Air Accidents Investigation Branch

AAIB Bulletin 4/2026

TO REPORT AN ACCIDENT OR INCIDENT
PLEASE CALL OUR 24 HOUR REPORTING LINE

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

AAIB investigations are conducted in accordance with Annex 13 to the ICAO Convention on International Civil Aviation, assimilated EU Regulation No 996/2010 (as amended) and The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2018.

The sole objective of the investigation of an accident or incident under these Regulations is the prevention of future accidents and incidents. It is not the purpose of such an investigation to apportion blame or liability.

Accordingly, it is inappropriate that AAIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

AAIB Bulletins and Reports are available on the Internet
www.aaib.gov.uk

This bulletin contains facts which have been determined up to the time of compilation.

Published: 9 April 2026.

Cover picture courtesy of Sophie Adams

ISSN 0309-4278

Published by the Air Accidents Investigation Branch, Department for Transport

CONTENTS

CONTENTS 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:	Bristell NG5 Speed Wing, G-STEL
No & Type of Engines:	1 Jabiru 3300A piston engine
Year of Manufacture:	2013 (Serial no: LAA 385-15235)
Date & Time (UTC):	20 May 2025 at 0842 hrs
Location:	Near Gordon, Berwickshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence (Aeroplanes) (Microlights Only)
Commander's Age:	59 Years
Commander's Flying Experience:	795 hours (of which 32 were on type) Last 90 days - 17 hours Last 28 days - 6 hours
Information Source:	AAIB Field Investigation

Synopsis

Shortly after takeoff from Nether Huntlywood Airfield for a planned flight to Kingsmuir Airfield, the pilot turned right and seemed to fly a pattern to attempt a landing back at the departure airfield. As he positioned the aircraft for landing, he appeared to enter cloud and lose control of the aircraft, rapidly entering a spiral descent from which he did not recover. The aircraft struck the ground, and the pilot was fatally injured.

History of the flight

On the morning of the accident the pilot arrived at Nether Huntlywood Airfield, near Gordon, Berwickshire, where the aircraft was hangered, for a flight to Kingsmuir Airfield, St. Andrews. CCTV in the hangar showed the pilot preparing the aircraft for flight, removing the covers, checking the oil and refuelling via a hand pump.

The pilot pulled the aircraft out of the hangar and finished the external checks. He started the engine and taxied for a departure from grass Runway 10.

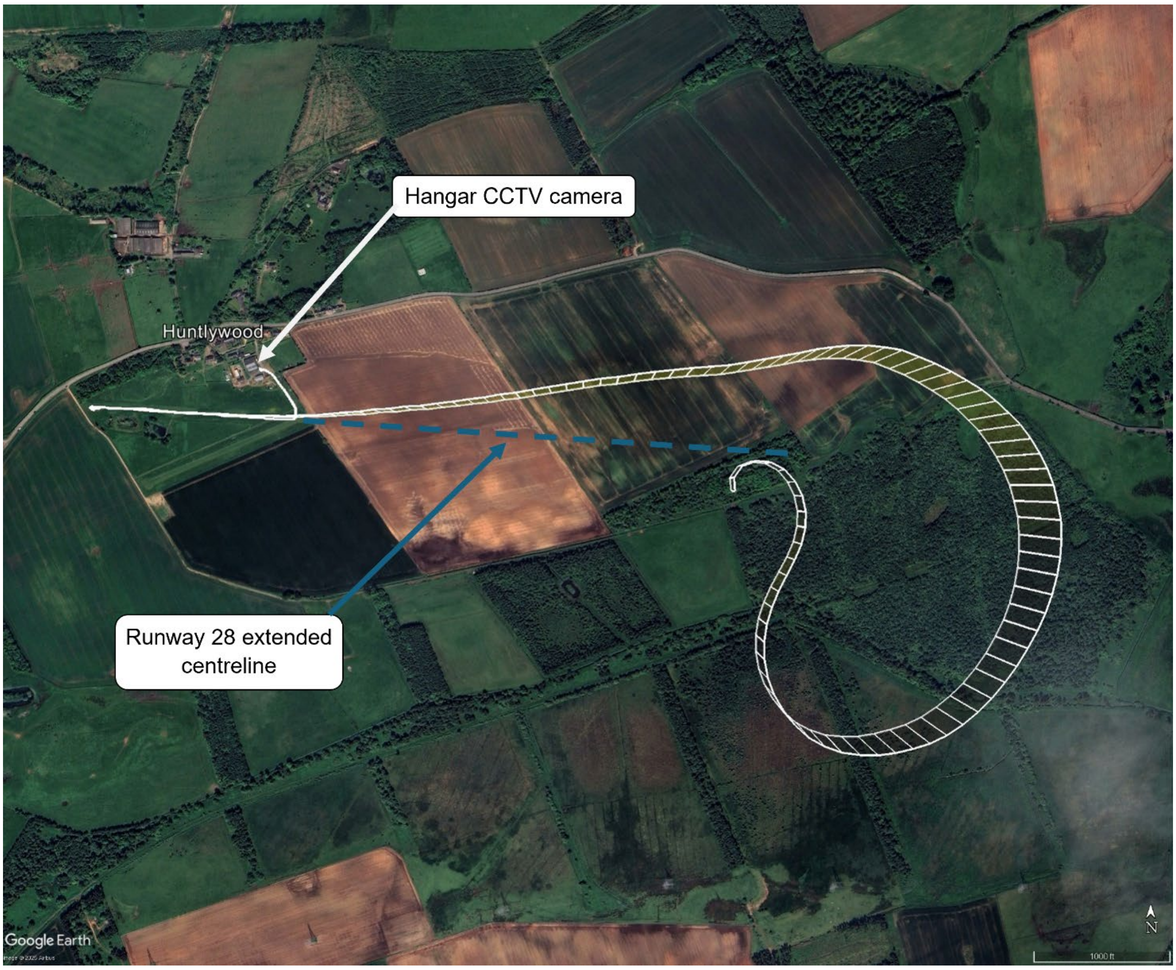


Figure 1
G-STEL flight path from GNSS data

The aircraft took off at 0840 hrs and reached a height of 610 ft aal before entering a right turn and reducing power. The right turn continued along with a descent for, what appeared to be, a landing on to the reciprocal Runway 28.

CCTV footage showed the aircraft appearing to enter cloud as it started a left turn, apparently to align with the centreline of Runway 28. The aircraft re-appeared from the cloud with a steep angle of bank to the left and a nose-down attitude. The bank angle continued to increase and the aircraft struck the ground in a steep nose-down attitude.

At 2011 hrs, the missing aircraft was reported to emergency services. The aircraft and deceased pilot were eventually located at 2111 hrs.

Aircraft information

General

The Bristell NG5 'Speed Wing', is a single-engine, all metal, low-wing aircraft with two side-by-side seats. The aircraft has a fixed tricycle undercarriage with a steerable nose-wheel.

The aircraft was fitted with a number of avionics components including a Primary Flight Display (PFD) and Engine Monitoring System (EMS), (Figure 2). In addition, a tablet was attached to the instrument panel and was known to be used with a flight planning and navigation app, which included a moving map.

Figure 2

G-STEL cockpit image (photograph used with permission)

G-STEL

The aircraft (Figure 3) was built in 2013 and had accrued about 630 flying hours at the time of the accident. It had a Jabiru 3300A, six-cylinder engine driving a two-bladed composite propeller.

Figure 3

G-STEL (photograph used with permission)

The last annual inspection was completed on 9 May 2025. Compression testing when the engine was cold[1] found that cylinder five was low (56 / 80), but the aircraft was already scheduled for routine engine maintenance[2] and the Permit to Fly was renewed until 11 May 2026. The aircraft subsequently flew three times, achieving just under six flying hours before the accident.

Recorded information

The aircraft was fitted with a number of devices which recorded data throughout the flight. This included the PFD, EMS and the tablet computer, all of which were recovered to the AAIB laboratories for download. In addition, CCTV recordings were supplied by the airfield, which recorded the pilot and aircraft in a number of locations including the hangar, taxiing areas, runway and when airborne just prior to the accident.

The PFD and EMS both had the capability to record flight data at a programmable rate of between every 1 and 60 seconds. Both devices suffered damage in the accident and were downloaded in the AAIB laboratories after repair. Both were set to record respective PFD and engine data every 10 seconds. The tablet also sustained significant damage but recordings from the flight planning and navigation app were recovered. These provided position, GNSS altitude and time recorded once per second. The recordings were combined to help determine the sequence of events leading up to the accident.

The CCTV and GNSS data confirmed the aircraft taxiing from the hangar at 0834 hrs, entering and backtracking Runway 10. One camera captured the airfield windsock which was flaccid and showed that there was no wind. Takeoff commenced at 0840:10 hrs with recorded engine rpm increasing to 2,920 rpm and the aircraft climbed straight ahead to a GNSS altitude of 1,160 ft[3] amsl (610 ft aal). The aircraft levelled, engine rpm reduced to approximately 2,190 rpm (Figure 4, Point A) and a right turn commenced (Point B).

Footnote

[1] Compression testing is normally carried out when the engine is hot so that the piston rings are most effective in creating a seal. The procedure defined in the Jabiru maintenance manual states that the test should be carried out with the engine in '*warm to hot condition*'.

[2] The aircraft was purchased approximately six months before the accident, and the new owners had arranged for the engine condition to be reviewed by a mechanic in the UK.

[3] The tablet recorded position GNSS altitude once per second. The PFD recorded pressure altitude but only every 10 seconds. The two data sources correlated well with a maximum difference during the flight of 20 ft.

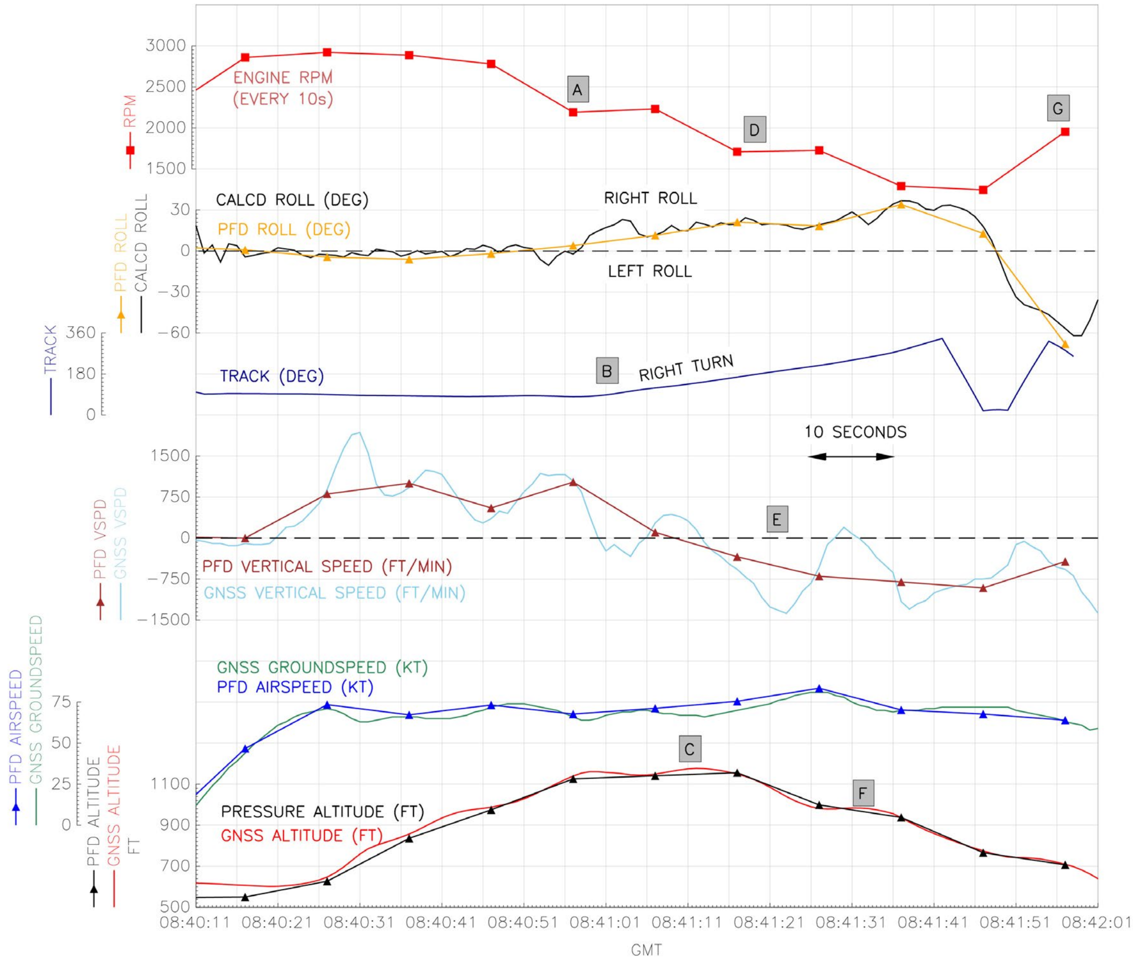


Figure 4

G-STEL flight data from GNSS, PFD and EMS recordings

Maximum GNSS altitude achieved was 1,177 ft amsl (627 ft aal) at 0841:12 hrs (Point C), after which the aircraft started to descend. Recorded rpm reduced again (Point D) and the initial part of the descent reached up to 1,377 ft/min (Point E)[4]. An estimate of bank angle was calculated which showed the bank angle increasing slowly during the turn up to approximately 30° to the right.

The aircraft continued to descend and turn to the right, briefly levelling for a few seconds at 980 ft amsl (430 ft aal) having turned through 180° (Point F). The descent and right turn continued until 0841:49 hrs when the right turn was reversed into a left turn. At this point the aircraft was 0.6 nm from the Runway 28 threshold at 753 ft amsl (203 ft aal). At this distance and altitude, it was close to being on a 3° slope to the runway threshold (Figure 5).

Footnote

4 Vertical speed was derived from the rate of change of GNSS altitude, which was recorded once per second, because this gave a higher resolution than the PFD vertical speed, which was recorded every 10 seconds.

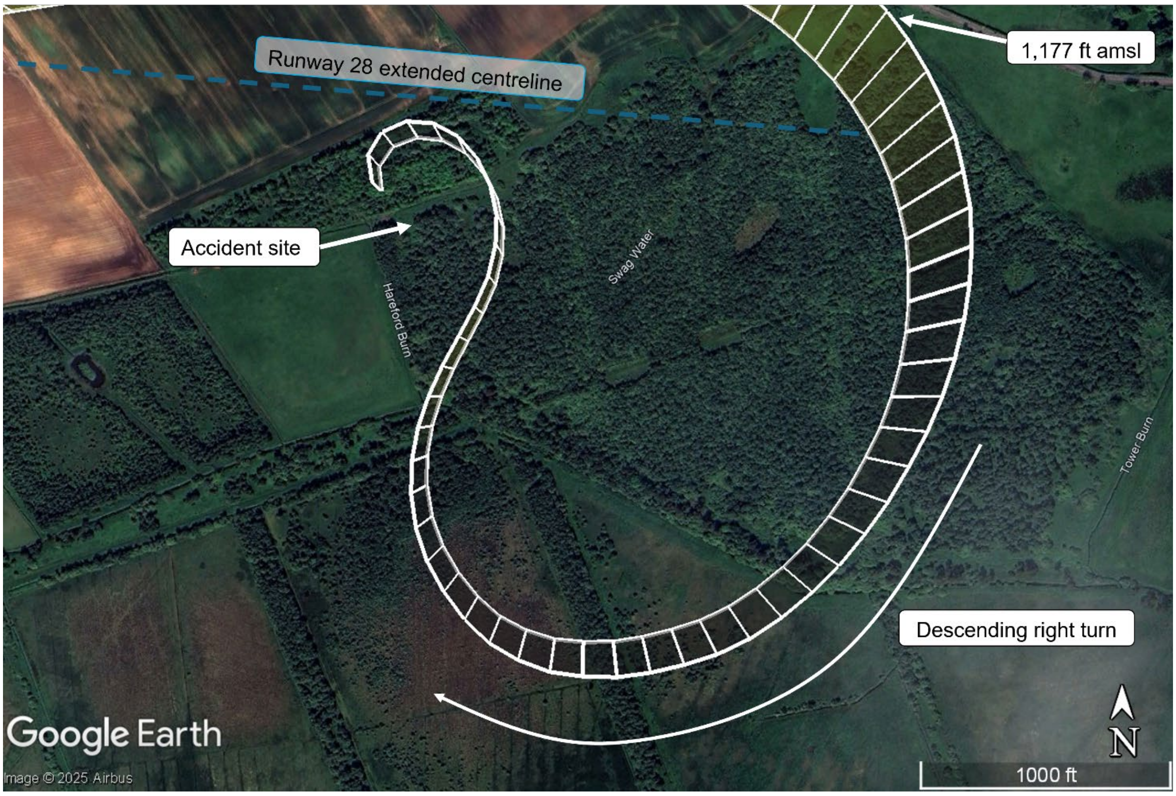


Figure 5

G-STEL aircraft track from recorded GNSS data

As the left turn commenced, CCTV recording from the airfield captured the aircraft on a camera mounted to the airfield hangar. This camera was approximately 0.6 nm from the accident site and the aircraft appeared in the top right corner. The footage showed the aircraft moving from right-to-left for around three seconds before disappearing from view. It re-appeared around three seconds later in a steeper descending left turn which continued until out of sight. Figure 6 shows a portion of the CCTV footage as a compound view of frames approximately every 0.5 seconds.

