not immediately arrested by either the student or the commander. The yaw to the left continued, increasing in rate with the helicopter completing four rotations before it struck the ground. The helicopter came to rest on its left side and both pilots were able to climb out. The student suffered minor injuries, and the commander reported that he was unhurt.

Four days after the accident, the commander was discovered unresponsive at home and was subsequently found to have suffered a basilar artery thrombosis. This is a blockage of the basilar artery due to a blood clot. The basilar artery is crucial for supplying blood to the brainstem, cerebellum, and posterior part of the brain. The prognosis for such a thrombosis is very poor and the commander died three days later. Medical expertise concluded that although the thrombosis occurred after the accident, it was unrelated.

Accident site

The helicopter came to rest on its left side (Figure 1) close to the location in which it had been hovering. The cabin and cockpit area had minor damage. The main rotor blades were severely damaged, the tail boom had separated, the right door had detached, and the skids had slid sideways to the right. The maintenance organisation attended the accident site and disconnected the tail rotor control rod from the tail rotor control unit, so that the tail boom could be removed to ease transportation of the helicopter back to a hangar for examination.

Figure 1
Accident site

Recorded information

The helicopter was fitted with a GoPro camera, located in the overhead panel, behind the pilots. The camera is powered using its internal battery which is charged using an external battery to ensure it can last all day. It was usually switched on and off manually prior to and after each flight.

Immediately after the accident the operator asked the commander if the camera recording was available to which he replied that it was not. Examination of the camera SD card confirmed that there was sufficient space remaining and that the flight had not been recorded.

CCTV footage of the airport was provided which captured the accident sequence. The helicopter was located to the south of the paved runway (Figure 2).

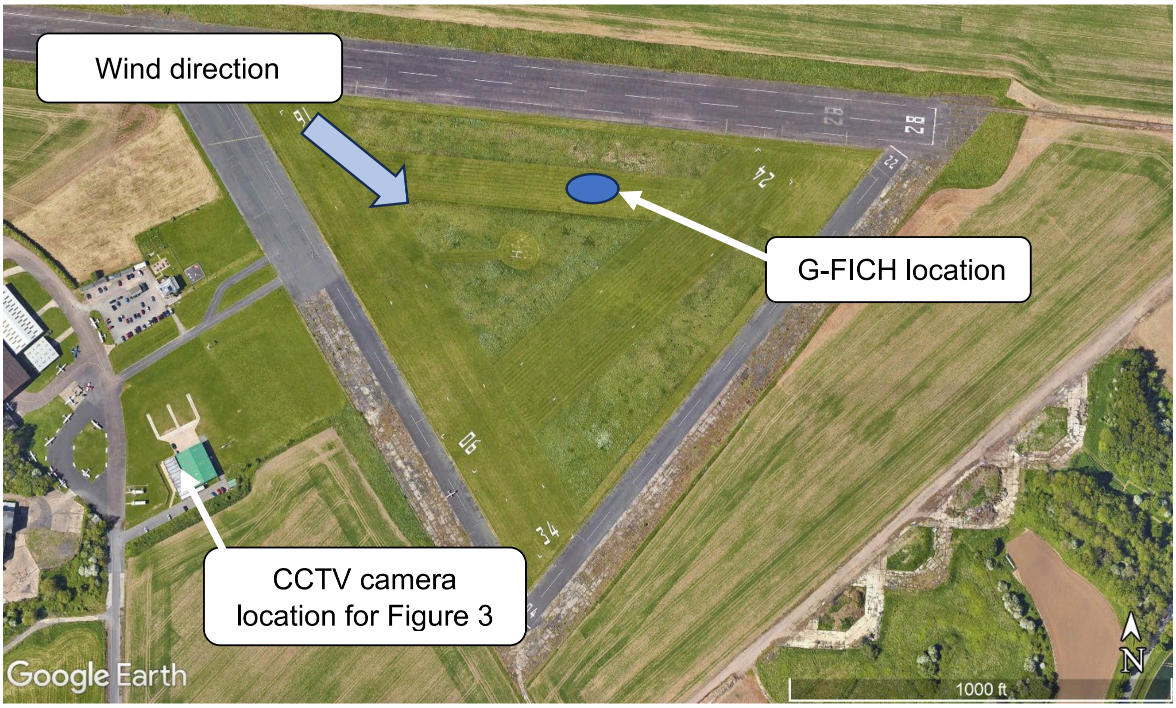

Figure 2

Leicester Airport with approximate helicopter location and Figure 3 camera location

The CCTV showed G-FICH moving forward very slowly as it was brought to a hover approximately into wind. It then yawed rapidly to the left and continued yawing, roughly level in pitch and height for the first rotation. The second rotation saw G-FICH descend closer to the ground, but the helicopter climbed vertically during the third rotation which would likely have been the result of an increase in the collective. The fourth rotation saw G-FICH descend before contact with the ground initially with the rear of the skids and the tail.

Two still images from the CCTV are shown in Figure 3 showing one of the turns to the left prior to striking the ground.

Figure 3
CCTV still images from Leicester Airport

Weather conditions, including the wind speed and direction, were recorded at the airport every five minutes. The recording showed that during the time that G-FICH was back at the airport manoeuvring, the wind was steady from a north westerly direction varying in speed between 16 and 24 kt. There was no cloud below 3,400 ft aal and the visibility was good.

Aircraft information

General

The Guimbal Cabri G2 is a two-seat light helicopter powered by a Lycoming O-360-J2A piston engine. The majority of Cabri G2s sold are used for flying training.

Yaw control

G-FICH was fitted with dual controls with yaw pedals on both sides. The pedals on the right side were adjustable, with two positions, which allows pilots to reduce the distance between the pedals and seat by 80 mm, by pivoting the top of the pedal aft (Figure 4). The left side had the standard non-adjustable pedals.

The manufacturer initially fitted the helicopter type with non-adjustable pedals on both sides[1], but in 2011 (from Serial Number 1024 onwards) it moved to fitting adjustable pedals on the right side as standard. The adjustable pedals were available for the left side as a factory-fit option or as a more expensive retrofit-option. As a result of the findings of this investigation, the manufacturer plans to install adjustable pedals on the left side as a standard fit on new models.

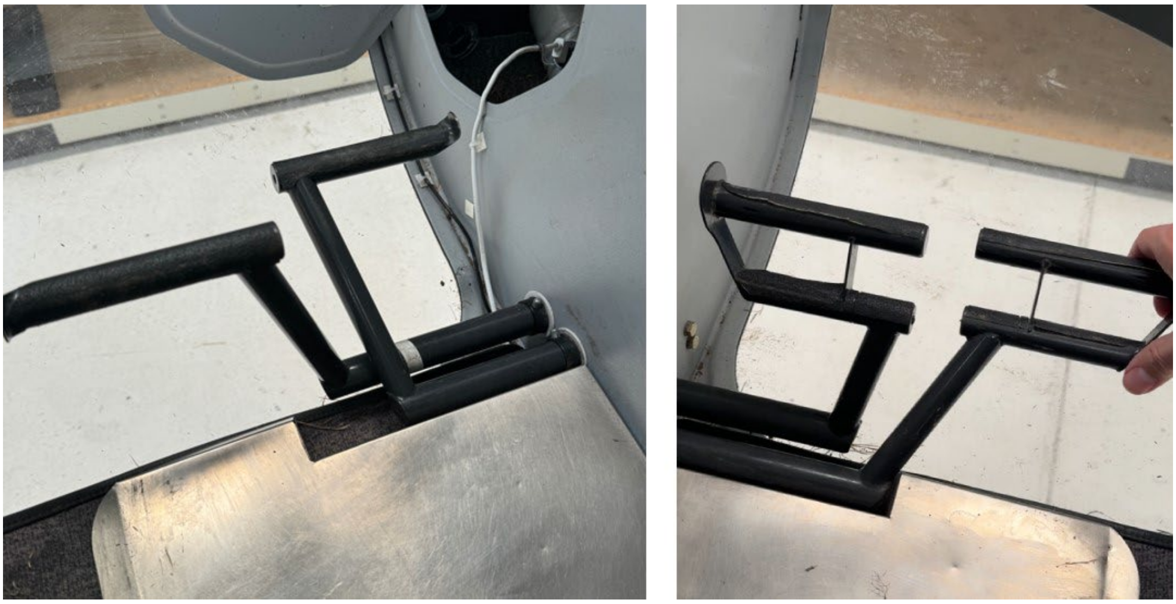

Figure 4

Left side fixed pedals (left image) and right side adjustable pedals (right image) on G-FICH

The manufacturer does not publish guidance regarding pilot height or the leg length[2] at which it might be appropriate to use the adjustable pedals. Other pilots who flew the helicopter type suggested that a pilot less than around 172 cm tall might find flying with the adjustable pedals more comfortable and find full pedal easier to reach, if the pedals were adjusted to the closest position.

All pilots when they carry out the pre-flight checks, should complete a full and free movement check to assure themselves that they can reach full travel on all the flight controls and they are functioning correctly. They must not only be able to reach full travel but to hold it there.

Footnote

1 The original non-adjustable pedals fitted to the type prior to 2011 were set in an intermediate position when compared to the two positions available with the adjustable pedals.