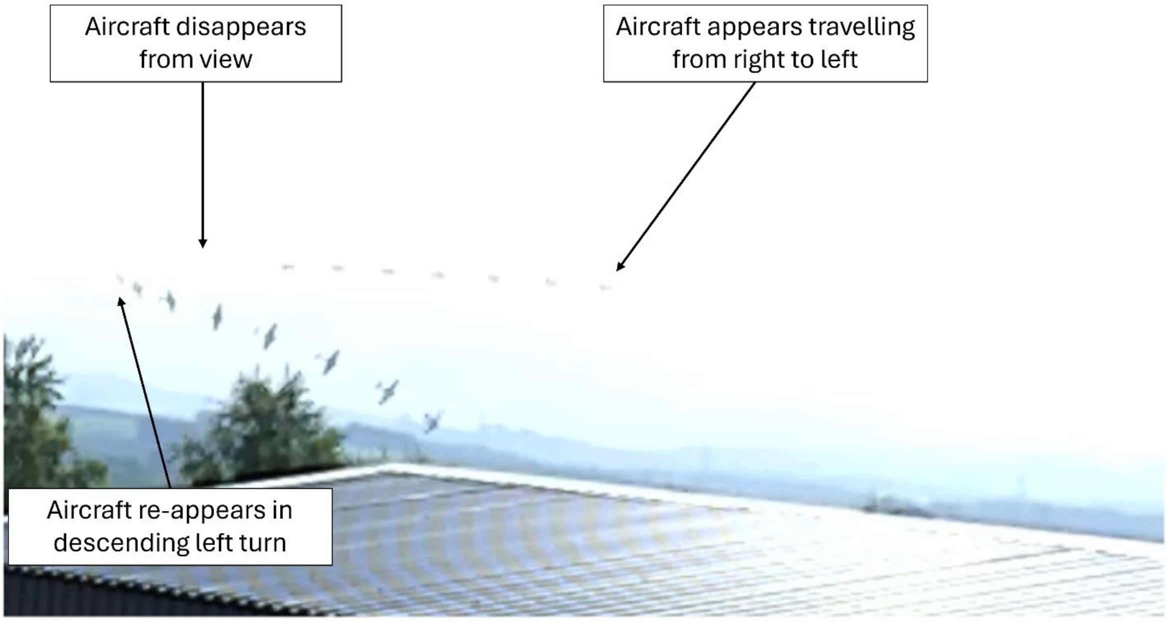


Figure 6
G-STEL CCTV image

The period when the aircraft disappeared from the CCTV view suggested that there were pockets of poor visibility and/or cloud.

The recorded GNSS data confirmed the CCTV footage with a steepening and descending left turn until the end of the recording. Recorded rpm showed an increase from 1,244 rpm to 1,954 rpm in the final 10 seconds of recording, indicating that engine power increased (Figure 4, Point G). The final recorded GNSS position was four seconds later, at 0842:01 hrs, at 639 ft amsl (89 ft aal) with the aircraft descending at approximately 1,400 ft/min.

Accident site

The accident site was barely larger than the aircraft itself. Ground indentations and damage sustained by the left-wing and fuselage indicated that the aircraft crashed in a nose-down attitude whilst rolling to the left. The aircraft bounced and turned approximately 90° before coming to rest upright with the cockpit and wings on a heading of approximately 260°(M). There was nothing to indicate that the aircraft had struck anything whilst airborne, and no evidence that anything had detached from the aircraft before the accident.

The canopy broke on impact and detached from the aircraft. Items from inside the cockpit were ejected with the majority coming to rest to the right of the aircraft centreline.

Both fuel tanks, in the wing leading edges, were disrupted in the accident. Minimal fuel was recovered and discoloured vegetation indicated that fuel had leaked from the aircraft and soaked into the ground after the accident.

One propeller blade was still attached to the hub, but the second was found embedded in the ground.

The ignition key was found in the ignition switch. It was bent and selected to the left ignition system. The direction of the force required to bend the key would have tended to turn the key towards the left position.

Aircraft examination

Flying controls

Examination found that the aileron and rudder control runs were intact. An elevator control rod behind the cockpit was broken where the rear fuselage had buckled and concertinaed in the accident.

Flaps

The flap actuator shaft indicated that the flaps were retracted when the accident occurred.

Fuel

Both fuel tanks ruptured in the accident and minimal fuel remained in them. The gascolator was disrupted in the accident but residual fuel was found in the carburettor bowl and mechanical fuel pump. The combined volume was insufficient for analysis.

The fuel selector control lever had detached, but the valve was found selected to the left-wing, which is the wing that the pilot refuelled before the accident flight. A specialist laboratory analysed a sample of fuel from the hangar supply, which the pilot used to refuel the aircraft prior to the flight, and its properties complied with the requirements for E5 mogas.

Engine

The engine could be rotated by hand, and its external condition showed no obvious anomalies apart from damage sustained in the accident; the right distributor cap and one of the ignition coils had been damaged.

The engine and carburettor were dismantled and examination found nothing that would have prevented either from working.

Review of the engine data downloaded from the EMS revealed no concerns about the operation of the engine during the flight. A number of parameters were recorded including oil temperature and pressure, fuel pressure and engine rpm, which were within their expected operating ranges. Further, data showed that the engine operated until the end of the recording, when the aircraft struck the ground.

Meteorology

The Met Office produced an aftercast of the weather in the area of the airfield at the time of the accident. The general conditions for the morning of 20 May 2025 could be described as settled with a bank of cloud affecting the east coast from the Firth of Forth southwards. This cloud penetrated inland and affected the Huntlywood area during the morning but cleared by 0900 hrs. Some low cloud would also have affected the Kingsmuir area during the early part of the morning, but this appears to have cleared by 0830 hrs. From the observations, surface visibility remained above 10 km throughout the period of interest.

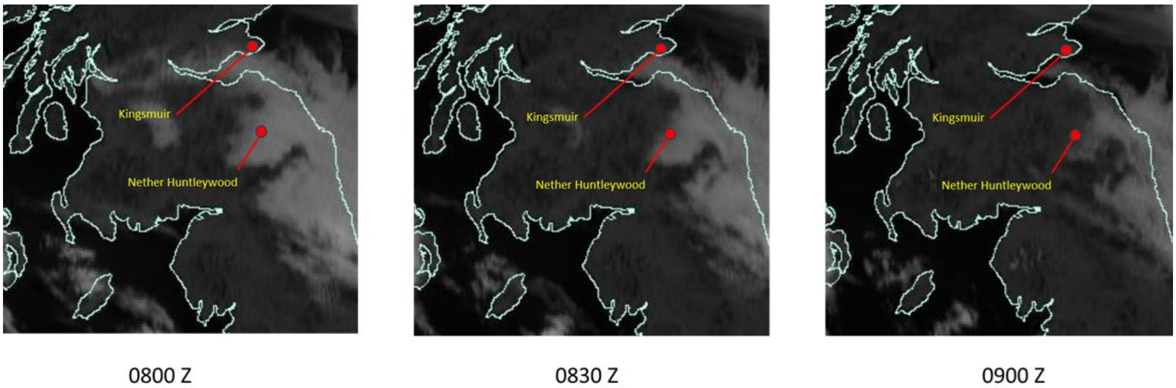


Figure 7
Met Office Aftercast cloud cover

Haar

In meteorology, haar or sea fret is a cold sea fog. It occurs mostly between April and September, when warmer moist air moves over the relatively cooler North Sea causing the moisture in the air to condense. Sea breezes and easterly winds then bring the haar into the east coast of Scotland and north-east England where it can continue for several miles inland.

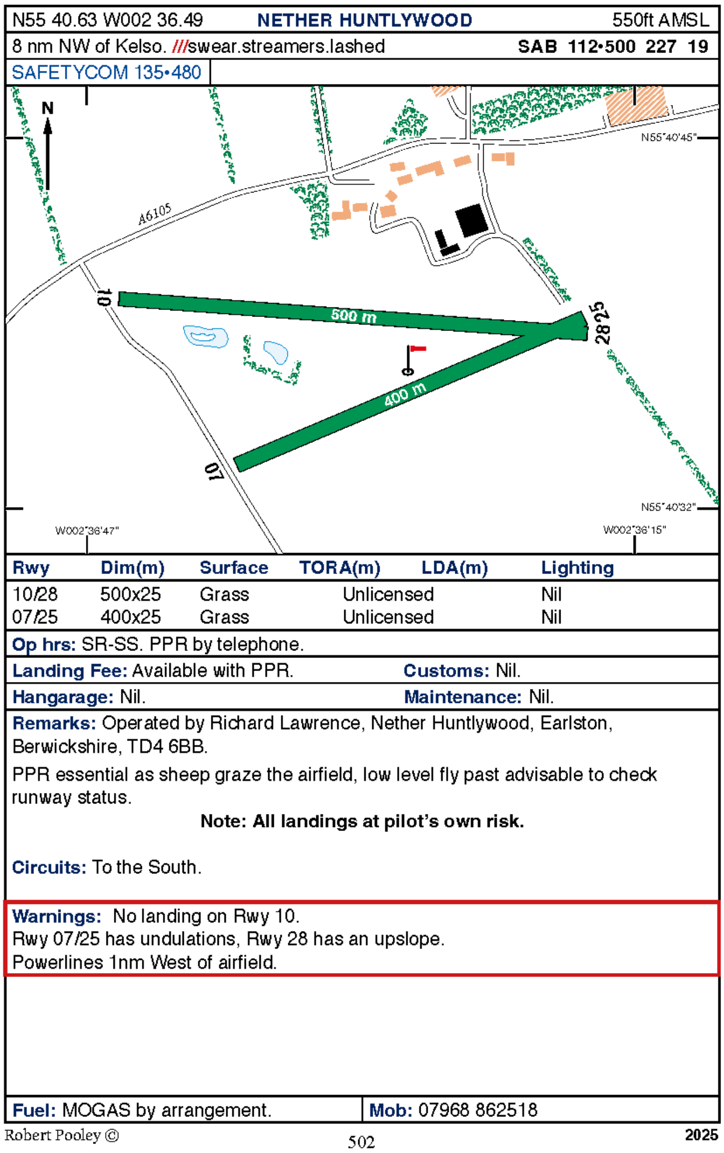
CCTV footage of the local area, before and immediately after the accident, showed shadows rolling across the fields corresponding with more dense cloud formations blocking the sun. Cameras looking towards the east of the airfield showed significantly more cloud than those looking to the west.

Airfield information

Nether Huntlywood is a privately operated farm airstrip located in Berwickshire, Scottish Borders. It caters to general aviation aircraft and operates with Prior Permission Required (PPR). The airfield features two grass runways:

- Runway 07/25: 400 m long.
- Runway 10/28: 500 m long.

The airfield sits at an elevation of 550 ft amsl, with sheep commonly grazing on the runways. In the *'Warnings'* section of the Pooley's guide to the airfield it states: '*No landing on Rwy 10'.*



N55 40.63 W002 36.49 **NETHER HUNTLYWOOD** 550ft AMSL

8 nm NW of Kelso. ///swear.streamers.lashed **SAB 112•500 227 19**

SAFETYCOM 135•480

Rwy	Dim(m)	Surface	TORA(m)	LDA(m)	Lighting
10/28	500x25	Grass	Unlicensed		Nil
07/25	400x25	Grass	Unlicensed		Nil

Op hrs: SR-SS. PPR by telephone.

Landing Fee: Available with PPR. **Customs:** Nil.

Hangarage: Nil. **Maintenance:** Nil.

Remarks: Operated by Richard Lawrence, Nether Huntlywood, Earlston, Berwickshire, TD4 6BB.

PPR essential as sheep graze the airfield, low level fly past advisable to check runway status.

Note: All landings at pilot's own risk.

Circuits: To the South.

Warnings: No landing on Rwy 10.
Rwy 07/25 has undulations, Rwy 28 has an upslope.
Powerlines 1nm West of airfield.

Fuel: MOGAS by arrangement. **Mob:** 07968 862518

Robert Pooley © 502 **2025**

Figure 8

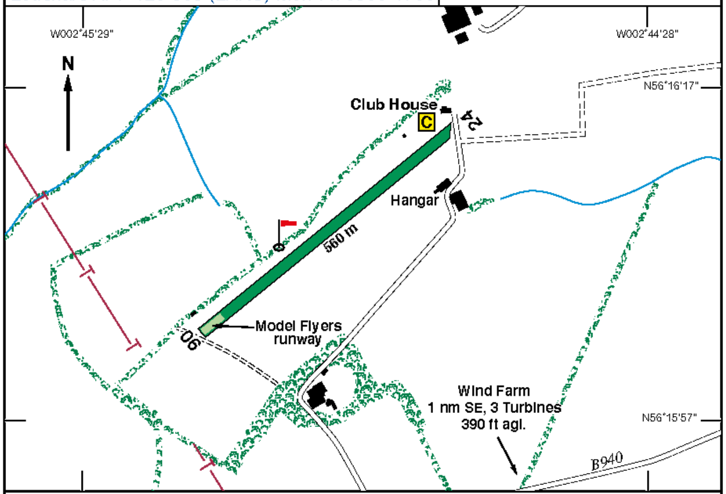
Pooley's Nether Huntlywood airfield plate

Kingsmuir Airfield is a private, unlicensed airfield located near St Andrews, Fife, approximately 40 miles north of Nether Huntlywood. Aeroplanes and microlights are accepted, while helicopters and gliders may be accommodated with prior permission. Runway lighting is not available, and operations are strictly during daylight hours. Communication is via Safetycom (135.480), and arrivals require PPR. The airfield features one grass runway:

- Runway 06/24: 560 m long.

The airfield sits at an elevation of 387 ft amsl.

N56 16.13 W002 45.06	**KINGSMUIR (Sorbie)**	387ft AMSL
7.4 nm SSE of RAF Leuchars. ///bitter.sourcing.variances		**TLA 113•80 028 50•5**
c/s Kingsmuir Traffic SAFETYCOM 135•480		
Leuchars APP 126•505 (LARS) Mon-Fri 0900-1700		



Rwy	**Dim(m)**	**Surface**	**TORA(m)**	**LDA(m)**	**Lighting**
06/24	560x25	Grass	Unlicensed		Nil

Op hrs: PPR, Tel: 07880 595447.

Landing Fee: £5. **Overnight parking:** £10 **Customs:** Nil.

Hangarage: Nil. **Maintenance:** Nil.

Remarks: Operated by David Smith, Kingsmuir Farm, Stravithie, St. Andrews, Fife KY16 8QQ. Contact Leuchars APP for traffic Information. Avoid overflying local churches on Sunday mornings.

Circuits: Make info calls on Safetycom 135•480 joining/departing/when in the circuit. Circuit direction is either way at 800ft but try and minimise circuits if possible.

Make overhead joins or join downwind (so model flyers can get clear).

Try and avoid landing/taxiing on the model flyers runway at 06 threshold.

Kingsmuir airfield accepts genuine emergency and precautionary diversions without charge per CAA CAP 667 9.2 (c) recommendations.