2 Height or leg length may not be the only anthropometric measures that influence preferred pedal position, but they can provide an overall indication.

The manufacturer is aware of a previous loss of yaw control incident, where an instructor taking control from a student discovered resistance due to the student's feet blocking or slowing the application of a greater amount of pedal. Cockpit footage showed that the helicopter initially continued to rotate until the instructor was able to apply full pedal, after the student had removed their feet from the pedals. Once full pedal was applied and held by the instructor the rotation stopped after 450° and the helicopter was recovered.

Training and manufacturers advice on yaw control

The Cabri G2 is fitted with a fenestron rather than a standard tail rotor. This means that the yaw control surfaces are encased within a shroud. A fenestron has some notable benefits such as decreasing the risk of injury to people walking through the arc of the tail rotor and the blades have some protection from ground or object contact. There are also some well-known disadvantages to a fenestron which pilots must be mindful of when operating.

Extensive testing by the manufacturer has shown that the helicopter type's yaw control is immune from stall or vortex ring states (often known as loss of tail rotor effectiveness). As the speed is reduced on approach to the hover, the Cabri G2 does however require a greater pedal input than a conventional tail rotor design, although the final amount of pedal travel may be similar. In the Cabri G2 this is partly due to the large, aerofoil-shaped vertical fin which is designed to provide stability in yaw during forward flight. Given the main rotor rotates clockwise when seen from above, this fin is also set at an angle of attack to the left, thus producing most of the thrust required in forward flight to counter the main rotor torque. The tail rotor thrust is null when the left pedal is about 3 cm forward (6 cm between the two pedals). As the helicopter slows to the hover the pilot must compensate for the decreasing amount of assistance provided by the fin as well as counteracting the additional yaw generated from increasing main rotor thrust.

The wind direction can also decrease the effectiveness of a fenestron especially if the wind is blowing in towards the air exiting. This can increase the pedal travel required with the wind from the right.

The manufacturer issued Service Letter 12-001 A - *'Yaw control in approach'*[3] in 2012. Although G-FICH was hovering rather than making an approach, the information on yaw control is relevant to the accident. The Service Letter states that there are three factors that can exacerbate the risk of the helicopter yawing left:

> *'If the pilot is surprised by the departure in yaw, he will instinctively raise the collective, thus accelerating the yaw to the left.*
>
> *If the wind comes from the right, and the pilot is slow to react, allowing the helicopter to depart in yaw to the left, the yaw will accelerate as the helicopter's tail passes through the wind due to the windvane effect (can be compared to a jibe).*

Footnote

[3] https://extranet.guimbal.com/link/srYndTZqHFa0lPu [accessed 25 June 2025]

> *If the helicopter is landing close to IGE[4] hover ceiling, over the transition altitude (3800 ft ISA), full power will be obtained with full throttle (100% FLO on MLI). If collective is increased too much, the rotor speed will decrease, reducing tail rotor thrust and increasing yaw to the left.'*

Both the first and second factors applied in the case of G-FICH. The application and maintenance of full pedal has been shown by the manufacturer to stop the rotation.

The manufacturer publishes a Flight Instructors Guide which gives details of the most common flight training exercises and guidance on how they should be carried out. The guidance was developed based on its experience of training pilots and analysis of previous accident reports. The guide includes an exercise in recovery from a high rate of left yaw. The aim of the exercise is to demonstrate the high authority of the tail rotor, for the pilot to appreciate the position of full right pedal and to build a reaction in case of loss of control in yaw to the left. The commander had received training in recovering from high rates of yaw both in the classroom and as part of his airborne instructors training based on the guidance from the manufacturer.

Aircraft examination

The helicopter was examined by the AAIB at the maintenance organisation. The tail rotor driveshaft was bent but free to rotate. The damage to the fenestron shroud indicated that the fenestron had been rotating at impact. The yaw pedals were free to move full right and full left and nothing was found that would have caused a temporary restriction. Actuating the pedals moved the tail rotor control rod that had been disconnected from the tail rotor control unit after the accident. When the tail rotor control unit was actuated, the fenestron blades rotated to their specified positions for full left and right pedal. The tail rotor driveshaft has an adjustable rod eye-end that connects to the tail rotor control unit. As this part had been removed it was not possible to confirm the correct length adjustment. If the length is not adjusted correctly the pedals can reach their stop before the tail rotor control unit reaches its stop.

Engine compression checks did not reveal any issues and there were 72 litres of fuel on board.

Maintenance history

The helicopter was manufactured in 2015 and had accumulated 4,862 hours at the time of the accident. The last 50-hour maintenance check had been completed on 22 September 2024. The only defect noted during this check was the map bag touching the Emergency Locating Transmitter test switch – this was rectified. The last disconnection of the tail rotor control rod was during the 2,200-hour maintenance check which was completed on 25 January 2024. The helicopter had been operated for 465 hours since this maintenance and, according to the flying training school, instructors regularly checked that full yaw travel could be reached by rotating the fenestron blades by hand and checking the travel against the 'shroud marks' on the fenestron shroud during their pre-flight checks (Figure 5).

Footnote

[4] In ground effect.

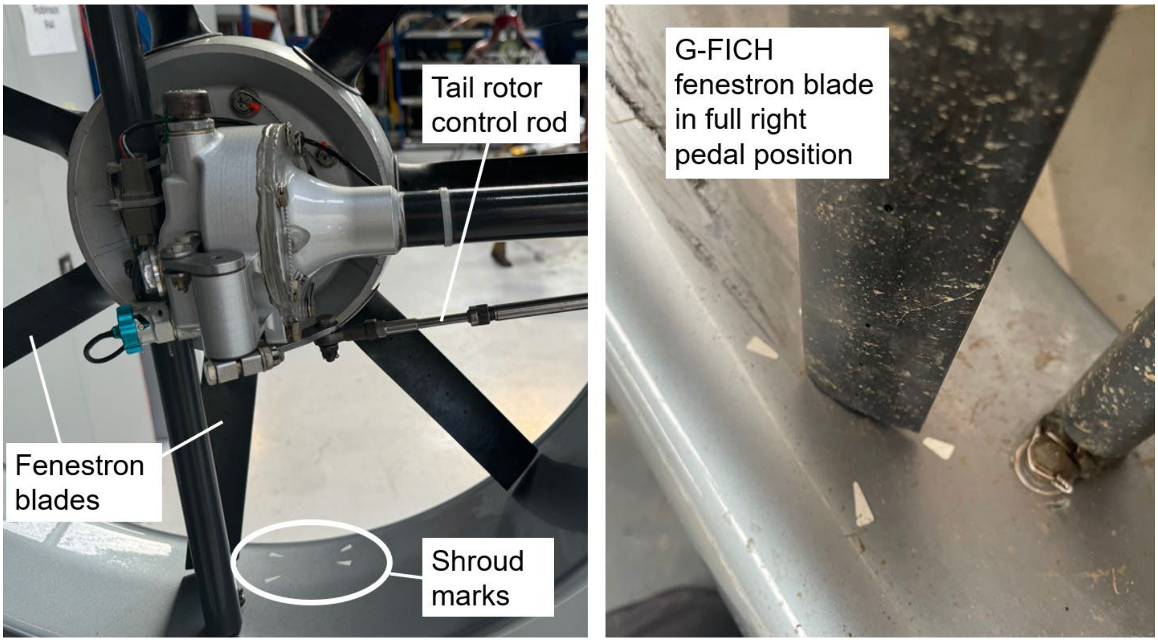

Figure 5

Shroud marks (left image) and fenestron blades aligned with the shroud mark for full right pedal on G-FICH (right image)

The pre-flight check list in the Flight Manual[5] contained a tail rotor blades condition and slack check, but it did not contain a check of the blades against the shroud marks. As a result of the findings of this investigation, the aircraft manufacturer plans to add the following pre-flight check in the next revision of the Flight Manual:

'Tail rotor blades max pitch…………………Aligned with shroud marks'.

Survivability

Neither occupant of the helicopter was seriously injured in the accident. The student sitting in the right seat reported that he had a sore lower leg, but the commander reported no injuries. The helicopter was fitted with stroking seats and skids designed to absorb vertical deceleration energy but neither mitigated any risk in this accident as the helicopter struck the ground on its side.

Personnel

Commander

The commander was a newly qualified instructor having completed his course and assessment at the beginning of August 2024. He had completed 28 hours of instructing before the accident flight. These instruction sorties covered the PPL (H) syllabus and had included hovering and airfield work. The commander was listed in his CAA medical information as being 169 cm tall[6].

Footnote

5 Cabri G2 Flight Manual Issue 11.
6 No other anthropometric data was available to the AAIB for the commander.

During flying training for his UK helicopter licence with the operator, the commander would have flown in the right seat. All of the operator's helicopters of this type had adjustable pedals fitted on the right side but only one had them fitted to both sides. He completed his instructor training at another operator where the helicopter he flew had adjustable pedals fitted on both sides. His instructor during this course commented that the commander preferred to fly with the pedals adjusted so that they were in the position closest to him. It is likely that on returning to the operator once his instructing course was completed, he would then have been flying with the non-adjustable pedals for the first time. Before he began instructing students, the commander completed a check and standardisation flight with the operator's training staff and no difficulties were noted in achieving full pedal travel from the left seat.

In a report submitted to the operator immediately after the accident, the commander recalled that whilst the student was moving forward slowly in the hover, the helicopter started to yaw to the left. The commander recalled taking control as it passed 90° of rotation and applying full right pedal, but this did not stop the yaw. He stated that he raised the collective slightly to keep the helicopter off the ground and attempted to increase the forward speed, but the rotation continued. After four complete rotations the skids touched the ground, and the helicopter rolled over. The commander had also discussed with a third party that the rotation rate increased with each rotation.

Student

The student had commenced his helicopter flying more than two years previously and for various reasons had not flown since July 2022. He was restarting his PPL training, and this flight was a refresher on the lessons completed so far and a chance for him to re-familiarise himself with the helicopter and the flying environment. He had completed 11 hours of flying before the accident flight.

The student recalled that he had completed around ten minutes of hovering exercises on the airfield when the helicopter suddenly yawed to the left. He stated that after the commander took control, he immediately removed his hands and feet from the controls.

Human factors considerations

Although the need for positive yaw control in the helicopter type is well understood and well-practised, if a significant yaw rate suddenly occurs, for whatever reason, it can lead to a delayed or insufficient reaction from a pilot who is not expecting it. The unexpected onset of an event such as a movement in a control axis can surprise[7] or startle[8] a pilot.

The helicopter completed four 360° rotations in less than 10 seconds with the rate of rotation increasing with each one. The manufacturer includes advice to pilots in a Service Letter that high rates of rotation '*can be very uncomfortable and disorienting for the pilot, and thus very dangerous at low height.*'

Footnote

[7] An emotional and cognitive response to unexpected events that are difficult to explain, forcing a person to change his or her understanding of the problem.

[8] A complex, involuntary reaction to a sudden unanticipated stimulus.

A pilot may often use complex motor programmes[9] to fly, just as a driver does for a road vehicle. These programmes are developed by repetition until they require little conscious thought. The commander had done almost all his flying on the helicopter type with adjustable pedals and flew with those pedals in the position closest to him. This would have meant his motor programmes for yaw control were probably based on foot positions used with the adjustable pedals in the closer position rather than those required in the left seat of G-FICH.

Other information

The operator conducted a flight using two qualified instructors in the same model of helicopter as G-FICH. This flight followed the guidance given in the Flight Instructors Guide for demonstrating recovery from high rates of left yaw. They allowed the helicopter to yaw left up to 360° by reducing the right pedal input whilst in the hover. Then full right pedal was applied to stop the rotation. The operator found that the rotation would stop within 40-50°, even after a complete 360° rotation. The manufacturer does not recommend allowing more than one complete rotation before recovery is commenced during training. Both instructors commented that the rotation was disorientating.

Analysis

The helicopter examination did not reveal any technical faults that could have caused or contributed to the accident. If the tail rotor control rod had been adjusted incorrectly it is likely that this would have been detected during a pre-flight check in the preceding nine months.

The reason the helicopter departed in yaw during the final stages of the flight was not established. It is possible that the increasing departure in yaw may have been made more likely by a handover of control to the commander, particularly if insufficient pedal had been applied to stop the helicopter continuing to yaw to the left. The wind direction would then have exacerbated the yaw as would any increase in collective pitch.

Full pedal travel was available to the commander, and flight trials by the manufacturer have shown that applying and maintaining full pedal will stop the rotation. The manufacturer has previously seen events where one pilot can accidently block the application of full pedal by the other pilot, but the student stated that he had immediately removed his feet from the pedals as soon as the commander had taken control. The commander may have inadvertently not applied full pedal, either due to a lack of familiarity with the full pedal position on the non-adjustable pedals, or because he could not easily achieve full right pedal in a natural position. It may also be that he applied full pedal but did not maintain it long enough to stop the rotation.

The yaw occurred rapidly and unexpectedly close to the ground. This could have startled the pilot which may have delayed the application of full pedal. The rate of rotation was also rapid which would have been disorienting, causing further challenges for any recovery.

Footnote

9 A set of co-ordinated movements and actions for completing a task that do not rely on conscious thought and feedback.

It was not determined why the accident flight was not recorded on the GoPro camera. While there was no requirement for the camera to be fitted to the helicopter, the operator had done so because it recognised the benefit of using recordings as a debriefing tool. Had a recording of the accident flight been available, it would have assisted the investigation in determining the cause of the accident.

Conclusion

Yaw control of G-FICH was lost during a hovering exercise. It is likely that full opposite pedal was not applied and/or held for sufficient time. This may have been because the commander was more familiar with flying using the adjustable pedals than those fitted on the left side of G-FICH. Whilst the commander was not injured in the accident, he died from an unrelated medical condition seven days later.

Safety actions

The aircraft manufacturer has agreed to install adjustable pedals on the left side as a standard fit on new models of Cabri G2.

The aircraft manufacturer has stated that it will amend the pre-flight checklist in the next revision of the Flight Manual to include a check that the tail rotor blades can be aligned with the fenestron shroud marks.

Published: 17 July 2025.

Accident

Aircraft Type and Registration:	Grob G109B, G-CHYB
No & Type of Engines:	1 Grob 2500-E1 piston engine
Year of Manufacture:	1985 (Serial no: 6372)
Date & Time (UTC):	27 August 2024 at 1545 hrs
Location:	A419 near Aston Down Airfield, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Serious)
Nature of Damage:	Aircraft damaged beyond economic repair
Commander's Licence:	Light Aircraft Pilot's License (Aeroplanes)
Commander's Age:	70 years
Commander's Flying Experience:	1546 hours (of which 170 were on type) Last 90 days - 20.5 hours Last 28 days - 4.5 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was on the late stage of final approach to Aston Down Airfield when it pitched down rapidly. The aircraft struck trees and then came to rest on the A419. Both those on board were injured and taken to hospital by the emergency services. The aircraft was severely damaged and the A419 was closed for several hours. The passenger, an experienced glider pilot, was flying the approach. The passenger's gliding experience meant that they would normally fly the approach with their right hand on the control column and their left hand controlling the rate of descent using the airbrake handle. Flying the Grob 109 from the right seat, this control arrangement was reversed. When attempting to reduce the rate of descent, the passenger inadvertently pushed forward on the control column which caused a rapid increase in the rate of descent which could not be corrected before the aircraft struck the ground.

History of the flight

The pilot, who was also the owner of the aircraft, was intending to sell a share of the aircraft and was flying to demonstrate it to a prospective buyer. The pilot arrived at Aston Down Airfield at 1130 hrs, took the covers off, cleaned and refuelled the aircraft. He refuelled with super unleaded automotive petrol, adding around 20 litres to give a total of 40 litres on board. The aircraft is a Grob 109B Touring Motor Glider (TMG) which is kept rigged at the airfield. The pilot completed the Daily Inspection.

The pilot then started the aircraft and took off with the prospective buyer on board. They flew to Enstone Airfield and back, then did some general handling, flying for around one hour. The buyer and their partner were well known to the pilot, after the first sortie the pilot offered the partner a flight to experience the aircraft. This second passenger is a very experienced glider pilot and instructor, with over 8,000 gliding hours but no experience of powered aircraft. The pilot and passenger had a brief discussion before departing and the passenger stated he told the pilot, “I am not a power pilot.”

They departed from the grass runway at Aston Down and flew to the south of the airfield to carry out some general handling. During this the pilot allowed the passenger to take control of the aircraft. The passenger was in the right seat, so for this phase of flight had his right hand on the control column and his left hand on the engine controls. After around 20 minutes the aircraft returned to Aston Down and positioned for an approach. The passenger stated that he had no intention of trying to land the aircraft. However, he continued to fly through the turn onto final approach with his right hand on the control column. The intent was to make an approach in gliding mode, with engine at idle power and the rate of descent (ROD) controlled by the airbrakes. The airbrakes are operated by a lever on the sides of the cockpit, so for the passenger in the right seat the control was to his right. After the final turn he swapped his left hand to the control column and operated the airbrakes with his right hand. The approach was made at an airspeed of 60-70 kt.

The pilot made no effort to take control from the passenger nor did the passenger say to the pilot “you have control”. The wind was 220° at 15 gusting 20 kt so there was some turbulence on the final approach. At approximately 100 ft agl the passenger felt the aircraft was too low on approach and believed he took corrective action. However, the aircraft pitched down rapidly and struck trees one and half seconds later. The aircraft then came to rest on the A419 which runs along the north side of Aston Down Airfield.

The pilot was able to get out of the aircraft, but the passenger was extracted by ambulance paramedics. Both the pilot and passenger were taken to hospital by the emergency services. The pilot had sustained only minor injuries and left hospital later that evening. The passenger suffered a spinal injury and required surgical intervention, spending several days in hospital.

Accident site

The accident occurred during a final approach to the grass runway parallel to and west of tarmac Runway 21 at Aston Down (Figure 1).