Overnight parking available at owner's risk.

Warnings: Model aircraft operate from west end strip on occasions.
Wind farm of 3 Turbines 390ft agl, 1 nm SE of the Rwy centre.

Restaurant: Self service Tea and Coffee in the Club House.
Accommodation: B&B by arrangement. Camping at £10 per night.

Fuel: MOGAS PPR. **Mob:** 07880 595447
Email: info@kingsmuirairfield.com

Robert Pooley © 388 2025

Figure 9

Pooley's Kingsmuir airfield plate

Prior Permission Required (PPR) airfields

At an uncontrolled aerodrome there is a requirement to obtain permission to use the manoeuvring area from the person in charge[5]. This is often achieved by the PPR process, which is also an opportunity for the pilot to be briefed by the owner on relevant hazards at the airfield, as recommended in *'CAP 793, Safe Operating Practices at Unlicensed Aerodromes'*[6].

Footnote

5 The Rules of the Air Regulations 2015, *Movement of aircraft on uncontrolled aerodromes.*

6 *CAP 793*, paragraph 5.4: *'If the aerodrome does not feature in any aeronautical publications, a procedure should be developed whereby visiting pilots are warned of hazards prior to arrival. A requirement to obtain prior permission before landing will facilitate such hazard warning by allowing visiting pilots to be briefed.'*

The pilot had contacted Kingsmuir Airfield for a PPR before his flight and been approved. However, Kingsmuir Airfield is normally unattended and there is no requirement for the owner to check that visiting aircraft have arrived.

Overdue action

Overdue action is a formal process that airfields may use when an aircraft expected under PPR does not arrive on time. It can also be activated by ATC units when an aircraft fails to report in accordance with a filed flight plan. This action may include contacting ATC, searching local radio frequencies, coordinating with emergency services, or checking alternative landing sites. The aim is to confirm the flight's safety and whereabouts, especially if there are concerns about the aircraft's well-being or if communication is lost.

VFR flight plan

A VFR flight plan is a formal notification submitted by pilots flying under visual flight conditions, primarily to enhance flight safety and facilitate search and rescue. It must be filed at least 60 minutes before departure and includes essential details such as aircraft identification, type, route, estimated times, and equipment. VFR flight plans are mandatory for flights crossing UK FIR boundaries or operating within controlled airspace (except Class E, where it is recommended). Pilots must activate their flight plan after departure and close it upon landing to ensure accurate tracking. Filing a VFR plan aids air traffic services in traffic management and emergency response.

This flight did not legally require a VFR flight plan, and none was submitted.

Distress and Diversion

In UK aviation, the Distress and Diversion (D&D) service is a dedicated emergency support unit for aircraft in difficulty. It is operated by the Royal Air Force out of the NATS Swanwick centre in Hampshire and is staffed 24/7. Pilots can contact D&D on 121.5 MHz (civilian) or 243.0 MHz (military) for immediate assistance in case of distress, such as being lost, suffering an emergency, or facing equipment failures. The D&D Cell assists by providing accurate safety and operational information and helps locate the nearest suitable landing site for each emergency scenario.

The standard squawk transponder code for an emergency is 7700. Pilots use MAYDAY for distress and PAN-PAN for urgency. The service is available to all pilots flying within UK airspace - including general aviation and commercial flights - to provide rapid, coordinated help during crises, such as engine failures, fuel leaks, medical emergencies, or navigation confusion.

Post-mortem report

A post-mortem examination, including full toxicology screening, was carried out at Edinburgh City Mortuary eight days after the accident. There was no evidence of significant natural disease or toxicology that may have led to the pilot having a medical event that would have resulted in him losing control of the aircraft.

The report found that the pilot died as a result of head and chest injuries relating to an aviation accident.

Other information

Spatial disorientation[7] can occur within seconds when a pilot enters cloud as a turn begins, especially when the pilot is expecting to operate the flight clear of cloud. Studies and reported incidents indicate that a pilot may lose reliable spatial orientation in as little as 20 seconds[8] after losing outside visual references - sometimes much faster if a turn is involved - due to conflicting inputs from the sensory and vestibular systems[9]. Without training and recent practice in flying aircraft solely with reference to aircraft instruments, this can result in rapid loss of aircraft control, commonly leading to spiral or uncontrolled descent.

Analysis

Examination of the wreckage revealed no pre-existing faults that would have affected normal aircraft operation, and there was no evidence to indicate that the aircraft hit anything whilst it was airborne before the accident. The recorded data indicated that the engine was running throughout the accident flight and, in the latter few seconds, engine power was increasing.

The post-mortem examination of the pilot revealed no ailments that would have accounted for an intention to make an immediate landing. There were no reports before the flight of him feeling unwell, and CCTV did not show evidence of him being impaired while preparing the aircraft for flight.

The Met Office aftercast showed that the haar was clearing from the area of the airfield when the aircraft took off, but it had not completely dissipated. The decision to abandon the flight and return to Nether Huntlywood might, therefore, be attributed to significant cloud remaining on the intended route to Kingsmuir, which was discovered after departure. Although this appeared likely, it was not positively determined and it is possible that there was another reason for the decision to return.

Having decided to return to the airfield, the weather probably favoured a landing on Runway 10, with better visibility to the west and no significant cloud. However, the Pooley's airfield chart contains a warning that does not allow landing on Runway 10, which would explain why the pilot positioned himself for a landing on Runway 28. The fact that the accident occurred as the aircraft was intercepting a 3° slope to the runway threshold, ie a normal approach path, also supported a conclusion that the pilot was attempting to land on Runway 28.

Footnote

7 Spatial disorientation in aviation is the inability of a pilot to correctly interpret aircraft attitude, altitude or airspeed in relation to the Earth or other points of reference.

8 Bryan, L.A, Stonecipher, J.W and Aron, K, 1954, 180-degree turn experiment, Aeronautics Bulletin No.11, University of Illinois Institute of Aviation, USA. Page 16.

9 The vestibular system is essential for balance and spatial orientation.

A return to land on a runway reciprocal to the runway used for takeoff requires continuous manoeuvring, as shown in Figure 1. Whilst starting the left turn to align with Runway 28, the pilot appeared to enter cloud, and at the point that the aircraft re-appeared on CCTV it had a high bank angle and steep nose-down attitude consistent with a spiral descent following a loss of control. It is likely, therefore, that the pilot became spatially disorientated very rapidly after entering cloud and when emerging from the cloud had insufficient height to understand and correct the flightpath.

PPR had been obtained from the destination airfield, but PPR should not be taken to imply that an airfield will be manned at the intended landing time and there should be no expectation that a delayed arrival will be reported promptly. To ensure that overdue action is started as early as possible, a VFR flight plan should be filed and activated, even if the flight does not legally require one. Overdue action would then be initiated if the pilot did not close the flight plan on arrival at their destination.

In circumstances where non-fatal injuries are sustained, early discovery is likely to have an impact on survivability. In this case, however, the post-mortem report showed the accident was not survivable, so the delayed discovery of the aircraft played no role in the outcome.

Conclusion

It appeared that at the time of departure the weather was not suitable for VMC flight from Nether Huntlywood to Kingsmuir, and shortly after takeoff the pilot decided to return to Nether Huntlywood to land. It is likely he inadvertently entered IMC during the initiation of a turn and became spatially disorientated. The aircraft entered a spiral descent and struck the ground with a high angle of bank and steep nose-down attitude.

Published: 19 March 2026.

Accident

Aircraft Type and Registration:	Cessna 208B, G-CPSS
No & Type of Engines:	1 Pratt & Whitney Canada PT6A-42A turboprop engine
Year of Manufacture:	2004 (Serial no: 208B1059)
Date & Time (UTC):	23 March 2024 at 1154 hrs
Location:	Cranfield Airport, Bedfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Engine corrosion
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	31 years
Commander's Flying Experience:	1,663 hours (of which 1,278 were on type) Last 90 days - 13 hours Last 28 days - 7 hours
Information Source:	AAIB Field Investigation

Synopsis

Following a low oil pressure warning and smoke from the engine exhaust, the pilot diverted to a nearby airport. Following detailed inspection of the engine by the manufacturer, significant corrosion was identified which had formed holes, leading to a loss of oil from the reduction gearbox housing into the engine exhaust. The corrosion resulted from numerous unapproved engine compressor washes which had been carried out without the drain plug being removed. This was a known issue on the engine, and the manufacturer had added warnings to the Approved Maintenance Manual and issued a Service Information Letter. The operator and contracted maintenance provider confirmed that any future engine washes would only be conducted by approved maintenance personnel and in accordance with the Approved Maintenance Manual.

History of the flight

The aircraft was on a ferry flight back to its main base following maintenance. The pilot reported that a scheduled A check completed prior to the flight, which included a check of the engine oil level, had confirmed that the oil contents was indicating in the middle of the green band on the gauge.

When the engine was started, the exhaust gas temperature had peaked at 818°C but it was only above 800°C for 4 seconds. All other engine checks were normal. During take-off full power was achieved on the engine, with temperatures and pressures indicating in their respective green bands. The pilot levelled out in the cruise with a power setting of 900 ft lbs torque and a propeller speed of 1,750 rpm.

Approximately seven minutes later, while transiting overhead Cranfield Airport at 3,300 ft amsl, the engine low oil pressure warning light came on. The pilot requested to divert into Cranfield, flying an immediate left hand turn to a downwind position and conducting a fast descent. During the descent the pilot noted smoke coming out of the engine exhausts. The aircraft landed on Runway 21, with the pilot reporting the engine performance was normal, but smoke was still coming from the exhausts. This became more significant when the engine power was reduced to idle during the flare to touch down.

The pilot taxiied off the runway, immediately shut down the engine and exited the aircraft. He went to open the engine cowlings to check the oil level and identify any leaks but noticed what appeared to be flames from within the right engine exhaust. The responding Airport Fire and Rescue Service discharged three CO_2 fire extinguishers into the exhaust. The aircraft was then towed to a parking stand.

Engine examination

The engine was removed and sent to the manufacturer's facility in Canada for further investigation. The manufacturer confirmed that there was a large amount of oil and water in the exhaust duct. Even when the drain plug for the duct was removed the liquid didn't drain out and the drain hole was found to be clogged by carbon build up. Once this obstruction was removed the liquid drained away freely. Disassembly and inspection of the engine confirmed a crack in the power turbine vane outer ring and significant corrosion, which had created two holes in the Reduction Gearbox (RGB) rear housing. This was considered by the manufacturer to be the source of the loss of oil.

Failure mechanism investigation

Further enquiries with the engine manufacturer identified that the exhaust duct drain plug was present to allow water to drain away when carrying out engine compressor and turbine washes. More frequent washes had been recommended on the engine by the manufacturer to address turbine blade sulphidation and salt corrosion on compressor blades. However, the manufacturer had seen an increase in corrosion in the same area of the RGB housing, when the drain plug hadn't been removed or the drain hole had become blocked, preventing water from draining away during and after washes. They had issued a Service Information Letter (SIL PT6A-206) in March 2013, which was then revised in 2016, to remind operators and maintainers of the importance of removing the drain plug and ensuring that water was able to drain freely. Otherwise, corrosion in the RGB housing was likely, which could lead to loss of oil and low oil pressure warnings.

The manufacturer had also added a warning in the Engine Maintenance Manual relating to engine washes in January 2024 stating:

> **CAUTION:** IF YOU DO NOT REMOVE THE EXHAUST DUCT DRAIN, IT CAN RESULT IN COLLECTION OF WASH LIQUID AND CAUSE SEVERE RGB REAR HOUSING CORROSION WHICH CAN LEAD TO LOW OIL PRESSURE CONDITION DUE TO OIL LEAK FROM RGB HOUSING (REF. SIL NO. PT6A - 206).

Along with an additional step in the maintenance procedure to ensure the wash liquid was draining freely:

> (16) Make sure that the wash fluid came out of the exhaust duct drain. Remove any obstruction from the drain fitting.

Incident aircraft's maintenance history

Maintenance of the aircraft was sub-contracted by the operator to an approved Part 145 maintenance provider. The maintenance provider's facility was located at a different airfield to the one where the aircraft was based and operated from. The operator confirmed that approximately five years ago they had been experiencing problems with blade corrosion, with previous engines needing overhaul hundreds of hours short of the expected on-wing life. They stated that they were advised by their Continuing Airworthiness Management Organisation (CAMO) and by the engine repair facility that had carried out previous work on the engines to increase the number of compressor washes being carried out on the engine.

Following this advice, they internally introduced a routine to conduct engine compressor washes on the aircraft once a week. This process did not reference the Approved Maintenance Manual (AMM) and did not require removal of the drain plug. The maintenance activity was not documented in the aircraft logbook and the pilots who carried out the work did not issue a Certificate of Release to Service afterwards, nor would they have been able to do so given the non-compliances in the process.

The operator stated that they were instructed how to carry out a compressor wash by both their CAMO and their previous maintenance organisation by watching a demonstration. This instruction suggested no tools were required. They were not aware of the requirement to remove the drain plug or that this level of wash was classed as maintenance rather than a user task and as such they were unaware of the requirement to complete a Release to Service.

The contracted Part 145 maintenance provider stated they had not issued any authorisations for pilot maintenance to be conducted remotely by the operator. They suggested that as many of the PT6A variations do not have the removable drain plug, which is only fitted to the larger engines, this may have been where the confusion arose.

They stated that "a compressor desalination wash on the small/medium engines is a simple case of connecting a water source to a factory installed fitting, motoring the engine & then carrying out the drying run. As such, this would not be classed as a 'complex task'."

Pilot maintenance regulations

UK CAA regulations in Part 145.A.30 (j) state:

> *'By derogation to points (g) and (h), in relation to the obligation to comply with Annex III (Part-66), the organisation may use certifying staff and support staff that are qualified in accordance with the following provisions:*
>
> *…*
>
> *4. If an aircraft is operated away from a supported location, the organisation may issue a limited certification authorisation to the pilot on the basis of the flight crew licence held, subject to being satisfied that the pilot has carried out sufficient practical training ensuring that the pilot can accomplish the specified tasks.*
>
> *…'*

The AMC for 145.A.30(j)(4) states:

> *'1. For the issue of a limited certification authorisation,*
>
> *(a) the pilot should hold either an airline transport pilots licence (ATPL) or a commercial pilots licence (CPL) in accordance with Regulation (EU) No 1178/2011 and, as applicable, Regulation (EU) 2020/723.*
>
> *2. In addition, the limited certification authorisation is subject to the MOE containing procedures to address the personnel requirements of point 145.A.30(e). The procedures should be accepted by the CAA and should include as a minimum:*
>
> > *(a) completion of adequate continuing airworthiness regulation training as related to maintenance;*
> >
> > *(b) completion of adequate task training for the specific task(s) on the aircraft. The task training should be of sufficient duration to ensure that the individual has a thorough understanding of the task(s) to be completed, and that it will involve training in the use of the associated maintenance data;*
> >
> > *(c) completion of the procedural training as specified in Part-145.*
>
> *2.(i) Typical tasks that may be certified and/or carried out by a pilot who holds an ATPL or a CPL are the minor maintenance or simple checks included in the following list:*
>
> > *(a) Replacement of internal lights, filaments and flash tubes;*
> >
> > *(b) Closing of cowlings and refitment of quick-access inspection panels;*

(c) Role changes, e.g. stretcher installation, dual controls, FLIR, doors, photographic equipment, etc;

(d) Inspection for, and removal of, de-icing/anti-icing fluid residues, including the removal/closure of panels, cowls or covers that are easily accessible but that do not require the use of special tools;

(e) Any check/replacement that involves simple techniques that are consistent with this AMC and that have been agreed by the CAA

3. The validity of the authorisation should be limited to twelve months, and may be renewed if there has been satisfactory recurrent training on the task(s) for which the pilot holds an authorisation.'

The CAA advised that they considered all engine compressor washing to be a complex task which is outside the scope of Part 145.A.30 (j)(4) and should only be certified by appropriately licenced maintenance personnel. There are also provisions in Part-M, specifically M.A.803, for pilot owner approved maintenance. The CAA advised that engine compressor washes would not fall within the limited scope of these regulations either.

Certificate of Release to Service

Following any maintenance activity, a Certificate of Release to Service must be issued by appropriately authorised certifying staff.