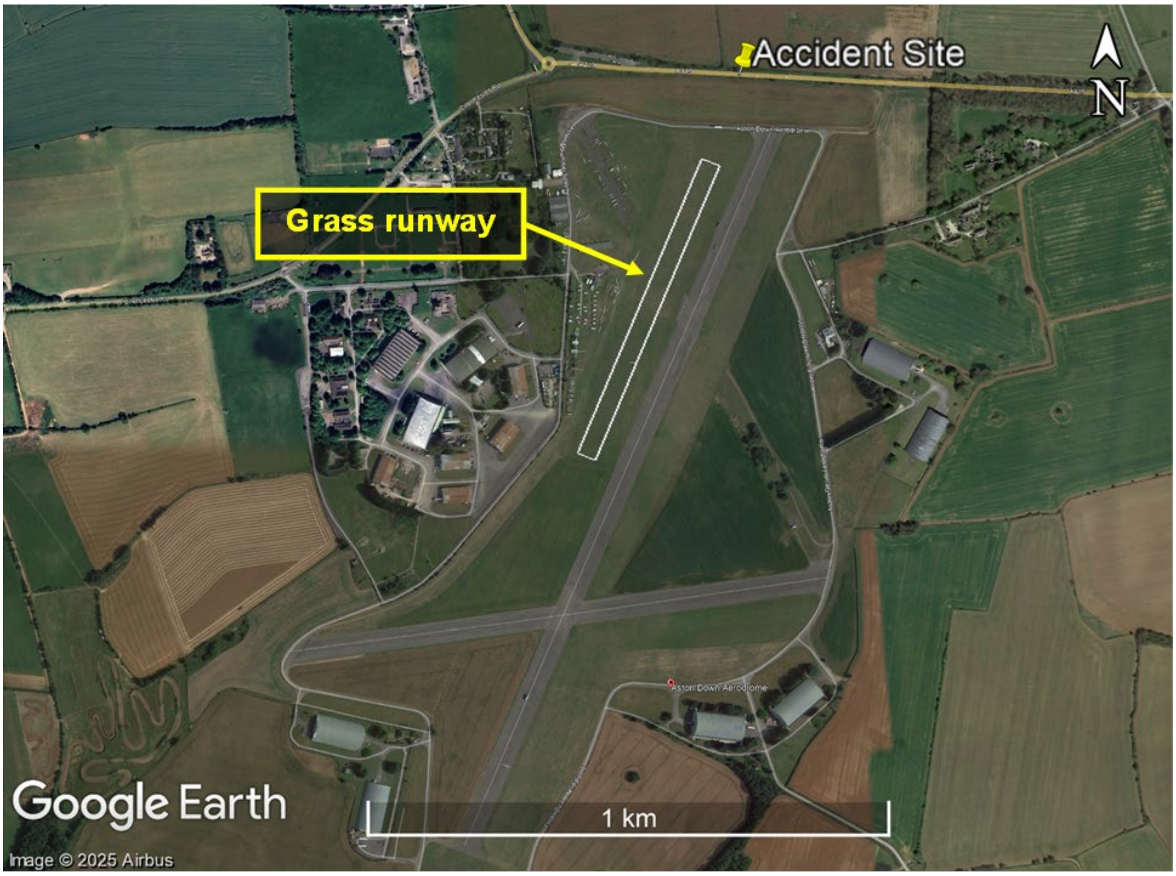

Figure 1

Aston Down Airfield
© 2025 Google, Image © Airbus

After striking the trees, the aircraft came to rest on the carriageway of the A419, blocking the road for several hours.

Recorded information

A PowerFLARM unit and PilotAware Rosetta were recovered from G-CHYB. Data from the accident flight was downloaded from the PowerFLARM's onboard memory.

Although no data was recorded on the Rosetta unit, multilaterated ADS-B data was recorded by a ground server, which captured most of the flight up until the base turn. This data was consistent with the FLARM recordings. Radio exchanges at Aston Down were not recorded, nor were they required to be.

FLARM logs

The PowerFLARM logged GPS position and pressure altitude once per second. The last recorded position was about 275 m short from where G-CHYB came to rest. FLARM logs from a glider tracking website also contained the GPS data, and, although at a lower sample rate, included two additional data points time-stamped after the PowerFLARM recording ended. It was not determined why the PowerFLARM recording stopped prematurely.

Figure 2 shows the groundspeed and altitude data from these data sources. The recorded groundspeed shortly before the accident corresponds to a calculated airspeed of about 60 kt based on the forecast wind conditions (see *Meteorology* section).

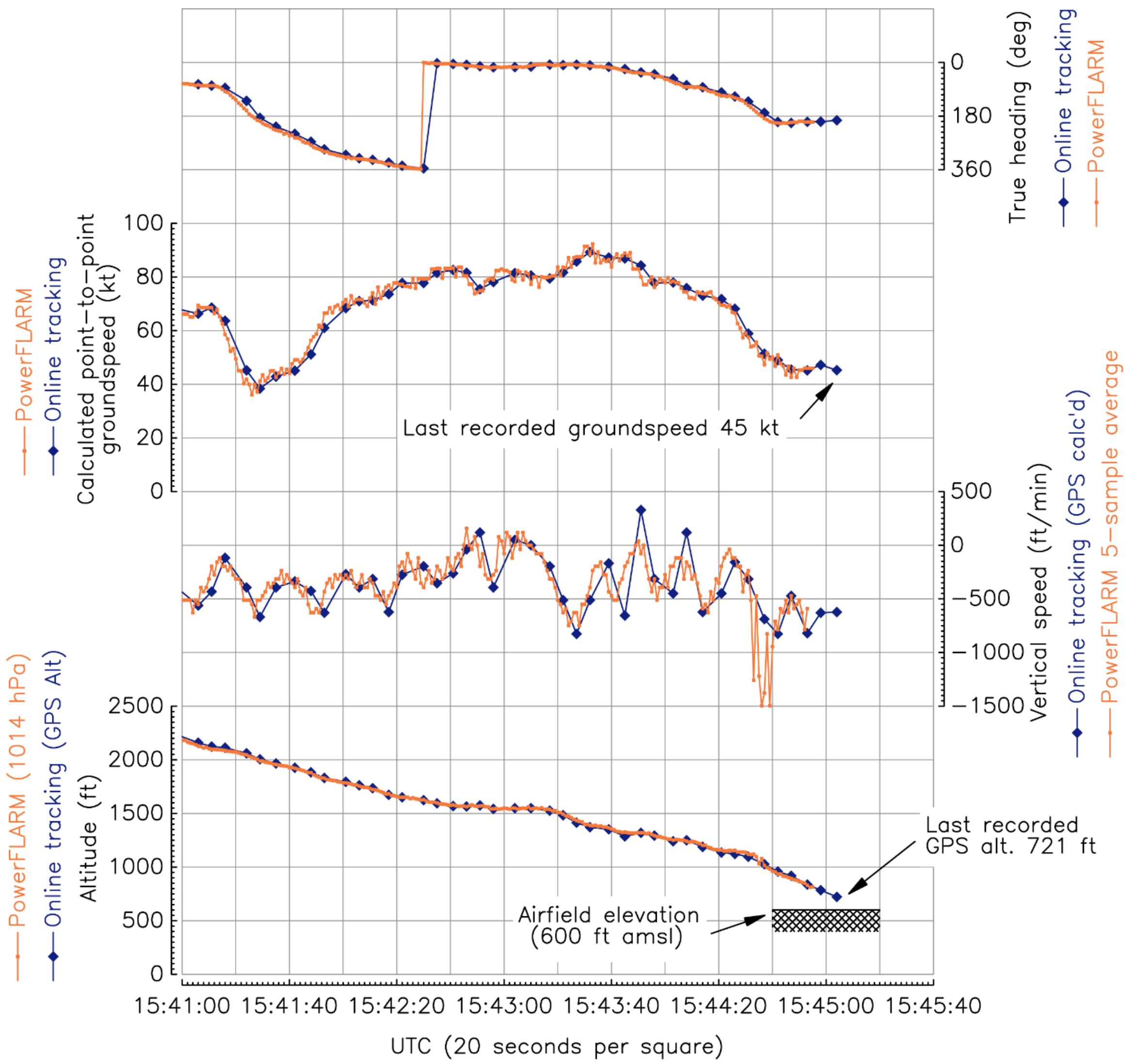

Figure 2

Pertinent parameters recorded during G-CHYB's base turn and approach

CCTV

A security camera captured the final seconds of the flight. G-CHYB became visible in the video just before it was seen to pitch down steeply. Figure 3 illustrates a composite image of frames taken at 0.25 second intervals from when G-CHYB became visible in the video.

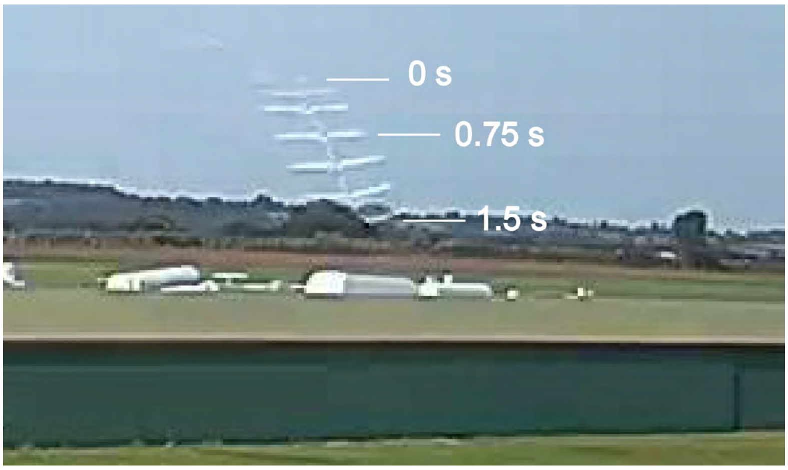

Figure 3
Composite image showing G-CHYB as it descended towards a tree beside the A419

Aircraft information

The Grob 109B is a 2-seat side-by-side low wing touring motor glider (Figure 4).

Figure 4
Grob 109B

The aircraft has side-by-side seating and dual controls. Each seat has a control column located centrally in front of the pilot. Engine and propeller controls are on the centre console of the cockpit. The airbrake controls are outboard of each seat (Figure 5). When in powered flight the operating pilot uses the control column and the engine/propeller controls. The engine is normally left to run at idle when in gliding mode, while the pilot uses the control column and airbrake to control the aircraft. As a result of this arrangement pilots are required to change hands on the flying controls when changing from powered to gliding flight. A modification is available for the aircraft to add an additional throttle control to the left side of the instrument panel which allows the left seat occupant to operate the airbrakes and engine controls without changing hands (Figure 5). However, this modification was not fitted to the accident aircraft and it does not change the control configuration for the right seat occupant.

Figure 5
Cockpit control positions

In most unpowered gliders the controls are arranged so that the pilot's use their right hand on the control column and operate the airbrake with their left hand. Unpowered two seat gliders typically have an in-line cockpit arrangement, rather than side-by-side, so the control layout is the same regardless of which seat the handling pilot is operating from. However, the side-by-side arrangment in G-CHYB meant that the pilot in the left seat would have the normal arrangement of gliding controls, while the pilot or passenger in the right seat would have the controls in opposite hands.

The airbrake system has an over-centre lock to stow the airbrake surfaces, which requires a notable physical input to overcome. When partially deployed, the aerodynamics of the aircraft tend to draw the airbrakes further out and so a relatively high input force is required to retract them. The airbrake control is therefore heavier to operate. In comparison the forces required on the control column are low. In operation, aft movement of the airbrake lever extends the airbrake surface on the wing and so increases the ROD.

Aircraft examination

The aircraft came to rest on a busy main road, resulting in significant disruption to traffic. To alleviate this as quickly as possible, permission was given for the aircraft to be recovered prior to the arrival of the AAIB. The wings and horizontal stabiliser of the glider were removed in order to transport it back to the gliding club's hangar. As such, control continuity could not be independently checked, but witnesses who conducted the disassembly, stated that the flying control connections were all normal and fully engaged.

The fuselage tail section and right wing were severely damaged in the ground impact sequence, along with the landing gear and cockpit canopy. This damage was consistent with contact with trees and the stone wall at a high rate of descent at impact.

Meteorology

Aston Down has no facility to record meteorological data, so the Met Office were asked to review the conditions for the area. A ballooning forecast had been prepared for the south-west region. The extract from the ballooning forecast stated:

> *'The forecast details for Malmesbury, approximately 12 miles south of the area of interest, was extracted from the afternoon Ballooning Forecast for the South West region. This is showing forecast surface winds to be around 13 knots at the time of the incident, with 21 knots at 500 FT and 23 knots at 1000 FT.'*

Malmesbury is at a similar elevation to Aston Down reported:

> *'The afternoon of the 27th August 2024 saw generally settled conditions with good visibility and Few amounts of cloud above 4000 FT across the area of interest. To the west of the area surface winds were generally light however they were slightly stronger in the east as shown by the observations from RAF Fairford. In addition to this the forecast conditions for a site close to the incident site is showing stronger winds above the surface. Due to the height of Aston Down, it is reasonable that the surface winds, would be similar to the forecast winds at Malmesbury, which is at a similar height.'*

The wind direction was from the south-west. Weather is not considered to have been a factor in the accident.

Personnel

Only the pilot of G-CHYB had a licence for powered aircraft, but both of those aboard were experienced glider pilots and gliding instructors. They had not previously flown with each other. The passenger had a significant profile within the gliding world and was well known to the pilot. The passenger had around 8,000 hours of glider experience.

There was no briefing about the handling of the aircraft prior to departure as the pilot stated he "was not acting as an instructor". Once airborne the pilot offered the passenger control and stated that the passenger "wanted to fly". The pilot described the passenger as handling the aircraft well. Away from the airfield the passenger flew the aircraft with his right hand on the control column and his left on the engine/propeller controls.

The intent was to make the final approach to land with the aircraft being operated in glider mode. In glider mode the pilot controls airspeed with pitch and ROD using the airbrakes. As the right seat airbrakes are mounted on the cockpit wall, a pilot in that seat operating in glider mode would have their left hand on the control column and their right hand on the airbrake. Most gliders are operated with the airbrake in the pilot's left hand and the control column in the right hand.

The passenger stated that he has flown 140 types of gliders, and that all had the "conventional" configuration of controls saved for the right seat of the Grob 109 and the Slingsby T21. The passenger owns a share in a Slingsby T21 which he stated he routinely flew from the left seat. The T21 has differing airbrake controls but the passenger did have some experience of flying with his left hand on the control column.

Left and right seat operations

The Pilots Operating Handbook for the Grob 109 states that for solo flights the aircraft must be operated from the left seat. In this event with two on board, the pilot in command was in the left seat. The passenger who was handling the aircraft had no experience of operating the Grob 109 from the right seat. Although he was an experienced glider pilot, he was more familiar operating aircraft with the air brakes in his left hand.

There is no established training requirement either in the British Gliding Association (BGA) guidance or CAA regulations for training pilots before operating from the right seat.

Analysis

The aircraft was being flown by the passenger in the right seat. Away from the airfield the passenger flew the aircraft with his right hand on the control column and had the engine controls in his left hand. Having the control column in his left hand was the configuration most familiar to the passenger and he did not have any difficulty operating the aircraft. The intent was to make the approach operating the aircraft in gliding mode so as the aircraft neared final approach, the passenger swapped hands so that his left hand was on the control column and his right hand was on the airbrakes. The passenger was controlling ROD with airbrake and airspeed with pitch, which is usual for an approach in a glide. He has significant experience of flying gliders, so the control principle was familiar to him. However, the passenger had limited experience of operating with the control column in his left hand and no previous experience of operating a Grob 109 from the right seat. His established practice would therefore have been to make control adjustments to pitch with his right hand and adjustments to ROD with his left hand. If the aircraft was low on approach the required adjustment from a pilot would be to reduce ROD by retracting airbrake and then to compensate for airspeed by slightly raising the pitch attitude. This would require a firm push on the airbrake control and a small input on the control column.

In this event, as the aircraft reached approximately 100 ft agl the pilot felt he was somewhat low on approach and intended to make control inputs to reduce the ROD. It is likely that the strong habits formed by his experience caused him to make the intended inputs on the incorrect controls, so he pushed firmly with his left hand expecting that to retract the airbrake while pulling back with his right hand to raise the pitch attitude. The outcome was that the aircraft pitched down rapidly, and more airbrake deployment increased the ROD. Both those on board were surprised by the rapid pitch down and did not immediately recognise the cause. It is probable that both suffered a startle response and were unable to take appropriate corrective action in the timeframe available. The aircraft struck the trees alongside the A419 approximately 1.5 seconds after the pitch down began.

The passenger believed that the pilot should not have allowed him to fly the approach. The pilot has stated that he did intend to take control for the landing but that the passenger initiated the pitch down before he did so. It would have been appropriate for the pilot to fly the approach but given the public profile and acknowledged experience of the passenger within the gliding community, the pilot believed the approach was within the expertise of the passenger. Had he felt uncomfortable with the handling of the aircraft the passenger had the opportunity to relinquish control, but he did not do so.

No evidence was identified of a contributory technical problem with the aircraft.

Conclusion

Inappropriate control inputs as a result of the passenger's lack of experience operating the Grob 109 from the right seat caused a rapid pitch down from approximately 100 ft agl. Neither of those aboard was able to take corrective action in the short time available and the aircraft struck trees adjacent to the A419 road before coming to rest on the carriageway. The pilot suffered only minor injuries, but the passenger was seriously injured. The aircraft was damaged beyond economic repair.

Published: 17 July 2025.

AAIB Correspondence Reports

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

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

The accuracy of the information provided cannot be assured.