Part 145.A.50 states:

'(a) A certificate of release to service shall be issued by appropriately authorised certifying staff on behalf of the organisation when it has been verified that all maintenance ordered has been properly carried out by the organisation in accordance with the procedures specified in point 145.A.70, taking into account the availability and use of the maintenance data specified in point 145.A.45 and that there are no non-compliances which are known to endanger flight safety.

(b) A certificate of release to service shall be issued before flight at the completion of any maintenance.'

CAA Review

A review of the general issue of operators conducting compressor washes on the PT6 engine was carried out by the investigation. This identified a broader problem than just the UK, with the national airworthiness authority in Australia issuing an Airworthiness Bulletin to clarify their requirements. This concern was raised with the CAA and they were requested to review whether further guidance was necessary to address the problem in the UK. They advised that their records confirmed there were 169 aircraft registered in the UK fitted with the PT6 engines, with 11 Part 145 approved maintenance organisations approved to maintain those engines. They stated:

"From the fleet, we have actively sampled three maintenance providers, which together have responsibility for 25 aircraft, regarding their compressor wash practices and the authorisation of the personnel undertaking this work.

Additionally, we have had numerous discussions and meetings with CAA airworthiness colleagues who have direct oversight of these CAA approved organisations to establish compliance checks against Part 145 regulations.

We have also reviewed safety data and non-compliances to Part 145 and all this leads us to conclude there is no additional evidence of unapproved operator maintenance taking place with regard to the issue identified with G-CPSS.

With regard to published guidance, the UK Continuing Airworthiness regulations are clear on the specific requirement for authorisations. By virtue of the fact these are approved organisations, they are aware of these regulations and our position is supported by the review that we have carried out as previously mentioned."

Analysis

As the operator was not conducting the engine compressor washes in accordance with the AMM for the aircraft, they were not aware of the requirement to remove the drain plug nor to ensure that the wash fluid drained freely out of the engine exhaust casing. They were also not aware of the engine manufacturer's warning that this would result in corrosion of the RGB, leading to oil loss and a low pressure warning. Eventually the wash fluid accumulating in the exhaust duct caused sufficient corrosion in the RGB that during the accident flight, holes formed in the casing and oil was lost into the hot exhaust duct. This triggered the low oil pressure warning and generated the smoke seen coming from the exhaust.

The implications of the oil loss are that if the engine continues to operate without sufficient lubrication, it will overheat and seize. As the Cessna 208B is a single engine aircraft, this could potentially result in a forced landing off airfield. In this case it was fortunate that the aircraft was overhead a suitable airfield at the time the warning light illuminated, allowing an immediate diversion and landing while the engine was still operating normally.

As the compressor washes were not being conducted in accordance the applicable airworthiness regulations, there were also implications for the legality of the continued use of the aircraft. The aircraft was routinely being used for parachute operations at the time.

As part of the investigation the CAA was requested to consider whether the investigation findings raised broader concerns that needed to be addressed for the UK fleet of PT6 engines. They advised that their assessment was that this was not a widespread concern, and issuing further guidance was unnecessary.

Safety actions

Following this accident and once the operator became aware of the RGB corrosion issue, they stopped conducting compressor washes on all their aircraft and have confirmed that this maintenance will now only be carried out by their approved maintenance provider.

The current maintenance provider has confirmed they are aware of the corrosion issue, will conduct compressor washes in accordance with the AMM instructions and have put in place a 200 hour repeat inspection of the drain plug hole to prevent blockages.

Published: 19 March 2026.

Accident

Aircraft Type and Registration:	Rockwell Commander 112 TCA, N4698W
No & Type of Engines:	1 Lycoming TO-360-C1A6D piston engine
Year of Manufacture:	1978 (Serial no: 13274)
Date & Time (UTC):	23 December 2024 at 1135 hrs
Location:	Kinglassie, Fife
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	187 hours (of which 92 were on type) Last 90 days - 19 hours Last 28 days - 0 hours
Information Source:	AAIB Field Investigation

Synopsis

Shortly after takeoff from Fife Airport for a brief local flight, closed-circuit television (CCTV) footage from the airport showed that the aircraft departed from controlled flight, possibly entering an incipient spin. Around the same time, CCTV in Kinglassie, one mile south-west of the airport, recorded the sound of an engine apparently misfiring and N4698W is seen to strike rising ground. Post-accident examination of N4698W's fuel system revealed a significant amount of water contamination throughout the system. N4698W was kept outside at Fife Airport and further examination of the aircraft showed that the right-hand wing filler cap grommet was cracked and this could have allowed rain to enter the fuel system.

The AAIB released a Special Bulletin in March 2025[1] that contained preliminary information on the accident and clarified that it is possible that an entire fuel sample tube of water, drained from the fuel system, can still produce an odour of Aviation gasoline (Avgas) when smelled.

The CAA has also undertaken to review *'Safety sense leaflet number 28: Fuel Handling and Storage'* to incorporate more detailed information for pilots on pre-flight fuel sampling techniques, including techniques to check that a sample is fuel rather than all water and to highlight to pilots the need to check all fuel drain points.

Footnote

[1] AAIB Special Bulletin S1/2025. Available at https://www.gov.uk/aaib-reports/aaib-special-bulletin-s1-slash-2025-rockwell-commander-112-tca-n4698w [accessed March 2025].

Further, one Safety Recommendation is made to Commander Aircraft Corporation to amend the aircraft maintenance manuals to provide specific inspection criteria for the acceptable condition of fuel tank rubber grommet seals.

History of the flight

N4698W was based at Fife Airport near Glenrothes and was owned by the pilot. On the day of the accident CCTV footage showed the pilot arriving at the airport at 1100 hrs and walking to N4698W, which was parked at the south-western end of the apron. The footage then showed the pilot removing the aircraft's covers and moving around the aircraft. However, due to limitations of the recording and, as N4698W was parked at the end of the apron, the extent of the pilot's activity at the aircraft could not be determined. A witness reported that the aircraft's engine was running on the apron for approximately 20 minutes before CCTV recorded it taxiing at 1128 hrs.

On seeing N4698W taxiing, a witness in another aircraft called the pilot on the radio to check his intentions. The pilot replied that he intended to leave the circuit for a brief local flight before returning. N4698W was then seen entering the runway, backtracking to the threshold of Runway 24, and stopping. The witness recalled the engine running at high power for about 20 seconds before the takeoff run, which began at 1133:18 hrs.

CCTV recorded N4698W climbing out to the south-west until 1134:20 hrs, when it appeared to abruptly depart from controlled flight, possibly entering an incipient spin. At approximately the same time, CCTV in the village of Kinglassie, one mile south-west, captured the sound of an engine apparently misfiring, followed by images of an aircraft striking rising ground nearby. The witness at the airport also reported hearing a brief MAYDAY call from the pilot of N4698W.

Airport responders arrived quickly at the scene and found local residents already present. They secured the aircraft by turning off the ignition and fuel, and police arrived on scene at 1155 hrs. The pilot was fatally injured during the impact.

Accident site

N4698W struck an area of rising ground to the north of Kinglassie (Figure 1) with low forward speed and a high rate of descent. The left wing was more damaged than the right wing, indicating that the aircraft was in a shallow left roll attitude at impact. The landing gear was in the UP position. The propeller was in fine pitch and had stopped with one blade folded rearwards, beneath the nose, with the other two blades intact without any impact marks, consistent with the propeller windmilling whilst not being driven under power by the engine at impact. No fire had occurred. It was not possible to reliably determine the pre-accident positions of the magneto switch and fuel selector valve.

Figure 1
Accident site

The left wing fuel tank was ruptured and no fuel remained within the tank. Approximately 20 litres of fuel was recovered from the right wing.

Recorded information

Engine monitor

N4698W was fitted with a J.P. Instruments EDM700 engine monitor which, every six seconds, logged fuel flow, turbocharger inlet air temperature, and cylinder head and exhaust gas temperature for each cylinder. The unit also tracked the total fuel consumed, by summing the fuel flow data but did not record engine rpm or manifold pressure.

Pilot Aware data

Position and altitude data from the aircraft was also recorded by a Pilot Aware ground station at Fife Airport; a network of receivers used to track aircraft location to provide an airborne traffic awareness service.

The data for the accident flight, along with the engine monitor data is shown in Figure 2.

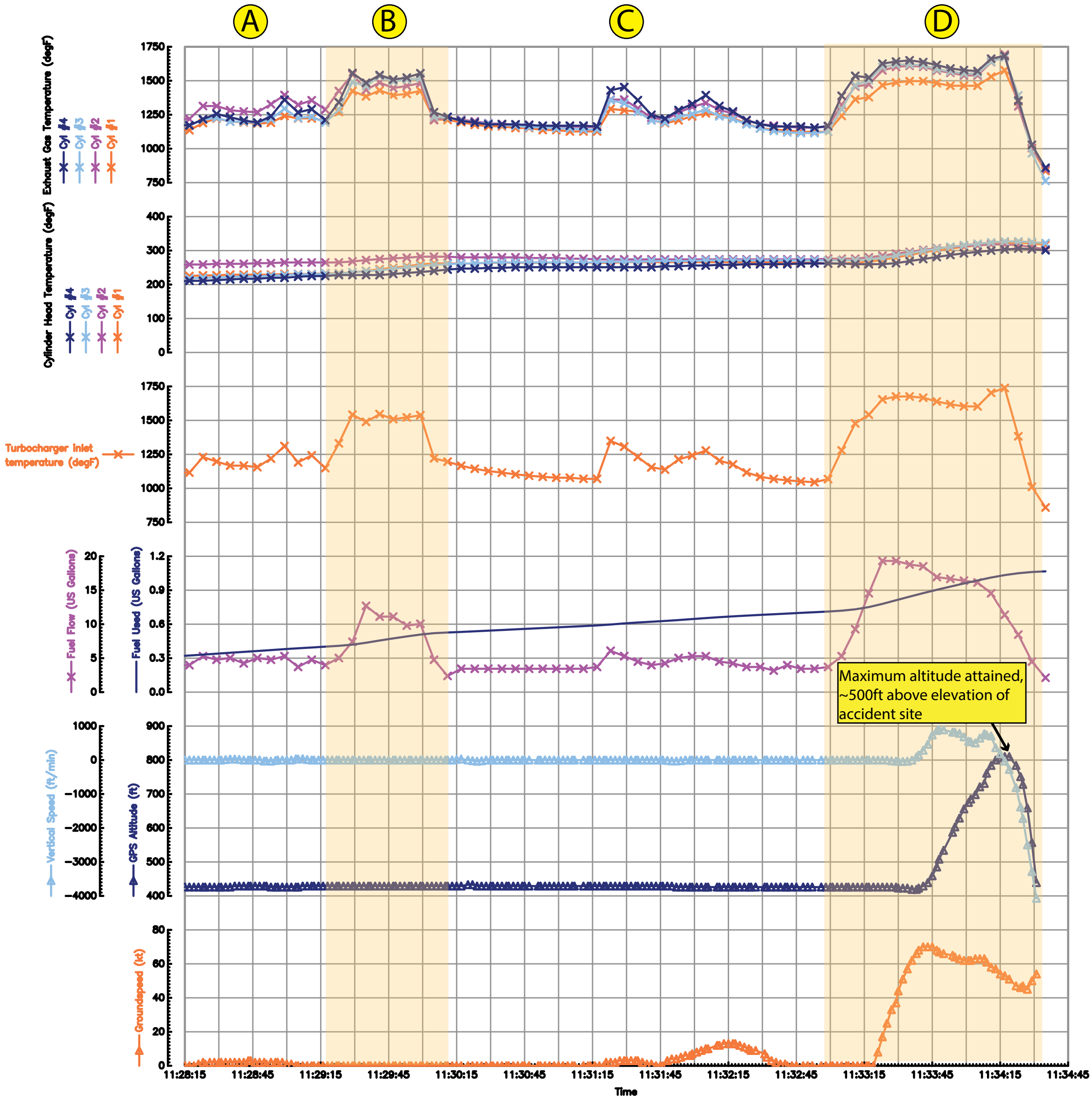


Figure 2

Pilot Aware and engine monitor data for the accident flight

Area A of Figure 2 shows N4698W taxiing to the area where engine run-up checks were performed, area B the actual engine run-up, area C the taxiing and back-tracking of the runway and area D the takeoff and initial climb-out. Of note is the solid blue line with no markers that represents the cumulative fuel used in US gallons (US gal). This shows that approximately 1.1 US gal of fuel was used before the engine parameters indicated that the engine was failing.

CCTV and mobile phone recordings

Several CCTV recordings and a mobile phone recording were obtained from properties nearby to the accident site and from the public. The mobile phone footage shows N4698W, descending over Kinglassie, predominantly in a right wing down bank, with a varying roll angle that is occasionally recovered to wings level. The propeller can be seen to be windmilling. One of the CCTV recordings then shows the aircraft, just before impact, in a left wing low and nose-down attitude. On the audio for this recording, N4698W's engine can be heard to misfire multiple times, interspersed with several periods of silence.

Further CCTV was also obtained from Fife Airport showing the departure and initial climb-out of N4698W.

Aircraft information

The Rockwell Commander 112 TCA is a four-seat light aircraft powered by a single turbocharged four-cylinder piston engine, driving a three-bladed constant speed propeller. The aircraft has one fuel tank in each wing and each tank has a useable capacity of 34 US gal. Two fuel sump drain points are provided for each wing, one at the inboard end of the tank and a second inboard of the main landing gear wheel well, close to the fuselage side (Figure 3).

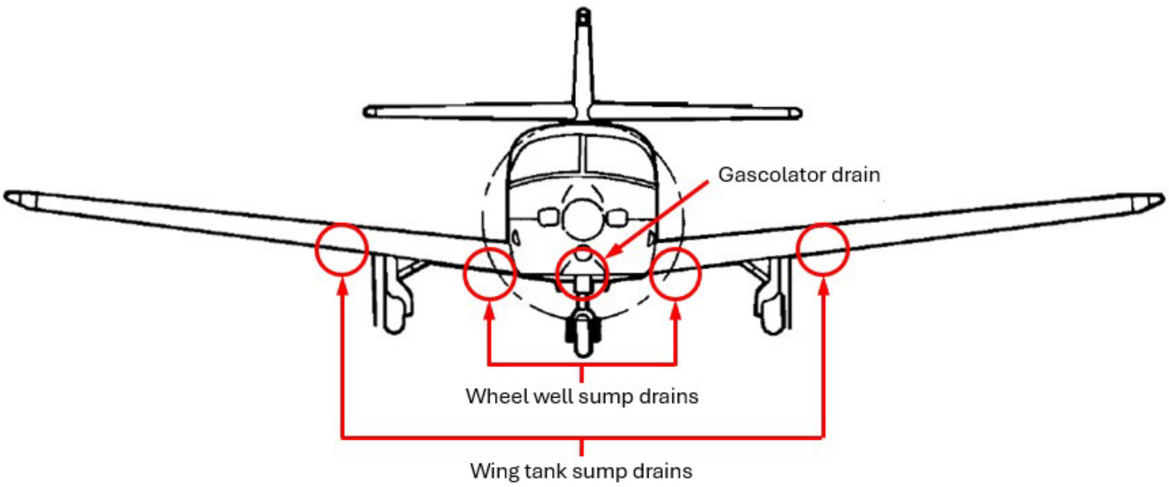


Figure 3

Rockwell Commander 112TCA fuel sump drain locations

The wing tanks are connected by fuel lines to a fuel selector valve in the cockpit where fuel can be selected by rotation of the valve. The selected positions vary between OFF, LEFT, BOTH, RIGHT and OFF, with the actuation of a sprung metal tab required to select either of the OFF positions to prevent their inadvertent selection. The Pilot's Operating Handbook (POH) requires the selector to be set to BOTH for takeoff and landing. Fuel flows downstream from the selector valve to a gascolator[2] mounted on the bottom of the firewall. The gascolator can be drained by pulling a handle beneath an access panel on the right side of the upper engine cowling. After the gascolator, fuel flows to an electric boost pump and then onwards to the engine-driven mechanical fuel pump before reaching the carburettor.

Footnote

[2] A gascolator is a fuel filter usually fitted at the lowest point of a fuel system.