Accident

Aircraft Type and Registration:	Aeroprakt A32 Vixxen, G-RASP
No & Type of Engines:	1 Rotax 912iS piston engine
Year of Manufacture:	2023 (Serial no: LAA 411-15841)
Date & Time (UTC):	20 June 2024 at 1015 hrs
Location:	Near Northrepps (Cromer) Airfield, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Substantial damage to airframe and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	69 years
Commander's Flying Experience:	1,711 hours (of which 32 were on type) Last 90 days - 70 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During a second approach to land at Northrepps (Cromer) Airfield, G-RASP encountered turbulence, which resulted in unexpected sink on short finals and caused the aircraft to land heavily on its nosewheel. Following the subsequent baulked landing go-around the pilot realised the rudder pedals were jammed and ascribed it to damage sustained at touchdown. Unsure of the consequences of trying to land on a hard runway with a compromised nose landing gear, and unwilling to use the aircraft's ballistic parachute in a pre-meditated way, the pilot elected to carry out a precautionary landing in a field of corn. After touchdown, however, the landing gear caught in the corn and the aircraft came to rest inverted. Both occupants were able to self-evacuate from the aircraft.

History of the flight

The aircraft took off from Nottingham City Airport with the pilot and passenger on board for a flight to Cromer Northrepps Airfield (Cromer) in Norfolk. The pilot was familiar with Cromer having landed there "many times" before. The surface wind was easterly at 8 kt so the aircraft was positioned for a straight-in-landing on Runway 04. As the aircraft passed over trees in the runway undershoot it experienced turbulence, which destabilised the approach. The pilot flew a go-around and repositioned for a second attempt on Runway 04.

The pilot reported that turbulence was again encountered on the second approach, "but this time it caused the aircraft to descend rapidly." He applied power and rudder in an attempt to correct the disturbance but was not able to stop the aircraft landing heavily on its nosewheel. The pilot then initiated a baulked landing go-around during which he found the rudder pedals were jammed and he could not move them.

The rudder restriction appeared immediately after the heavy nosewheel-first landing so, given G-RASP had a steerable nosewheel connected by pushrods to the rudder pedals, the pilot deduced that damage to the steering assembly was preventing him from moving the rudder pedals.

The pilot considered diverting to an airfield with a longer and more in-to-wind runway but was concerned that any damage to the nose leg could lead to it collapsing on touchdown, with unpredictable consequences. While the aircraft was equipped with a ballistic parachute recovery system, the pilot said he was unwilling to use it in a pre-meditated way because the outcome would be "unknown." At this point his passenger was becoming increasingly distressed, so the pilot elected to conduct an immediate precautionary landing on the "softest soil and springiest crop" that he could find. He identified a corn field nearby and landed aligned with the furrows, using full flap for the approach. Just before touchdown he turned the fuel and battery master switches off and landed as close to the stall as he could. After touchdown the aircraft came to rest inverted (Figure 1). Both occupants were able to self-evacuate from the aircraft with only minor injuries.

Figure 1

G-RASP inverted after landing in crop field.

Accident pilot's observations

The pilot stated that, having experienced it earlier, he was expecting turbulence over the trees on the second approach but was caught out by the associated sink, which had not been a feature of the first approach. Despite the sink, the pilot judged at the time that increasing power would be sufficient to correct the approach path, hence he continued to land rather than initiating a second go-around.

Despite the aircraft coming to rest inverted, the pilot considered that landing as slow as possible in the corn field had achieved a more predictable and safer outcome than using the ballistic parachute system or diverting to an airfield with a tarmac or concrete runway.

Accident

Aircraft Type and Registration:	Europa, G-CBWP	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2002 (Serial no: PFA 247-12930)	
Date & Time (UTC):	1 March 2025 at 1500 hrs	
Location:	East Kirkby Airfield, Lincolnshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damaged beyond economical repair	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	62 years	
Commander's Flying Experience:	53 hours on type Last 90 days - 6 hours Last 28 days - 2 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

Synopsis

During a flight to East Kirkby Airfield, which was an unfamiliar location to him, the pilot found that the geographical features of the airfield were visually similar to surrounding fields. Whilst on the approach, the pilot believed he became focussed on his approach speed at the expense of maintaining his position in relation to the glidepath. He landed in a rough field short of the runway threshold and attempted to go around but had insufficient speed to takeoff again. He tried to steer away from a hedgerow ahead but clipped the right wing, spinning the aircraft nose into the hedge. The pilot was uninjured, but the aircraft was damaged beyond economical repair.

History of the flight

The pilot had planned a flight from Full Sutton to East Kirkby Airfield but was unfamiliar with the destination. He checked the information in an airfield guide, checked the TAF and METAR for Humberside, and set off in good weather conditions. On the approach, the pilot called on East Kirkby's Safetycom frequency but received no reply. The pilot had difficulty identifying the airfield as there was a cluster of similar green fields at the location and the runways did not stand out. He made a pass over the area at 500 ft and eventually noticed the different shades of green which marked the runways on the airfield. There were no runway numbers or windsock visible. From a circuit height of 500 ft, he aligned the aircraft with what he believed was Runway 26. He landed but found the grass surface was very rough, at which point he realised he had landed in a field short of the runway threshold. He attempted a go-around but there was insufficient room to achieve the necessary takeoff speed. He steered left, to avoid the hedge ahead (Figure 1), but clipped the right wing which spun the aircraft into the hedge. The pilot was uninjured.

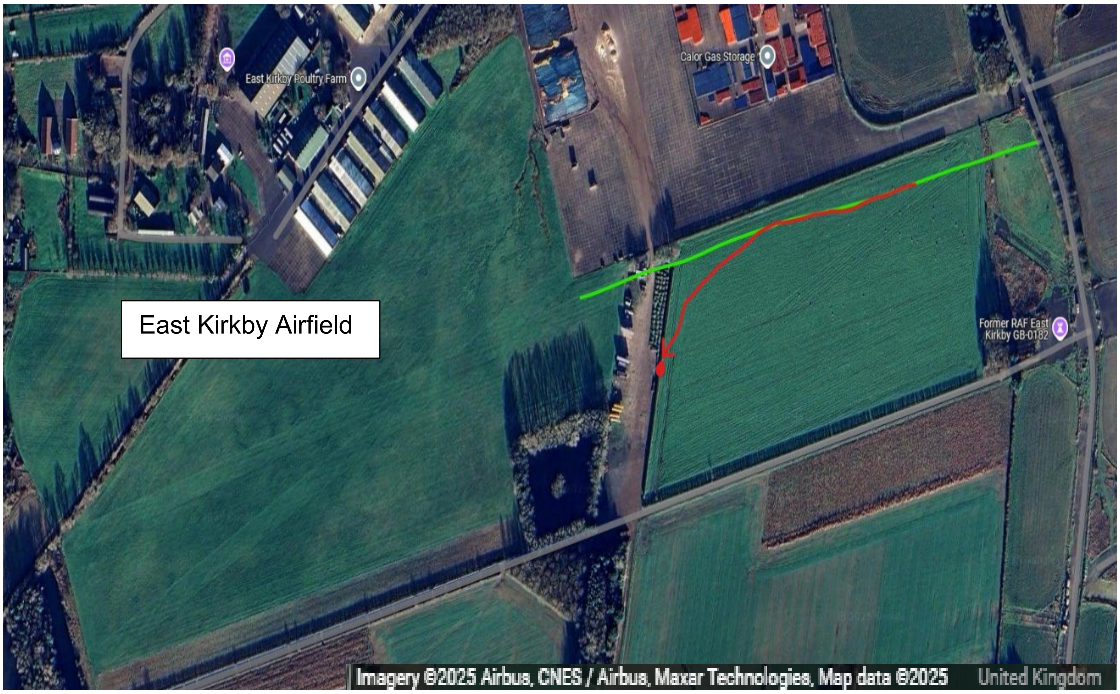

Figure 1

East Kirkby Airfield showing landing direction (green) and path of the aircraft (red)

Accident site

The aircraft was recovered from the accident site (Figure 2) but was subsequently assessed as beyond economical repair, due to extensive damage to the mounting structure of the wings.

Figure 2

G-CBWP after it had come to rest

Aerodrome information

East Kirkby Airfield is the former RAF East Kirkby Aerodrome site and has two unlicensed grass strip runways. The concrete runways can still be identified but are not in use, with trees and buildings covering much of the former runway surfaces. There is an LPG storage and cylinder recharge site on a large concrete area to the north-east of the airfield, at the threshold of Runway 24. There is also an aviation heritage centre to the north, adjacent to the airfield.

Analysis

The pilot stated that he was unfamiliar with the layout of the airfield and was confused by the surrounding fields, which looked approximately the same size and colour as the airfield, and the perimeter vegetation was very similar. He could not identify any of the features of an airfield that he would normally expect to see, such as a control tower, other aircraft, hangars, runway numbers or windsock. The low circuit height also contributed to his confusion, because at that height, the airfield runways appeared even more indistinguishable from the surrounding fields. With the benefit of hindsight, the pilot considered that had he looked at an overhead satellite view of the airfield prior to the flight, he may have been able to identify key geographical features to assist in identifying the airfield and the appropriate approach path.

He also stated that the Europa monowheel aircraft can be difficult to land, so he had to "concentrate fully" on achieving the correct approach speed. The pilot believed that whilst concentrating on the approach speed, it was at the expense of maintaining awareness of his position in relation to the runway and glidepath.

Conclusion

The aircraft landed in a field short of the runway threshold because the pilot was unable to distinguish the runway from the surrounding fields. On the approach, he did not maintain awareness of his position relative to the glidepath, because he was focussed on his approach speed.

Serious Incident

Aircraft Type and Registration:	Piper PA-28-181, G-JACS	
No & Type of Engines:	1 Lycoming O-360-A4M piston engine	
Year of Manufacture:	1997 (Serial no: 2843078)	
Date & Time (UTC):	27 April 2025 at 1400 hrs	
Location:	Fowlmere Aerodrome, Cambridgeshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Minor)	Passengers - N/A
Nature of Damage:	Propeller destroyed and engine shock-loaded. Damage to engine cowling, right and left wings. Building stuck by the aircraft also damaged	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	72 years	
Commander's Flying Experience:	219 hours (of which 153 were on type) Last 90 days - 3 hours Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft's engine started at an unexpectedly high power setting, caused by the throttle being set excessively open. The pilot manoeuvred the aircraft but did not retard the throttle or apply the brakes, and it struck a building. This accident highlights the importance of correctly following the aircraft's checklist and also the need to anticipate an unexpected outcome during a routine task such as starting the engine.

History of the flight

The pilot reported that following completion of the pre-flight checklist and with the parking brake engaged, he twice tried to start the engine without success. He sought assistance from a maintenance engineer, who after rotating the propeller suggested the pilot attempt a further engine start. The pilot recalled setting the throttle to ¼ open, which he stated was required by the aircraft's checklist.

The engine started and immediately ran at high power. The pilot's attempts to apply the toe brakes and parking brake were unsuccessful and the aircraft, having completed a 180° right turn followed by a left turn, struck a building (Figure 1). The engine stopped on impact and the pilot, who was wearing the three-point harness, received minor injuries to his left elbow and forehead.

Figure 1
G-JACS after the accident

Aircraft information

The aircraft's checklist was reviewed following the accident and the pre-start section included checking the throttle for full and free movement, before setting it to ¼ inch open.

Full throttle movement on a PA-28 was measured by the AAIB and found to be approximately 2 inches. Setting the throttle open to ¼ of its operating range would therefore result in approximately twice the setting required by the pilot's checklist.

The aircraft's braking system was inspected after the incident and both the parking brake and toe brakes were found to function correctly.

Analysis

The unexpectedly high-power level delivered by the engine once it had started was due to the throttle lever being set further open than required by the aircraft's checklist. It is possible that this may have been caused by the pilot setting the throttle to ¼ open, rather than ¼ inch open as required by the pre-start checklist.

It is also likely that the parking brake was not fully applied, as the aircraft started moving immediately after the engine had started and the braking system was found to work correctly following the incident.

The pilot's inability to bring the aircraft to a stop may have been due to a combination of startle, following the unexpected movement of the aircraft, and his prioritisation of steering the aircraft over retarding the throttle and application of the toe brakes.

This incident highlights the importance of correctly following the aircraft checklist and also the need to anticipate an unexpected outcome during a routine task such as starting the engine.

Conclusion

The throttle was set excessively open prior to engine start, resulting in an unexpectedly high-power setting when the engine started. It is likely that the parking brake was not fully applied, allowing the aircraft to move following the engine start. The pilot did not retard the throttle or apply the brakes, and the aircraft struck a building, causing minor injuries to the pilot and significant damage to the aircraft and building.

Serious Incident

Aircraft Type and Registration:	Piper PA-24 Comanche, D-EKKE
No & Type of Engines:	1 Lycoming IO-540 piston engine
Year of Manufacture:	1958 (Serial no: 24-469)
Date & Time (UTC):	14 March 2025 at 1734 hrs
Location:	Solent Airport, Hampshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Collapsed undercarriage, damage to underside of fuselage and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	56 years
Commander's Flying Experience:	2,137 hours (of which 65 were on type) Last 90 days - 8 hours Last 28 days - 3 hours

After a short local flight, D-EKKE was on approach to Runway 05 at Solent Airport when the landing gear light did not illuminate when the gear was selected DOWN. After several attempts to lower the landing gear normally, the pilot used the emergency procedure and the control tower visually confirmed the landing gear was down. The pilot recalls hearing the gear lock on extension and so continued with a normal landing. The aircraft touched down but during the latter stage of the landing roll the landing gear slowly collapsed and the aircraft slid on its underside for approximately 100 m. The pilot and passenger exited the aircraft unaided and without injury.

Accident

Aircraft Type and Registration:	Westland Wasp HAS1, G-CMBE
No & Type of Engines:	1 Rolls Royce Nimbus 10301 turboshaft engine
Year of Manufacture:	1966 (Serial no: F9664)
Date & Time (UTC):	15 March 2025 at 1142 hrs
Location:	Marston Doles, Warwickshire
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Aircraft fuselage, main and tail rotor impact damage
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	5,108 hours (of which 331 were on type) Last 90 days - 71 hours Last 28 days - 39 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

An instructor and student pilot were carrying out pre-flight checks. One of the checks required the deselection of the hydraulic system to ensure mechanical flying control continuity and freedom of operation in the correct sense. As the instructor selected the hydraulic system OFF[1], the collective lever 'jumped' upwards and the aircraft lifted into the air. The instructor was unable to regain control and the helicopter struck the ground and rolled over. The cause of the abnormal collective movement could not be positively determined but a transient system malfunction could not be ruled out.

History of the flight

An instructor was preparing for a routine instructional type rating flight with an experienced rotary wing pilot. They were running through the post engine start pre-flight checks with the rotors running. One of these checks required the hydraulic system to be cycled OFF, to carry out an assessment of the flight control forces without hydraulic servo assistance. When completed the hydraulic system is selected back ON for flight. Immediately the instructor selected hydraulics OFF, the collective lever forcefully lifted taking the instructor by surprise.

Footnote

[1] Hydraulic system (HYD) selector switch on the collective is marked POWER/MANUAL. For simplicity the words ON/OFF are used in this bulletin report.

The helicopter became airborne to a height of 5 or 6 ft and ”lurched” forward and to the right towards a nearby hangar door. The instructor was unable to select the hydraulic system back ON but immediately attempted to regain control. The helicopter moved back away from the hangar and tipped rearwards causing the tail rotor to contact the ground. As this happened the main rotor hit the ground and the helicopter rolled onto its side. The instructor then shut down the engine and made the aircraft safe, after which he extricated himself and assisted the student to vacate the cockpit. The helicopter sustained severe main, tail rotor and structural damage during the accident.

Sequence of events

The instructor had carried out pre-flight checks on this helicopter numerous times before and was very familiar with its characteristics. When instructing, sitting in the left seat, he would move his hand from the collective to the cyclic control and with his right hand lean over to cycle the hydraulic system using the toggle switch on the collective lever next to the student in the right seat. Taking care to ensure the collective friction was applied and then to hold the collective down whilst operating the toggle switch with his index finger.

The forceful reaction of the collective on this occasion took him by surprise and he described how, with his right arm outstretched, he did not have the strength to lower the collective lever quickly enough and despite moving his hands rapidly back to his own controls was unable to regain control and land the helicopter.

Analysis

The instructor sought an independent technical assessment of the helicopter hydraulic system, flying controls and rotor head, which found no obvious evidence of system malfunction or component failure. However, it was found that the single piston hydraulic collective pitch servo jack was fully extended (Figure 1) after the accident. He considered that this may have been an artefact of the roll over and subsequent damage to the helicopter. This was plausible because the servo would not have been in hydraulic lock, therefore free to extend and retract, because the system had been set to OFF for the check. Nevertheless, it was unexpected.

Figure 1
Collective servo extension

He also consulted other Wasp and Scout helicopter pilots. In their experience, during this particular check, the collective lever was known to move upwards, but never more than a few centimetres. Its movement can easily be arrested by hand pressure. This matched the instructor's experience when regularly carrying out or demonstrating this check.

The abnormally forceful upward movement of the collective lever, immediately after the hydraulic system was selected OFF, and the post-accident position of the servo jack, suggest the possibility of a transient system malfunction.

Accident

Aircraft Type and Registration:	Chaser S 508, G-MVGG
No & Type of Engines:	1 Rotax 508 piston engine
Year of Manufacture:	1988 (Serial no: CH721)
Date & Time (UTC):	31 July 2024 at 1742 hrs
Location:	Near Trimdon, County Durham
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Damaged beyond economic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	40 hours (of which 280 were on type) Last 90 days - 0 hours Last 28 days - 0 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

After carrying out his pre-takeoff checks, including a check that the engine was able to produce full power, the pilot took off from Fishburn Airfield for a local flight. However, at about 300 ft aal, he reported that the engine misfired and lost power. In front of him was an electricity pylon, so he turned left and selected a field into which he could carry out a forced landing.

The approach was over the top of some trees which initially he thought he would clear. However, having lost height in the turn, he was unable to clear them and although he aimed for a small gap, the right wing clipped a tree and the aircraft fell to the ground. The pilot's smartwatch detected the impact and alerted emergency services, who attended the scene. The pilot sustained a broken wrist during the accident.