Fuel is permitted to enter the carburettor float bowl through a float valve that opens in response to downward movement of the carburettor float. Fuel leaves the carburettor float bowl via a power jet orifice located in a slightly raised section of the bottom of the float bowl. The carburettor meters this fuel into a main nozzle in response to throttle lever demand. The main nozzle exhausts into a venturi in the induction airflow, providing a fuel to air mixture for induction into the cylinders.

The total internal volume of the fuel system between the wing fuel tank outlet fittings and the carburettor power jet inlet was measured by the AAIB and estimated to be 1,057 ml (0.28 US gal).

Each wing fuel tank has a single filler cap that is secured in place by a quick-release Camloc stud (Figure 4). The stud engages with a hinged flap immediately beneath the fuel filler aperture. The hinged flap provides an anti-syphon function in case the filler cap releases in-flight. When the stud is engaged in the hinged flap, the filler cap is pulled downwards against a rubber grommet seal, to seal the filler cap to the wing. The stud's shaft has an O-ring seal that is compressed when the filler cap is locked, to provide sealing between the head of the stud and the top of the filler cap.

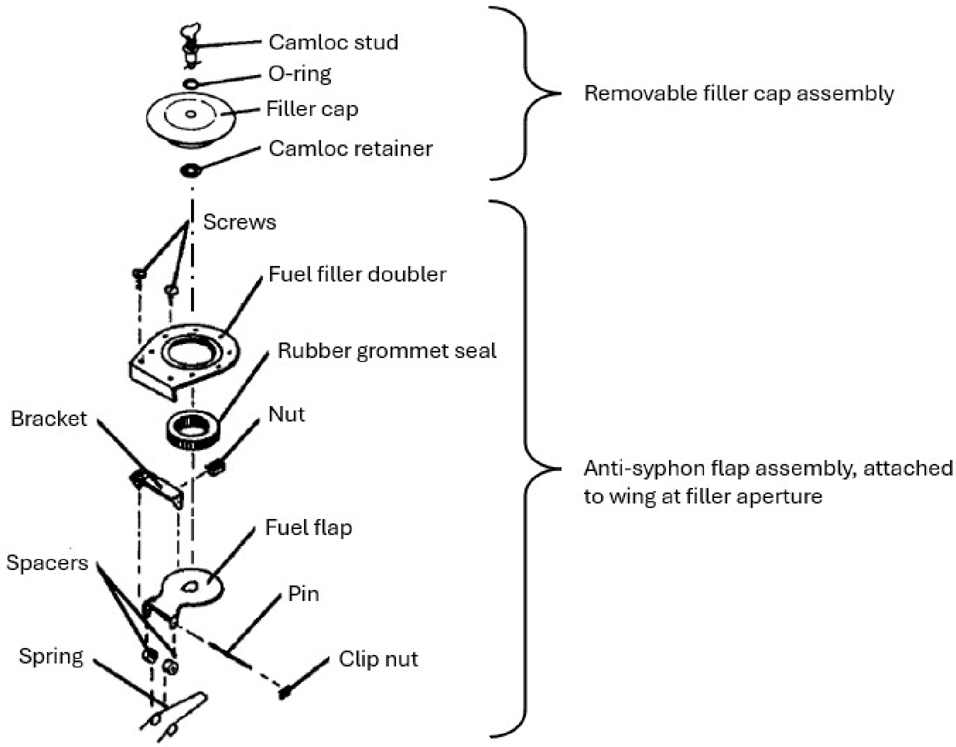


Figure 4

Wing fuel tank filler cap and anti-syphon flap assembly (adapted from Rockwell Commander 112TCA Illustrated Parts Catalogue, courtesy of Commander Aircraft Corp)

Maintenance history

A 50-hour service was carried out on the aircraft on 1 December 2023. The service included 14 routine servicing tasks and rectification of three defects, none of which related to the aircraft's fuel system.

As N4698W was not used for commercial operations, the maintenance tasks covered in the 50-hour service were permitted to be completed by the aircraft owner, as a privilege of his FAA Private Pilot's Licence. The permitted maintenance tasks are listed in *'14 CFR Part 43, Appendix A, Subpart C (Preventative Maintenance)'*.

However, this work was instead carried out by an LAA Inspector. He did not hold FAA approval to certify maintenance on US-registered aircraft and the work was not supervised by an FAA A&P (Airframe and Propulsion) mechanic. He stated that he had carried out the 50-hour service and that he performed the work on the basis of being a 'time-served experienced engineer' but was not exercising the privileges of his LAA Inspector rating.

The worksheets recording the tasks completed for the service were later counter-stamped by an FAA A&P IA (Inspector Authorisation) mechanic who was not present when the service took place and the date when the counter-stamp was added to the worksheets was not recorded. No logbook entry had been made for the 50-hour service. The FAA A&P IA mechanic stated that the 50-hour check worksheets had been counter-stamped in error, during the subsequent 2024 annual maintenance inspection, and that he had no involvement in the 50-hour service.

An annual maintenance inspection was completed on 7 March 2024, at 2,245 airframe hours. In July 2024 the pilot requested a maintenance organisation to investigate several defects, which were subsequently rectified. The defect list included the pilot reporting finding water in the fuel tanks. Inspection of the fuel filler caps revealed that the Camloc stud O-ring seals were in poor condition. The maintenance organisation replaced the O-ring seals, fitting two to each filler cap stud; one O-ring was installed correctly between the head of the stud and the filler cap, and a second O-ring was fitted on the shaft below the filler cap. This second O-ring seal was not required and provided no sealing function.

After this work was complete, the sealing of the new Camloc stud O-rings was checked by pouring small amounts of water onto the surface of the filler caps. No water was visible beneath the filler caps and the aircraft was released to service on 26 July 2024. The maintenance provider stated that he reminded the pilot to check for the presence of water in the fuel tanks on every pre-flight inspection.

Further maintenance work took place in late October 2024, following a flight on 19 October 2024 when the aircraft's engine stopped unexpectedly during rollout after landing. All eight sparkplugs were of a "sooty" appearance. They were inspected, cleaned and tested before being reinstalled in the engine, apart from the bottom sparkplug on the No 3 cylinder that was worn beyond permissible limits and was replaced with a new plug. The engine's fuel to air mixture was adjusted by ½ turn of the carburettor mixture adjusting screw in the lean direction, to lean the mixture. Following successful ground runs, the aircraft was released to service on 30 October 2024.

On 2 November 2024 the pilot refuelled the aircraft with 121 litres of Avgas 100LL and then flew it for 10 minutes, stating afterwards to the maintenance organisation that the aircraft was performing well, with no recurrence of the engine stoppage fault. This was the last recorded fuel uplift and no further flights took place between this flight and the accident flight. The aircraft was parked outside, on the parking apron, during this seven-week period. It had a cover over the cockpit area but no covers over the wings.

The aircraft had accumulated a total of 2,281 hours when the accident occurred. The engine had accumulated 341 hours since overhaul in 2010, and the propeller had accumulated 150 hours since new. A review of the aircraft logbooks showed that five different maintenance organisations had performed annual inspections on the aircraft in a 12-year period prior to the accident.

Maintenance manual

The Rockwell Commander 112TCA maintenance manual was reviewed for information relating to the filler cap rubber grommets. No information on inspection requirements, rejection criteria, or any life limit for the grommets was included. The grommets are also installed on Commander 114 and 115 aircraft.

The work pack for the annual maintenance inspection in March 2024 included proforma task sheets from *'The Commander Inspection Programme'*, which is only a guidance document that states maintenance personnel must *'Use maintenance manual for specific guidance/ instructions'*. This Inspection Programme contained a task[3] to *'Verify operation, condition and fit of fuel vent lines, fuel caps, fuel tank anti-syphon flaps. Verify appropriate fuel placards.'*. The Inspection Programme did not include any reference to the rubber grommet seals.

Aircraft examination

Examination of the aircraft's engine did not reveal any pre-accident mechanical defect that could cause the engine to run roughly or lose power. The engine's ignition system was examined in detail and found to function correctly.

Testing of fuel recovered from the right wing confirmed it met the specification for Avgas 100LL. Examination of the aircraft and engine fuel system revealed significant water contamination throughout the system downstream of the fuel selector value and in the left wheel well sump drain (Figure 5). The volume of water recovered from the carburettor float bowl was sufficient to cover the power jet inlet port in the bottom of the bowl, proving that it was possible for water, rather than fuel, to be drawn into the main nozzle and carburettor venturi.

Footnote

3 Airframe Task 11, page 5.

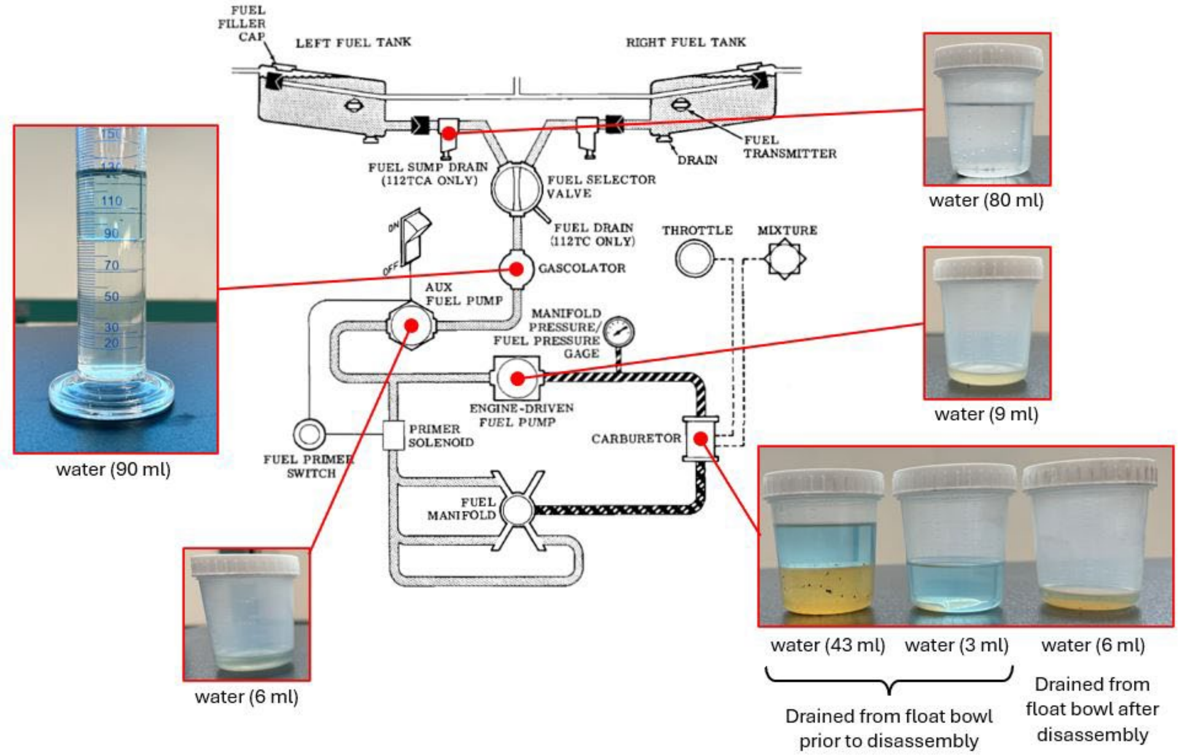


Figure 5

Water recovered from the aircraft's fuel system (fuel system diagram courtesy of Commander Aircraft Corp)

The total volume of water recovered from the aircraft's fuel system was 237 ml.

Fuel tank filler sealing grommets

The wing fuel filler rubber grommets were visually examined. When viewed from above the wing, both grommets had visible surface cracking (Figure 6). The grommets had also taken on a permanent deformation where a raised section on the lower side of the filler cap had been pressed into the grommet when the caps were in the locked down position. This permanent deformation was caused by age-related hardening of the grommet's rubber material. As the section of wing skin around the filler aperture was cut away for access after the accident, it was possible to also view the lower surface of the grommets. The lower surfaces of both grommets had large cracks present, outlined in yellow in Figure 6, and some of the grommet material was missing.

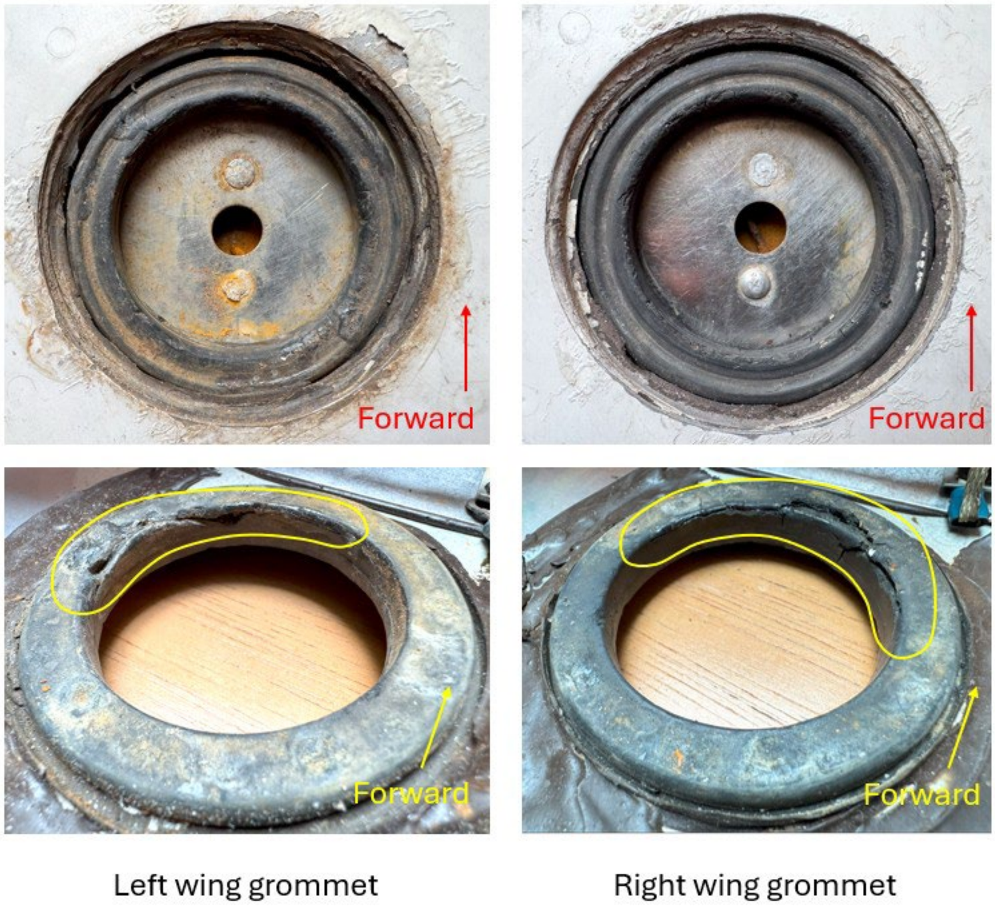


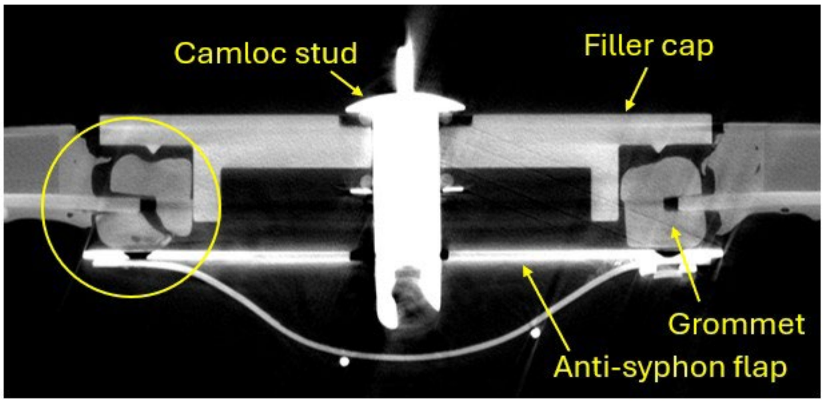
Figure 6

Visual condition of the fuel filler rubber grommets (upper surface of grommet shown above, lower surface shown below)

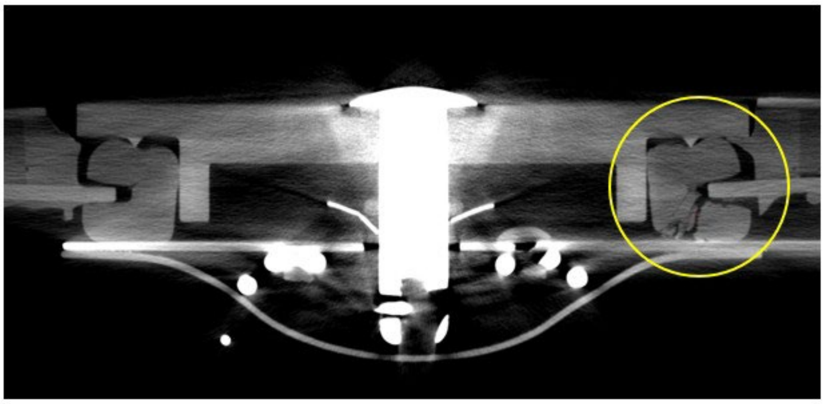
The internal condition of the sealing grommets was examined using CT X-ray[4], with the filler cap fitted. The right filler cap was fitted in the locked position, but this was not possible with the left filler cap due to the Camloc stud retaining wire having broken in the accident, so the filler cap was loosely inserted into the grommet without being locked down. The CT X-ray images showed that the cracks in both rubber grommets extended through their thickness (Figure 7).

Footnote

4 Computerised Tomography combines multiple X-ray image 'slices' through an item to create a 3-D model of the interior of its structure.



Left wing filler cap – loosely inserted



Right wing filler cap – locked position

Figure 7

CT X-ray images of the left and right fuel filler cap assemblies, showing through-thickness cracking (circled yellow) of the rubber grommet seals

The right filler cap assembly was locked down and checked for leakage when water was applied to the upper wing skin. No leakage occurred when water was applied locally to the Camloc stud, showing that the O-rings replaced in July 2024 created an effective seal between the stud and the filler cap. When water was applied to the whole filler cap assembly, significant leakage past the filler cap was observed (Figure 8). It was not possible to conduct a similar leakage test on the left filler cap assembly due the broken Camloc stud retaining wire.

Figure 8

Water leaking past the right filler cap seal when exposed to water, supported on trestles and viewed from below

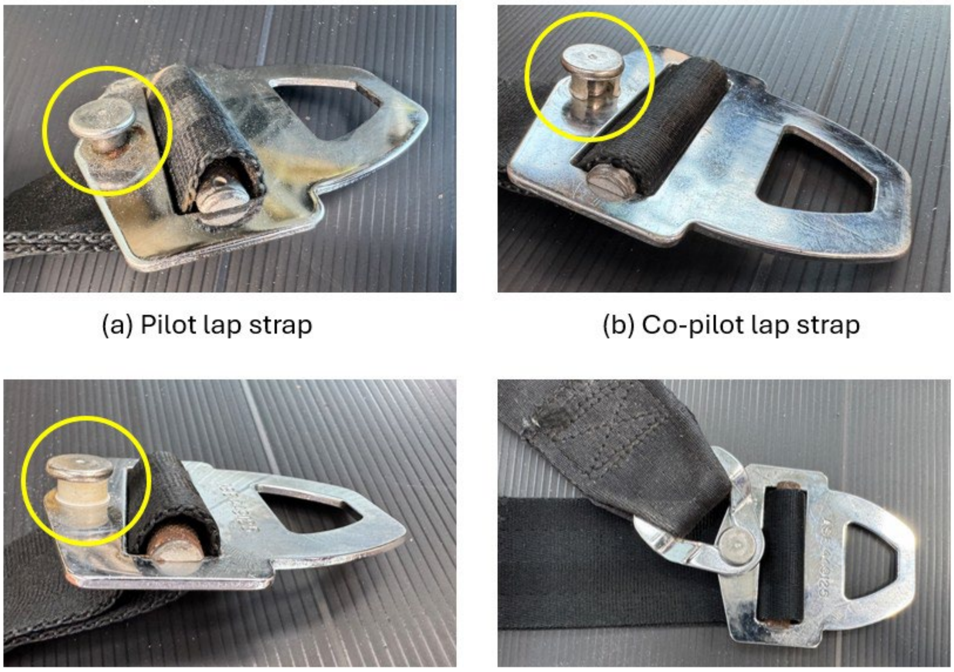
Manufacturer's comments

The manufacturer commented that the poor condition of the sealing grommets was well beyond typical normal ageing of in-service grommets, and that they were in a state inconsistent with continued airworthiness expectations. They stated that the degree of visible deterioration would ordinarily and reasonably be expected to trigger their removal and replacement under standard aviation maintenance practice, irrespective of whether explicit life limits or inspection criteria were published.

The manufacturer further commented that as five different maintenance organisations had performed annual inspections on the aircraft over a 12-year period, with none rejecting the deteriorated grommets, this constituted multi-party oversight failure across several maintenance organisations.

Other observations

The aircraft was fitted with AmSafe three-point seat belts for all occupants. It was noted that the plastic collar on the pilot's lap strap buckle pin was missing (Figure 9 (a)). This collar is designed to provide a positive 'snap' location of the single shoulder strap where it attaches to the lap strap buckle pin, to prevent the shoulder strap from becoming inadvertently detached from the lap strap. Despite the missing collar, the pilot's shoulder strap had remained attached to the lap belt during the accident. The co-pilot lap strap buckle had a plastic collar fitted, but this was cracked and loose on the pin (Figure 9 (b)). The passenger lap belts had plastic collars fitted and these were in good condition (Figure 9 (c) and (d)).



(a) Pilot lap strap

(b) Co-pilot lap strap

(c) Passenger lap strap

(d) Passenger lap strap with shoulder belt

Figure 9

Seat belt shoulder strap retaining pin plastic collars

Pre-flight fuel sampling

Pilot's Operating Handbook (POH)

The POH recovered from the aircraft describes items to be checked in the pre-flight inspection, and lists the actions required for five fuel system drains:

- Right wing fuel tank sump – '*DRAIN SAMPLE. Check valve closed'.*
- Right wheel well fuel drain – '*DRAIN SAMPLE. Check valve closed'*.
- Fuel gascolator – *'DRAIN'.*
- Left wheel well fuel drain – *'DRAIN SAMPLE. Check valve closed'*.
- Left wing fuel tank sump – '*DRAIN SAMPLE. Check valve closed'*.

In the description of the fuel system, the following advice is provided:

> *'**Fuel filters and Drain Valves***
>
> *…Prior to the first flight of the day, the wing tank sumps, gascolator, and wheel well sumps should be drained to check for the presence of water or sediment*

in the fuel system. If water is found in the gascolator, there is a possibility that the wing tank sumps or the wheel well sumps may contain water. Therefore, the wing tank sumps and wheel well sumps should be redrained as necessary'.

In a later section on fuel contamination, it advises:

> *'If water or sediment is present in the fuel sample, continue to drain fuel until all traces of water or sediment are removed from the system'.*

Fuel sampling techniques and testing

The CAA's '*Safety sense leaflet number 28: Fuel Handling and Storage'* covers fuel sampling and testing. It states, *'Draw fuel from each drain or sump and examine it in accordance with the Flight Manual or Operating Handbook'.* Further, when discussing drawing a fuel sample it states that *'If you see no separation in the sample, confirm that the sample is all fuel rather than all water'.*

The Aircraft Owners and Pilots Association has also published several articles on fuel sumping techniques, easily located on their website using the search facility, including the article *'Fuel Sumping – Good to go, or check again?'*, June 1 2022. Available at https://www.aopa.org/news-and-media/all-news/2022/june/flight-training-magazine/technique-fuel-sumping [accessed March 2026] and *'Checking Fuel Samples'*. Available at https://www.aopa.org/training-and-safety/students/presolo/skills/checking-fuel-samples [accessed March 2026]. A graphic, from the first of these articles, is reproduced below as Figure 10.

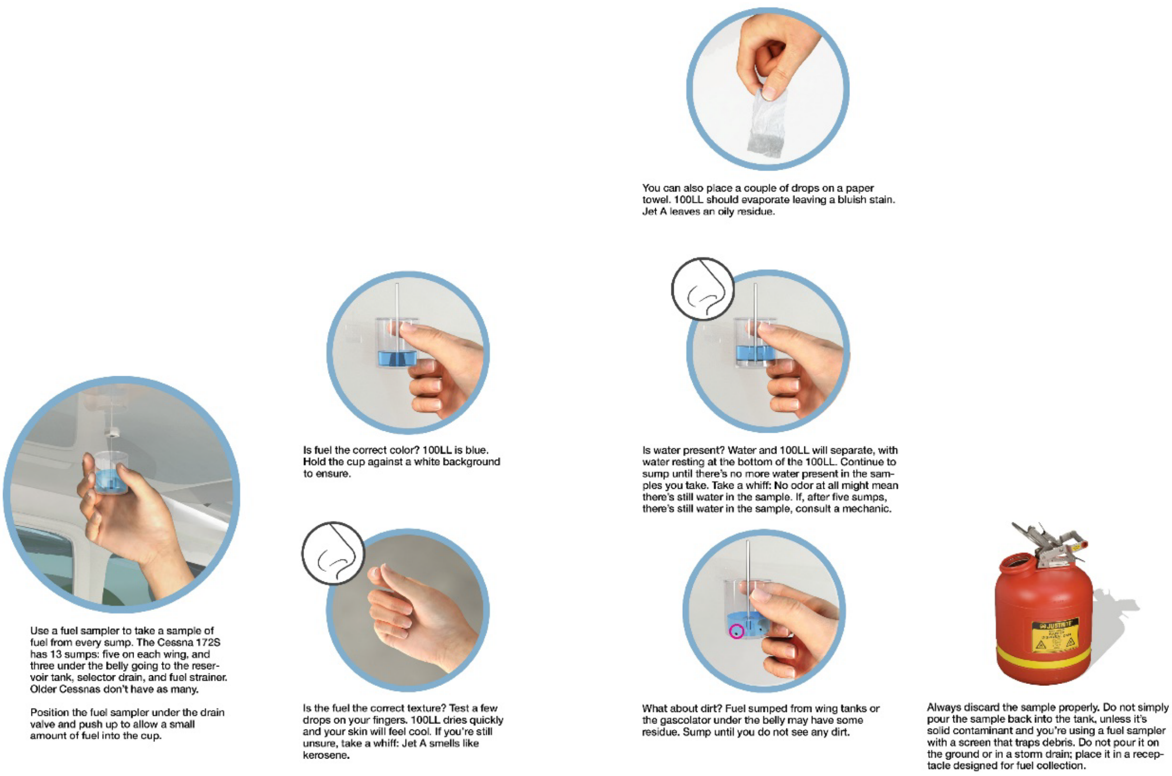


Figure 10

AOPA article on fuel sumping techniques

The AAIB is aware that the UK General Aviation Safety Council (GASCo) has also been highlighting the risk of fuel contamination at various general aviation events over the summer in response to AAIB Special Bulletin S1/2025 on this accident. They have been demonstrating that smell alone does not confirm the sample is Avgas and that it can be visually challenging to tell the difference between a full sample of water or Avgas using several test tubes filled with different combinations of fuel and water for pilots to learn from.

Figure 11

GASCo Safety Promotion work

Commercially available water detecting paper, capsules or pastes that indicate the presence of water by changing colour can also be used to detect the presence of water in hydrocarbon based fuels.

Survivability

The aircraft's impact on an area of rising ground caused a rapid deceleration and the accident was not considered to be survivable.

Meteorology and aircraft exposed to the elements

The Scottish Environmental Protection Agency maintains a weather station at Fife Airport, located immediately adjacent to the aircraft parking apron. Rainfall records were analysed that showed a total of 82.0 mm of rain had fallen at Fife Airport in the period between N4698W's flight on 2 November 2024 and the accident flight.

The CAA's '*Safety sense leaflet number 3: Winter flying'* covers aircraft exposed to the elements and recommends the use of a cover, as was utilised on N4698W, and further details the risk of water ingress into the fuel, via the deterioration of filler cap seals and through condensation. A witness at the airport noted that at the time of the accident, the wind was from 240° at less than 15 kt, and the cloud base was approximately 2,000 ft. CCTV imagery from the local area indicated that there had been recent light rain.

Airfield information

Wind turbines

Fife Airport is located approximately 3 km south-west of Glenrothes. During the investigation, the AAIB was made aware of a wind turbine installation (Westfield Wind Farm) situated south-west of the airport, which had raised concerns within the flying community during its planning process.

The installation comprises four wind turbines, each with a rotor diameter of 80 m and a maximum tip height of 110 m. The two closest turbines are positioned about 2.9 km south-west of Fife Airport.

In response to the rapid expansion of wind turbine development across Europe, EASA commissioned an assessment of their safety impact in the vicinity of aerodromes. The resulting report was published in October 2023[5].

A literature review conducted during this assessment found broad agreement among recent experimental (wind tunnel and water tunnel) and computational fluid dynamics studies. These concluded that the highest hazard for light aircraft upset occurs at between four and six rotor diameters downwind of the turbine, depending on windspeed. Within this range, rolling moments generated by turbine wake vortices can induce hazardous upset conditions for small aircraft, particularly within high-shear zones at the vortex edge. Such hazards are amplified under stable atmospheric conditions, which allow turbulence to persist for longer. Beyond approximately nine rotor diameters downwind, this turbulence typically dissipates.

Footnote

[5] Available at https://www.easa.europa.eu/en/document-library/general-publications/safety-impact-wind-turbines-vicinity-aerodromes-and-air [accessed March 2026].

The turbines at Westfield Wind Farm have a rotor diameter of 80 m, generating wake vortices that may extend up to 720 m downwind. The location at which N4698W was observed to depart from controlled flight was approximately 1,600 m downwind of the wind farm (20 rotor diameters).

Pilot information

The pilot held a UK Private Pilot's Licence (issued in March 2023) with an SEP rating valid until February 2025. He also held a Private Pilot's Licence issued by the US FAA with a rating for single engine aircraft, valid until March 2025. He had flown 187 hours, of which 92 hours were in N4698W which he purchased in March 2023. He conducted differences training in April and May 2023.

His last check-flight with an instructor, on 2 March 2024, was for a FAA PPL flight review. The pilot held a night rating and was working towards a restricted instrument rating.

Additionally, the pilot co-owned a Cirrus SR22 (purchased in July 2024) and completed differences training and an approved manufacturer's course for this aircraft.

Medical

The pilot held a Class two medical which was valid until July 2025.

Engine failure after takeoff

The CAA publishes *'Safety Sense Leaflet 30: Loss of Control Stall & Spin Awareness'*[6], which identifies loss of control through stalling or entering a spin as one of the leading causes of general aviation accidents.

In the event of an engine failure after takeoff (EFATO), on page 5 the leaflet states:

> *'On departure the aircraft will have a low airspeed and high nose attitude. An engine failure or partial loss of power will lead to a rapid deceleration and increasing angle of attack. To maintain a safe airspeed and avoid stalling, the pilot must promptly select a lower nose attitude. If the aircraft has already decelerated below the recommended gliding speed, this will initially require a lower attitude than normal'.*

Standard flight instruction following an EFATO emphasises immediately lowering the nose of the aircraft to maintain or achieve best glide speed, then selecting a landing site within 30° either side of the nose, even if it is less than optimal. The overriding priority is to preserve flying speed and maintain control.

The pilot was assessed on this technique during his PPL skill test in February 2023, and again during his FAA PPL flight review in March 2024.

Footnote

[6] Available at https://www.caa.co.uk/our-work/publications/documents/content/safety-sense-leaflet-30/ [accessed March 2026].

Partial power loss

In 2021, the AAIB conducted investigations into two accidents involving single-engine aeroplanes that experienced a partial loss of engine power[7] The report into G-BBSA cited a 2013 study published by the Australian Transport Safety Bureau[8], which found that:

> *'In the research period, from 2000 to 2010, there were nine fatal accidents resulting from response to a partial power loss compared to no fatal accidents where the engine failed completely. The research data also indicated that a partial power loss was up to three times more likely to occur than a total loss.'*

The AAIB investigations identified that partial power loss events were not covered in the UK PPL(A) syllabus and issued three safety recommendations to the CAA. These addressed the inclusion of partial power loss scenarios in ab initio training, the provision of guidance for instructors and examiners on training and rating revalidation, and the publication of guidance for pilots. The CAA addressed these recommendations within the context of the ongoing General Aviation Pilot Licensing and Training Simplification Project, which led to the following actions:

- From 1 October 2025, flight exercises addressing partial loss of engine power were introduced into the training syllabi for the PPL(A), NPPL(A) and SPL with Touring Motor Glider (TMG) rating.
- Revised Flight Crew Licensing requirements and crediting provisions now ensure that applicants for the PPL(A) with previous aeroplane, TMG or microlight experience complete the specified partial power loss training before finishing their course.
- Revised Acceptable Means of Compliance for FCL.740 - biennial refresher training for single-engine pilot, TMG and microlight class ratings - now include partial power loss as a recommended exercise.