Accident

Aircraft Type and Registration:	Schleicher AS-K 13, G-DEVJ	
No & Type of Engines:	None	
Year of Manufacture:	1984 (Serial no: 13637AB)	
Date & Time (UTC):	7 April 2025 at 1305 hrs	
Location:	Lasham Airfield, Hampshire	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - 1 (Serious)
Nature of Damage:	None	
Commander's Licence:	Sailplane Pilot's Licence	
Commander's Age:	72 years	
Commander's Flying Experience:	23,000 hours (of which 1,500 were on type) Last 90 days - 28 hours Last 28 days - 20 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

History of the flight

The glider was being flown on an instructor revalidation flight and various manoeuvres had been completed before approaching to land. As the aircraft was about to land the pilot in command (PIC), acting as a student, performed a ballooned[1] landing. The instructor immediately took control. The glider then landed tailwheel first and de-rotated rapidly before coming to a stop. The instructor suffered a spinal injury during the landing and the PIC was uninjured. There was no damage to the glider.

Pilot's assessment

In assessing the causal or contributory factors, the PIC considered there were two main issues which led to this accident. Even though he initiated the landing anomaly and, being with an experienced and able instructor under revalidation, he anticipated an extended float across the airfield to land. He considers that he should have been quicker to intervene and ensure the airbrakes were closed, and remained closed, which would have prevented the rapid de-rotation.

He also felt that his pre-flight brief should have made it clearer that when he was roleplaying as the student, the instructor being revalidated must take care not to falsely assume he would fly to a high standard.

Footnote

[1] A sudden unwanted gain in height as the glider nears the ground on approach to landing.

AAIB comment

Instructor revalidation flights in sport or general aviation are vitally important in ensuring the safety of students and their instructors. However, it must be accepted that they introduce a slight increased risk of a mishap when an unexpected or unusual inject is made, particularly during the crucial phases of any flight.

Accident

Aircraft Type and Registration:	Tekever AR3
No & Type of Engines:	1 Desert Aircraft DA-35 engine
Year of Manufacture:	2024 (Serial no: 3144)
Date & Time (UTC):	19 March 2025 at 1222 hrs
Location:	Aberporth Airport, Cardiganshire
Type of Flight:	Training
Persons on Board:	Crew - None Passengers - None
Injuries:	Crew - N/A Passengers - N/A
Nature of Damage:	UA destroyed
Commander's Licence:	Other
Commander's Age:	27 years
Commander's Flying Experience:	176 hours (of which 2 were on type) Last 90 days - not known Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The UA was operating a daylight VLoS training flight from Aberporth Airport at a height of up to 400 ft in benign weather. Having been airborne for 19 minutes, the UA suddenly pitched down and banked sharply. It struck the ground, within the airport boundary, and a small lithium battery fire ensued which was quickly put out by the airport's fire service.

The manufacturer's safety department concluded that the most probable cause of the accident was the failure of a flight control servo. At the time of this accident, the commands received from the Ground Control System and the demands made to flight control servos were recorded but the actual positions that the servos then achieved were not. The manufacturer stated that it intends to modify the UAS to record a feedback signal for all flight control servos.

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 2025

22 Apr 2024 **Rotorsport UK MTOSport 2017** **G-CKYD** 10 miles south-east of Inverness Airport

During the third practiced forced landing (PFL) of the flight, with the aircraft set up for a 65 mph glide and the student in control, the aircraft began to yaw right, pitched nose up and slowed to 30 mph. The instructor took control but was unable to arrest the descent and the aircraft had a heavy landing. The instructor believed he did not intervene quickly enough and will review how he carries out training for PFLs in future.

20 Jun 2024 **Vans RV-8A** **G-RVBJ** Bolthead Airfield, Devon

The pilot landed on grass Runway 11 having used the windsock near the threshold to assess the wind as "a few knots" from the south. After a normal touchdown, the pilot began braking but became aware that the aircraft was still moving quickly. He applied maximum braking, and subsequently shut down the engine, but the aircraft veered left just before the end of the runway, struck a fence and came to rest. The pilot was uninjured although the aircraft sustained substantial damage. After securing the aircraft, the pilot noticed that the windsock at the eastern end of the airfield indicated a tailwind of approximately 4 to 6 kt.

14 Aug 2024 **Quikr** **G-CGWZ** East Fortune Airfield, East Lothian

The aircraft landed long and overran the end of the runway which caused the aircraft to spin 180° and become inverted. The pilot switched off the magnetos' and, after releasing their harness, was able to leave the aircraft unaided.

27 Nov 2024 **Pitts S-1C** **G-AXNZ** On RWY at Blackpool Airport

During the landing roll at Blackpool Airport, the aircraft started to turn left. The pilot reported he applied full right rudder but, because of the way his foot was positioned on the pedal, he could not apply sufficient right braking. The aircraft left the paved surface onto grass, and tipped onto its spinner.

3 Mar 2025 **Piper PA-28R-201** **G-CBZR** Wycombe Air Park, Buckinghamshire

While the student was conducting a glide approach, the instructor directed a go-around because he had anticipated a long landing. The student did not add power as expected for the go-around and the aircraft touched down firmly, then slewed left and exited the runway surface. The nose landing gear collapsed and the aircraft came to a stop on the grass. The aircraft had a known defect of a slowly deflating left tyre which may have contributed to the left slew on touchdown.

Record-only investigations reviewed: May - June 2025 cont

6 Mar 2025 **Rockwell Commander 114** **G-TWIZ** Lydd Airport, Kent

The pilot departed for night circuit practise 15 minutes before the airport closed but became disoriented on the downwind leg. After regaining situational awareness, he landed with the landing gear retracted, having omitted the pre-landing checks.

9 May 2025 **Thruster 450** **T600N** **G-CDDI** Grasby, Lincolnshire

After landing, the pilot applied a control input appropriate for a flex wing microlight and the aircraft tipped onto its nose damaging the propeller and nose cowl.

10 May 2025 **Mission M108** **G-STUZ** Shotteswell Airstrip, Warwickshire

During a normal landing the pilot lowered the nose of the aircraft and the nose landing gear collapsed. The pilot attributed the collapse to a failure of the nose wheel attachment bracket.

11 May 2025 **Jabiru UL-450** **G-LYPG** Baxby Airfield, North Yorkshire

After a normal approach the pilot flared a bit early and the main wheels contacted the ground leading to a bounce. The pilot stated that they were too slow in applying the throttle and the nose wheel struck the ground and folded under the aircraft. The left main landing gear also collapsed and the aircraft came to a halt on the runway.

15 May 2025 **Piper PA-28-161** **G-RIZZ** Cranfield Airport, Bedfordshire

During landing the right landing gear leg collapsed; the instructor took control of the aircraft from the student pilot and brought the aircraft to a controlled standstill on the runway.

20 May 2025 **Jodel DR1050** **G-ARXT** Wellesbourne Airfield, Warwickshire

Following the second landing on the grass runway, the aircraft yawed to the left. The pilot applied right rudder to try to counteract this but not sufficiently to prevent the left wing entering the standing crop. The aircraft yawed further left and came to an abrupt stop about 50 yards into the crop.

23 May 2025 **Tecnam P2002-JF** **G-TECI** Radley Farm Airstrip, Berkshire

In the latter stages of landing on Runway 20, the aircraft encountered sink and drifted left, which the pilot tried to correct. The aircraft touched down on soft ground and the nose landing gear collapsed. The pilot considered that wind effects due to the trees west of the runway had affected his approach.

Record-only investigations reviewed: May - June 2025 cont

13 Jun 2025 **MCR-01** **G-PGAC** Little Snoring Aerodrome

The aircraft suffered a brake failure which resulted in the aircraft not being able to slow and stop before the end of the runway. The aircraft ran off the end of the runway and into a ditch, between the runway and adjacent field, which caused the aircraft to pitch forward and become inverted.

14 Jun 2025 **Piper PA-28-151** **G-BTNT** Elstree Aerodrome

After a normal approach and touchdown, the left main landing gear collapsed shortly after landing and the aircraft skidded off the runway.

15 Jun 2025 **Cessna T206H** **G-NIME** Private field, near Whitby, Yorkshire

The aircraft struck a ridge in the runway while landing which resulted in the propeller striking the ground and the nose landing gear strut buckling.

16 Jun 2025 **Ikarus C42 FB80** **G-CEHV** White Ox Mead Airfield, Somerset

After a normal approach the aircraft made a hard landing which resulted in the left landing gear collapsing. The aircraft came to a halt at the edge of the runway.

18 Jun 2025 **Ikarus C42 FB80** **G-CKGS** Clench Common airfield, Wiltshire

During the approach to land the aircraft experienced turbulence due to thermal activity which resulted in a heavier than anticipated touchdown. This resulted in the nose and left main landing gear collapsing.

26 Jun 2025 **Rotorsport UK Calidus** **G-PCPC** Damyns Hall, Essex

The pilot reported that he did not pull the stick back before starting his takeoff. He stated that, having realised, he then pulled it back but "at the wrong time" and the aircraft veered left and fell on its side.

Miscellaneous

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

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

Bulletin Correction

Aircraft Type and Registration: G-CSHB

Date & Time (UTC): 4 April 2025

Location: Newtownards Airport, County Down

Information Source: Event notification

AAIB Bulletin No 6/2025, page 73

The June bulletin contained an incorrect date for G-CSHB Record Only report. See correction below:

Original date: 4 March 2025.

Corrected date: 4 April 2025.

The online report was corrected on 25 June 2025.

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