The CAA provided detailed guidance on techniques for managing partial power loss situations through a comprehensive webinar delivered on the 10 September 2025 by their safety partner Astral Aviation Consulting. This webinar was promulgated by the CAA's notification system 'Skywise' as well as social media and emails.

Further safety promotion material on managing partial power loss situations in single-engine fixed-wing aeroplanes is also being developed by the CAA and is intended to be published by the end of Q2 2026.

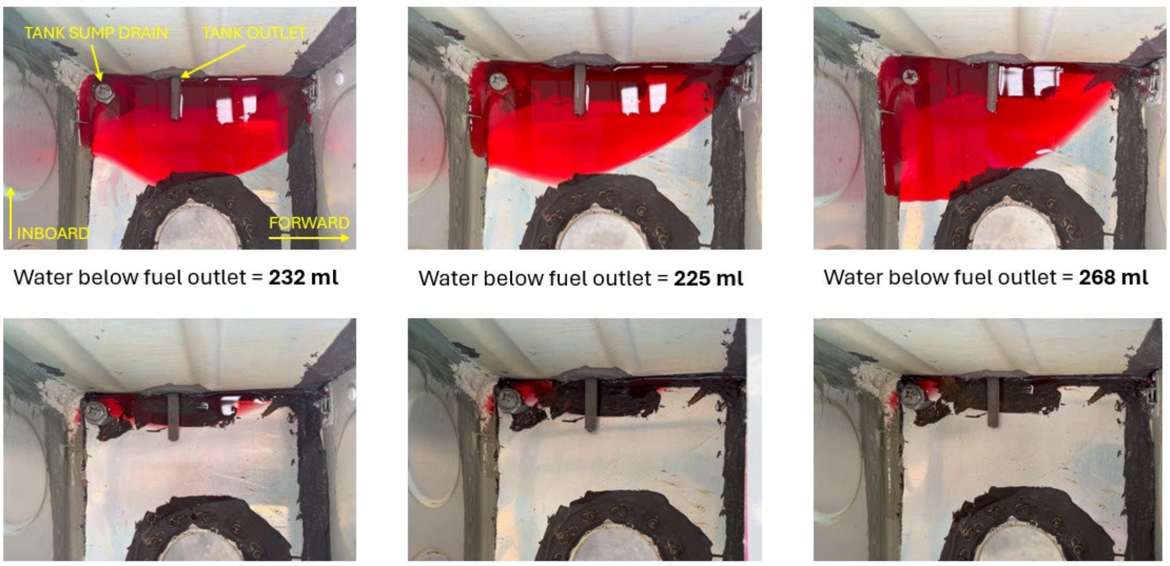
Footnote

7 Rogers Sky Prince, G-CJZU and Grumman AA5 G-BBSA, published 16 June 2022.
8 https://www.atsb.gov.au/sites/default/files/media/4115270/ar-2010-055_no3.pdf [accessed March 2026].

Tests and research

Nine other Rockwell Commander 112/114/115[9] aircraft were measured to assess the typical range of wing pitch attitudes (measured at the rib at the inboard end of the wing fuel tank) when parked, and what the dihedral[10] angle of wings was at the inboard end of the wing fuel tank. The average wing dihedral measured was 6.2°, and the incidence of the inboard fuel tank rib ranged between 2.0° and 5.7°. N4698W's right wing was supported at a dihedral angle of 6.2° and at three different pitch angles, 2.0°, 4.0° and 6.0°, to cover the range observed in the other aircraft assessed. For each pitch angle, a measured volume of water, coloured red to aid visibility, was added to the fuel tank to assess how much water could collect at the inboard end of the tank before it began to flow out of the tank outlet fitting (Figure 12). The amount of water able to collect in the wing tank varied between 225 ml and 268 ml, depending on the wing pitch attitude.

The effect of draining the water from the fuel tank using the tank sump drain was also assessed for each pitch angle. In every case, the tank sump drain was effective in removing all but a very small residue of the water in the fuel tank.



Water below fuel outlet = **232 ml** | Water below fuel outlet = **225 ml** | Water below fuel outlet = **268 ml**

After wing sump drain used | After wing sump drain used | After wing sump drain used

(a) Fuel tank rib incidence = 2.0° | (b) Fuel tank rib incidence = 4.0° | (c) Fuel tank rib incidence = 6.0°

Figure 12

Water retained in the wing fuel tank at varying wing pitch angles and effect of using the fuel tank sump drain. Water coloured red to aid visibility

Footnote

9 These models of Rockwell Commander share a similar design of wing fuel tank.

10 The dihedral angle of a wing is the angle between the wing and a horizontal plane, when the aircraft is viewed from the front. The dihedral angle is positive when the wing slopes downwards from the wing tip to the wing root.

Other information

Photograph of N4698W's parking area

A photograph of the apron area where N4698W had been parked was taken in the morning of the day after the accident by the AAIB (Figure 13). This photograph showed a triangular pattern of fuel staining at a similar spacing and orientation to the aircraft's wheel well fuel drains and firewall-mounted fuel gascolator. No similar fuel staining was present outboard of the three fuel stain marks. Fife Airport had remained closed since the accident had occurred and no other aircraft had occupied this area of the apron since N4698W departed.

Figure 13

Fuel stain marks, circled in yellow, on the Fife Airport apron where N4698W had been parked

Analysis

Loss of control

Shortly after takeoff, N4698W was observed to depart from controlled flight, possibly entering an incipient spin. CCTV audio captured the sound of the engine running roughly, with intermittent combustion, before it ultimately lost power completely. Based on the available evidence, the investigation was unable to determine the precise cause of the loss of control.

Westfield Wind Farm is located approximately 1,600 m upwind of the point at which N4698W departed from controlled flight. Recent research indicates that the highest hazard for light aircraft upset occurs at a distance of between four and six rotor diameters downwind of the turbine. Beyond approximately nine rotor diameters downwind, this turbulence typically dissipates. At approximately 20 rotor diameters away, it is therefore unlikely that turbine wake vortices were a causal factor, although this possibility could not be definitively excluded.

The CAA identifies loss of control through stalling or entering a spin as one of the leading causes of accidents in general aviation. This highlights the importance of pilots regularly practising EFATO drills, where the overriding priority is to preserve flying speed and maintain control of the aircraft. Such practice is especially critical in cases of partial engine failure, which introduce additional pressure and uncertainty factors, particularly at low altitude, as was the case here where the maximum elevation attained above the accident site was ~500 ft, that can adversely affect decision-making.

Water contamination

The engine's rough running and loss of power was caused by ingestion of water into the carburettor float bowl, leading to water being fed into the main nozzle. Significant water contamination was present throughout the fuel system downstream of the fuel selector valve and also in the left wheel well sump drain.

The volume of water recovered from the aircraft's fuel system after the accident was comparable to the volume of water able to collect in a single wing tank, below the level of the outlet fitting, if the wing tank sump drain was not used during pre-flight inspection. Given the poor condition of both fuel cap seals, the rainfall that the aircraft had been exposed to and the demonstration of leakage of water past the right wing seal during testing, it is likely that water was present in both wing fuel tanks prior to the pre-flight inspection on the day of the accident.

The time in service of the seals was not determined, however their poor condition is age-related and they were likely to have been fitted to the aircraft for many years. During this period, multiple maintenance organisations had performed annual inspections on the aircraft, none of which had rejected the seals based on their appearance. The lack of any recommended service life or inspection criteria for the seals was a contributory factor in maintenance personnel not rejecting the seals before they deteriorated to the point they had when the accident occurred.

Therefore, the following Safety Recommendation is made:

Safety Recommendation 2026-002

It is recommended that Commander Aircraft Corp. publishes maintenance information that provides specific inspection criteria for the acceptable condition of Rockwell Commander 112/114/115 fuel tank rubber grommet seals.

Timeline of the loss of power

The time interval between the engine being started and the point where it began to misfire during the climb-out was approximately 26 minutes. Data recorded by the aircraft's flowmeter showed that the fuel flow at idle power was approximately 4.4 US gal/hr. The volume of fuel downstream of the wing fuel tanks, with the fuel selector set to BOTH, would therefore be sufficient for the engine to run at idle power for approximately four minutes.

As this period is much less than 26 minutes, it follows that any water present in the bottom of the wing fuel tanks only started to flow out of the tank outlet fittings when disturbed as the aircraft manoeuvred during taxiing and takeoff. The aircraft's recorded fuel flow at takeoff power for the accident flight was 19 US gal/hr. At this rate, the fuel downstream of the wing tanks with the fuel selector set to BOTH would have been consumed in approximately 50 seconds, before water began to reach the carburettor. This is similar to the time interval observed between the start of N4698W's takeoff roll and the point where the engine began to misfire.

Pre-flight inspection

The pre-flight inspection was not effective in removing all the water present in the aircraft's fuel system. It could not be determined what actions were performed on the pre-flight inspection, due to the limitations of the CCTV footage. The POH required that fuel samples were drawn from all five fuel system drains during the pre-flight inspection prior to the first flight of the day. If water is present in the fuel sample, the POH recommends continuing to drain fuel until all traces of water are removed from the system.

The triangular pattern of fuel staining on the apron surface where N4698W had been parked may indicate that the wing sump drains were not used during the pre-flight inspection, or if they were drained, a full sample tube of water may have been drawn and that this may have been assessed as clean fuel, rather than water[11].

Testing carried out by the AAIB showed that use of the wing tank sump drains was effective in removing most of the water that may collect at the wing tank's low point, when the aircraft was parked.

Conclusion

Shortly after takeoff, N4698W departed from controlled flight, possibly entering a spin, after the engine began running rough and then lost power completely. The engine's rough running and loss of power was caused by ingestion of water into the carburettor float bowl, leading to water being fed into the main nozzle. Significant water contamination was present throughout the fuel system downstream of the fuel selector valve and in the left wheel well sump drain. Although the extent of the pilot's pre-flight inspection could not be determined from the CCTV footage, it was not effective in removing all the water present in the aircraft's fuel system.

Footnote

[11] AAIB Special Bulletin S1/2025, S1-2025_Rockwell_Commander_112_TCA_N4698W.pdf [accessed March 2026].

The wing fuel tank filler seals were found to be in poor condition, allowing water to leak into the wing fuel tanks whilst the aircraft was parked outside. This defect had not been rectified at recent annual inspections and the aircraft's maintenance manual did not contain a recommended service life or inspection criteria for the acceptable condition of the seals.

The exact cause of the departure from controlled flight could not be determined. The investigation considered but largely discounted wind turbine wake effects due to distance, though they could not be fully ruled out. The CAA stresses that loss of control remains a leading accident cause in general aviation, highlighting the need for regular EFATO practice to maintain speed and control, particularly during partial engine failures.

A number of safety actions have been agreed with the CAA and one Safety Recommendation has been made.

Safety actions

The CAA has undertaken to review *'Safety sense leaflet number 28: Fuel Handling and Storage'* to incorporate more detailed information for pilots on pre-flight fuel sampling techniques, including techniques to check that a sample is fuel rather than all water and to highlight to pilots the need to check all fuel drain points. They also intend to include the topic in one of their regular safety webinars carried out by their third party supplier. Both activities are scheduled for completion by the end of Quarter 2 of 2026.

In addition, the CAA has run a series of aircraft maintenance and continuing airworthiness roadshows and a segment of these covered fuel caps and life-limited items, such as seals.

Safety Recommendations

The following Safety Recommendation has been made to Commander Aircraft Corp.:

Safety Recommendation 2026-002

It is recommended that Commander Aircraft Corp. publishes maintenance information that provides specific inspection criteria for the acceptable condition of Rockwell Commander 112/114/115 fuel tank rubber grommet seals.

Published: 26 March 2026.

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 accidency of the information provided cannot be assured.

Serious Incident

Aircraft Type and Registration:	Boeing 737-8200 MAX, EI-HEZ
No & Type of Engines:	2 CFMI LEAP-1B27 engines
Year of Manufacture:	2019 (Serial no: 62312)
Date & Time (UTC):	24 April 2025 at 1300 hrs
Location:	London Stansted Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 191
Injuries:	Crew - None Passengers - None
Nature of Damage:	None reported
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	33 years
Commander's Flying Experience:	6,700 hours (of which 6,380 were on type) Last 90 days - 184 hours Last 28 days - 40 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

A Boeing 737-8200 MAX experienced a fuel leak on a scheduled flight from Venice to Manchester, resulting in a diversion to London Stansted Airport. The non-normal checklist was not actioned fully, with the pilots deciding not to shut down the affected engine. On landing, the use of thrust reverse with a fuel leak increased the risk of fire.

History of the flight

The crew reported for duty for a flight from Venice Airport to Manchester Airport. Weather across Europe was good and they agreed to accept the standard operational flight plan (OFP) fuel load, which included 637 kg of extra fuel. They positioned out to a remote parking stand to wait for the arrival of the aircraft.

The aircraft was handed over by the off-going crew, the commander conducted an external inspection and a normal refuel took place. The passengers were boarded but aircraft dispatch was delayed by an hour due to a company computer system failure. During this time the APU was running and a fuel imbalance had developed between the main fuel tanks. This was corrected with the fuel balancing procedure being conducted from memory. The aircraft completed a normal pushback with engine start and departed without any further delay.

Shortly after reaching their cruise altitude of FL380, the commander noted a fuel imbalance developing, with the right main tank indicating 250 kg less that the left main fuel tank. The fuel balancing procedure was conducted again from memory, with normal fuel pump configuration restored after seven minutes of fuel cross-feeding.

After another 20 minutes of flight, a fuel imbalance of 170 kg was noticed with the right main fuel tank low. The commander decided to action the fuel '*IMBAL'* non-normal checklist which directed them to the '*Fuel Leak Engine'* non-normal checklist. The pilots noted an increasing fuel imbalance of around 100 kg every 10 minutes, which indicated an engine fuel leak (the QRH stated that a change of fuel imbalance of 228 kg within 30 minutes or less should be classified as a leak). The cabin crew did not observe any signs of fuel spray from the engine or strut.

Based on the current leak rate, continuing to their destination would use all the additional fuel on board, and so a decision was made to initiate a diversion to Stansted Airport. The pilots considered that their leak rate of 300 kg every 30 minutes exceeded the QRH value by only 70 kg, and so they decided not to shut down the engine on the affected side given that the weather at Stansted Airport was good and the diversion was only expected to take about 20 minutes. They stopped the checklist and monitored the fuel consumption.

A normal approach was conducted with the IMBAL alert illuminating during the approach, and the aircraft landed with a fuel imbalance of 586 kg. The aircraft stopped after exiting the runway and was met by the fire service who confirmed there was fuel leaking from the right engine. The aircraft was shutdown and towed to stand for passengers to disembark.

Aircraft fuel system

The Boeing 737-8200 MAX has three main fuel tanks: left wing, right wing and centre. Each fuel tank has two electrically driven fuel pumps that provide pressurised fuel into a fuel manifold associated with each engine. The centre tank fuel pumps produce higher pressure to ensure the centre tank fuel is used before the wing tank fuel. Check valves located throughout the system ensure the proper direction of fuel flow. Fuel shutoff valves are located on the front spar outboard of each engine strut (spar fuel shutoff valve) and at the engine (engine fuel shutoff valve).

The engine fuel manifolds are interconnected by a cross-feed valve. Normally the cross-feed valve is closed, and each engine is independently fed with pressurised fuel from their respective side. If the cross-feed valve is opened, fuel pressure can be provided to both engines from any operating fuel pump.

Fuel imbalance

The Airplane Flight Manual (AFM) and Flight Crew Operations Manual (FCOM)[1] provide a maximum lateral fuel imbalance limitation between main wing tanks of 453 kg for taxi, takeoff, flight or landing.

Footnote

1 The FCOM is prepared by Boeing for the aircraft operator. It contains operational procedures and information for the flight crew to safely and efficiently operate the aircraft.

The manufacturer states in the Flight Crew Training Manual (FCTM)[2] that the fuel balance limitation is not for aircraft controllability, but to maximise the structural life of the airframe and landing gear. Lateral control is not significantly affected when operating beyond the normal balance limits. The FCTM goes on to say that *'routine fuel balancing when not near the imbalance limit increases the possibility of crew errors and does not significantly improve fuel consumption'*.

An amber IMBAL alert is displayed to the pilots when the lateral fuel imbalance between the wing tanks is greater than 453 kg. Fuel cannot be transferred between wing tanks to correct a fuel imbalance. A fuel imbalance is rectified by burning fuel from the heavier side by using the cross-feed valve. There is an *'IMBAL'* non-normal checklist contained in the Quick Reference Handbook (QRH).

If considering balancing fuel before the limitation is reached, the FCTM refers to the *' Fuel Balancing'* supplementary procedure contained in the FCOM. The FCOM guidance on supplementary procedures states, '*at the discretion of the captain, procedures may be performed by memory, by reviewing the procedure prior to accomplishment, or by reference to the procedure during its accomplishment.'*

Fuel leak

The FCTM states that a fuel leak should be considered as a possibility any time an unexpected fuel quantity indication, Flight Management Computer (FMC) fuel message, or fuel imbalance condition is experienced. This consideration is incorporated at the start of both the QRH *'IMBAL'* non-normal checklist and the FCOM *'Fuel Balancing'* supplementary procedure.

The most common type of fuel leak is between the front spar and the engine as fuel lines are exposed in the strut. This is the assumption of the QRH *'Fuel Leak Engine'* non-normal checklist, which instructs the pilots to shut down the associated engine, closing both the spar fuel shutoff valve and the engine fuel shutoff valve. This stops further loss of fuel and prevents fuel leaking around the hot parts of the engine.

The FCTM offers additional information when fuel is leaking around an operating engine stating, *'the risk of fire increases further when the thrust reverser is used during landing. The thrust reverser significantly changes the flow of air around the engine which can disperse fuel over a wider area.'*

Analysis

Fuel imbalance

On reaching the cruise altitude the commander noted a fuel imbalance during a fuel check and decided to balance the fuel before an IMBAL alert was displayed. The pilots completed

Footnote

[2] The FCTM provides information on manoeuvres and techniques, developed and recommended by Boeing, and recognised by the FAA for use in flight operations. They are provided as guidance and do not prevent the operator from developing equivalent techniques.

fuel balancing from memory, missing the prompt at the start of the FCOM *'Fuel Balancing'* supplementary procedure to consider a possible fuel leak. This delayed the start of the diagnosis process until the second imbalance was noticed, some 35 minutes into the cruise.

Memory 'v' checklist

Boeing encourages the use of the FCOM *'Fuel Balancing'* supplementary procedure with good crew coordination to reduce the possibility of errors. The FCOM guidance on the use of supplementary procedures gives the captain the discretion to accomplish the procedure from memory, by reviewing the procedure prior to accomplishing it, or action the procedure as a checklist. If used as a checklist there is less likelihood of an omission or error occurring and, in this case, it is likely the pilots would have had the opportunity to diagnose a fuel leak on first recognition of the imbalance at around seven minutes into the cruise.

Fuel leak

When the fuel imbalance was addressed for the second time in flight, the commander actioned the QRH *'IMBAL'* non-normal checklist although there was no IMBAL alert. A fuel leak was suspected, leading to the QRH '*Fuel Leak Engine'* non-normal checklist. The pilots confirmed an engine fuel leak but decided not to continue with the non-normal checklist, which would have led them to shut down the affected engine, because they considered the leak rate to be only marginally greater than the trigger value in the QRH. Advice contained in the FCTM did not form part of their decision-making process.

The thrust reversers were used for approximately six seconds on landing. With fuel still leaking around the right engine, the use of thrust reverse would have dispersed fuel vapour around the hot parts of the engine and the risk of a fire would have increased.

Conclusion

In completing fuel balancing from memory, the pilots did not consider the possibility of a fuel leak, delaying diagnosis of the problem. Once the leak was confirmed, they decided not to fully complete the non-normal checklist, which directed them to shut down the affected engine. The subsequent use of thrust reverse on landing increased the potential risk of fire due to disbursement of fuel vapour around hot parts of the engine.

Serious Incident

Aircraft Type and Registration:	Piper PA-22-108, G-ARNE
No & Type of Engines:	1 Lycoming O-235-C1B piston engine
Year of Manufacture:	1961 (Serial no: 22-8502)
Date & Time (UTC):	23 May 2025 at 1820 hrs
Location:	Old Buckenham Airfield, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Left aileron partly detached from the wing
Commander's Licence:	Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	293 hours (of which 36 were on type) Last 90 days - 3 hours Last 28 days - 0 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent discussions with the maintenance organisation

Synopsis

During the initial climb after takeoff, the left outboard aileron hinge detached. The pilot was able to maintain control and land without incident. Assessment of the aircraft revealed that a non-standard clevis pin had been fitted to the right outboard aileron hinge. It is possible that a similar non-standard part had been fitted to the left aileron and had failed, or fallen out during operation.

This event serves as a reminder to ensure that when maintaining aircraft the correct parts are used.

History of the flight

Shortly after takeoff from Old Buckenham Airfield, at approximately 400 ft, the pilot heard a 'clunk' and felt a jolt through the aircraft. He completed a troubleshooting scan of the aircraft and observed that the outboard end of the left aileron had partially detached from the wing.

Unsure of the effect on controllability or whether the aileron would detach completely, the pilot declared a MAYDAY. He began a steady climb before making some gentle control inputs. Assessing that he could manoeuvre using mainly rudder inputs, the pilot decided to attempt to land back at Old Buckenham. He made a successful landing on Runway 07, after completing a wide circuit to avoid populated areas and to minimise aileron control inputs.

Subsequent assessment of the aircraft identified that the left outboard aileron hinge clevis pin was missing (Figure 1). It was also noted that the hinge bracket through which the clevis pin fitted was worn.

Figure 1
G-ARNE left aileron outboard hinge with missing clevis pin (reproduced with permission)

Assessment by the aircraft repair organisation identified that the equivalent clevis pin on the right aileron was a non-standard part (Figure 2) and had a larger diameter than the part specified by the aircraft manufacturer (Figure 3), and that the hinge bracket was also worn.

Figure 2
Non-standard part fitted to the right outboard aileron hinge on G-ARNE

Figure 3
Unused clevis pin, part number AN394-41 that should be fitted to PA-22-108 aileron hinges

Assessment of the maintenance history for the aircraft did not identify when the pin had been replaced, so it was considered to pre-date the current ownership of the aircraft.

Analysis

Although the left aileron outboard clevis pin was missing, the wear identified on both sets of hinge brackets and the presence of a non-standard clevis pin fitted to the right outboard aileron hinge suggests that the left outboard aileron clevis pin had been replaced. With the hinge brackets showing signs of wear, it is likely that oversized replacement clevis pins were manufactured, or non-standard pins found, to fit the worn hinge holes and negate the need to replace the hinge brackets.

Given the absence of the clevis pin, it was not possible to determine whether it was missing because the split pin had been lost, allowing the clevis pin to migrate out of the hinge, or if the clevis pin itself had failed. However, the fitment of non-standard parts in place of those specified by the aircraft manufacturer may have led to the loss of the clevis pin.

Aircraft manufacturers specify parts to fulfil design requirements, such as operating loads, fatigue life and corrosion resistance. They are designed to operate through the life of the aircraft or, if maintained on-condition, replaced when inspections reveal they are failing or worn out. To maintain the airworthiness of the aircraft, replacement parts must be those specified by or repaired in accordance with the manufacturer’s manuals and instructions. It seems that in this case a work-around was used to allow the aircraft to operate without use of the specified parts or correct repairs, possibly leading to a premature component failure.

The action taken by the pilot to calmly and methodically troubleshoot and identify the issue, before applying a threat-and-error-management strategy is good practice when responding to in-flight emergencies. In minimising the aileron control inputs by using the rudder, the aileron loading was reduced, lessening the possibility of the aileron detaching in flight.

Accident

Aircraft Type and Registration:	Experimental Drone Variant 4J
No & Type of Engines:	4 electric motors
Year of Manufacture:	2025 (Serial no: PT-1046)
Date & Time (UTC):	11 December 2025 at 1500 hrs
Location:	Salisbury Plain Training Area, Wiltshire
Type of Flight:	Commercial Operations (UAS)
Persons on Board:	Crew - N/A Passengers - N/A
Injuries:	Crew - N/A Passengers - N/A
Nature of Damage:	UA destroyed beyond economic repair
Commander's Licence:	CAA Level 1 and 3 Category A
Commander's Age:	32 years
Commander's Flying Experience:	60 hours (of which 7 were on type) Last 90 days - 7 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During a verification and validation test flight of a fixed wing UA command and control was lost. The flight was terminated when it was confirmed the UA was over a safe area. The UA descended to the ground and the wreckage recovered. A fault was found within its navigation module which caused it to breach the geofenced area in which it was flying. The operator has taken safety actions which introduce a fall-back logic within the system which can switch to other navigational sources and has modified the user interface to provide a clear alert to the remote pilot in the event of a positioning data anomaly.

History of the flight

A UA was conducting a verification and validation test flight within an authorised test area. Shortly after launch the ground control station experienced a loss of command and control which led to the UA disregarding its preset geofence. Attempts to recover accurate navigational control were ineffective and, when it was confirmed the UA had not strayed over a populated area, the ground control operator initiated an immediate flight termination. The UA entered a vertical descent and struck the ground.

Technical cause

The operator recovered the UA wreckage and conducted an investigation to determine the cause of the loss of control. It found that the 'in-house' navigation module undergoing the test was faulty. Whether it was a hardware or software fault could not be positively determined. This module manages both visual and the fall-back logic to alternative systems such as GPS. The fault prevented the module switching to alternative navigational sources and led the UA to become 'trapped' in a non-recoverable navigation state resulting in its breach of the geofence.

Operator's analysis

The operator considered that this event highlighted the need for clearer flight termination procedures to be briefed pre-flight and for robust Emergency Response Plan training for the remote pilots. The operator's Safety Review Board has mandated a staged return to flight to mitigate any risks.

Safety action taken by the operator

The operator identified that the UAS navigation system was unable to switch to an alternative navigational data source. Therefore, the operator has taken the following safety actions.

A fall-back logic which can switch to other navigational sources has been integrated into the flight control system.

Modified the user interface to provide a clear alert to the remote pilot in the event of a positioning data anomaly.

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: January - February 2026

12 Jan 2026 **Vans RV-14** **G-TREL** Sittles Farm Airfield, Staffordshire

After a local flight, the pilot returned to land at the airstrip from which he had departed approximately 25 minutes earlier. During the approach, the pilot misidentified the runway and landed in a crop of wheat to the right of the landing strip. The landing was smooth and the deceleration felt normal but, at about 10 to 15 kt, the main wheels entered soft ground and the aircraft tipped forward, coming to rest upside down.

28 Jan 2026 **Piper PA-28-181** **G-BOEE** Leicester Airport

After completion of engine start, the pilot commenced taxiing the aircraft. As the aircraft left its parking position, the pilot initiated a left turn. CCTV showed the aircraft accelerating during the turn and, as the aircraft completed the turn, its right wing struck the left aileron of a stationary PA-28, G-GALB, with sufficient force to move it approximately 30 ft.

14 Feb 2026 **M20J 201** **N937BP** Retford Gamston Airport, Nottinghamshire

The landing gear did not lower and so the aircraft landed with the landing gear retracted.

24 Feb 2026 **Piper PA-28-140** **G-BBBY** Abbots Bromley Airfield, Staffordshire

During takeoff for a local flight, with a student pilot in command, the engine appeared to lose power as the aircraft rotated. The instructor advised the student to abort the takeoff and land straight ahead, towards a hedge line which crossed the aircraft's path. The instructor took control during the resulting forced landing. The aircraft struck the hedge.

25 Feb 2026 **Socata TB9** **G-BIBA** Denham Aerodrome, Buckinghamshire

The aircraft was approaching the runway for a flapless landing but clipped trees on short final. A go-around was flown after which the aircraft was flown past the tower to confirm that the landing gear was intact, which it was. The aircraft landed without further incident. The pilot reported that visibility on the approach had been poor because the sun was low and in line with the runway, which resulted in the approach being flown too low.

Miscellaneous

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

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

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

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

Published October 2015.

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

Published March 2016.

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

Published September 2016.

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

Published March 2017.

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

Published March 2018.

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

Published November 2018.

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

Published March 2020.

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

Published May 2021.

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

Published September 2023.

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

Published November 2023.

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

http://www.aaib.gov.uk

GLOSSARY OF ABBREVIATIONS

aal	above airfield level
ACAS	Airborne Collision Avoidance System
ACARS	Automatic Communications And Reporting System
ADF	Automatic Direction Finding equipment
AFIS(O)	Aerodrome Flight Information Service (Officer)
agl	above ground level
AIC	Aeronautical Information Circular
amsl	above mean sea level
AOM	Aerodrome Operating Minima
APU	Auxiliary Power Unit
ASI	airspeed indicator
ATC(C)(O)	Air Traffic Control (Centre)(Officer)
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot’s Licence
BMAA	British Microlight Aircraft Association
BGA	British Gliding Association
BBAC	British Balloon and Airship Club
BHPA	British Hang Gliding & Paragliding Association
CAA	Civil Aviation Authority
CAVOK	Ceiling And Visibility OK (for VFR flight)
CAS	calibrated airspeed
cc	cubic centimetres
CG	Centre of Gravity
cm	centimetre(s)
CPL	Commercial Pilot’s Licence
°C,F,M,T	Celsius, Fahrenheit, magnetic, true
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European Union Aviation Safety Agency
ECAM	Electronic Centralised Aircraft Monitoring
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration (USA)
FDR	Flight Data Recorder
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth’s gravity
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hrs	hours (clock time as in 1200 hrs)
HP	high pressure
hPa	hectopascal (equivalent unit to mb)
IAS	indicated airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IP	Intermediate Pressure
IR	Instrument Rating
ISA	International Standard Atmosphere
kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	knots indicated airspeed
KTAS	knots true airspeed
km	kilometre(s)

kt	knot(s)
lb	pound(s)
LP	low pressure
LAA	Light Aircraft Association
LDA	Landing Distance Available
LPC	Licence Proficiency Check
m	metre(s)
mb	millibar(s)
MDA	Minimum Descent Altitude
METAR	a timed aerodrome meteorological report
min	minutes
mm	millimetre(s)
mph	miles per hour
MTWA	Maximum Total Weight Authorised
N	Newtons
N_R	Main rotor rotation speed (rotorcraft)
N_g	Gas generator rotation speed (rotorcraft)
N_1	engine fan or LP compressor speed
NDB	Non-Directional radio Beacon
nm	nautical mile(s)
NOTAM	Notice to Airmen
OAT	Outside Air Temperature
OPC	Operator Proficiency Check
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
POH	Pilot’s Operating Handbook
PPL	Private Pilot’s Licence
psi	pounds per square inch
QFE	altimeter pressure setting to indicate height above aerodrome
QNH	altimeter pressure setting to indicate elevation amsl
RA	Resolution Advisory
RFFS	Rescue and Fire Fighting Service
rpm	revolutions per minute
RTF	radiotelephony
RVR	Runway Visual Range
SAR	Search and Rescue
SB	Service Bulletin
SSR	Secondary Surveillance Radar
TA	Traffic Advisory
TAF	Terminal Aerodrome Forecast
TAS	true airspeed
TAWS	Terrain Awareness and Warning System
TCAS	Traffic Collision Avoidance System
TODA	Takeoff Distance Available
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
USG	US gallons
UTC	Co-ordinated Universal Time (GMT)
V	Volt(s)
V_1	Takeoff decision speed
V_2	Takeoff safety speed
V_R	Rotation speed
V_{REF}	Reference airspeed (approach)
V_{NE}	Never Exceed airspeed
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional radio Range

AAIB Bulletin 4/2026

Air Accidents Investigation Branch