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.

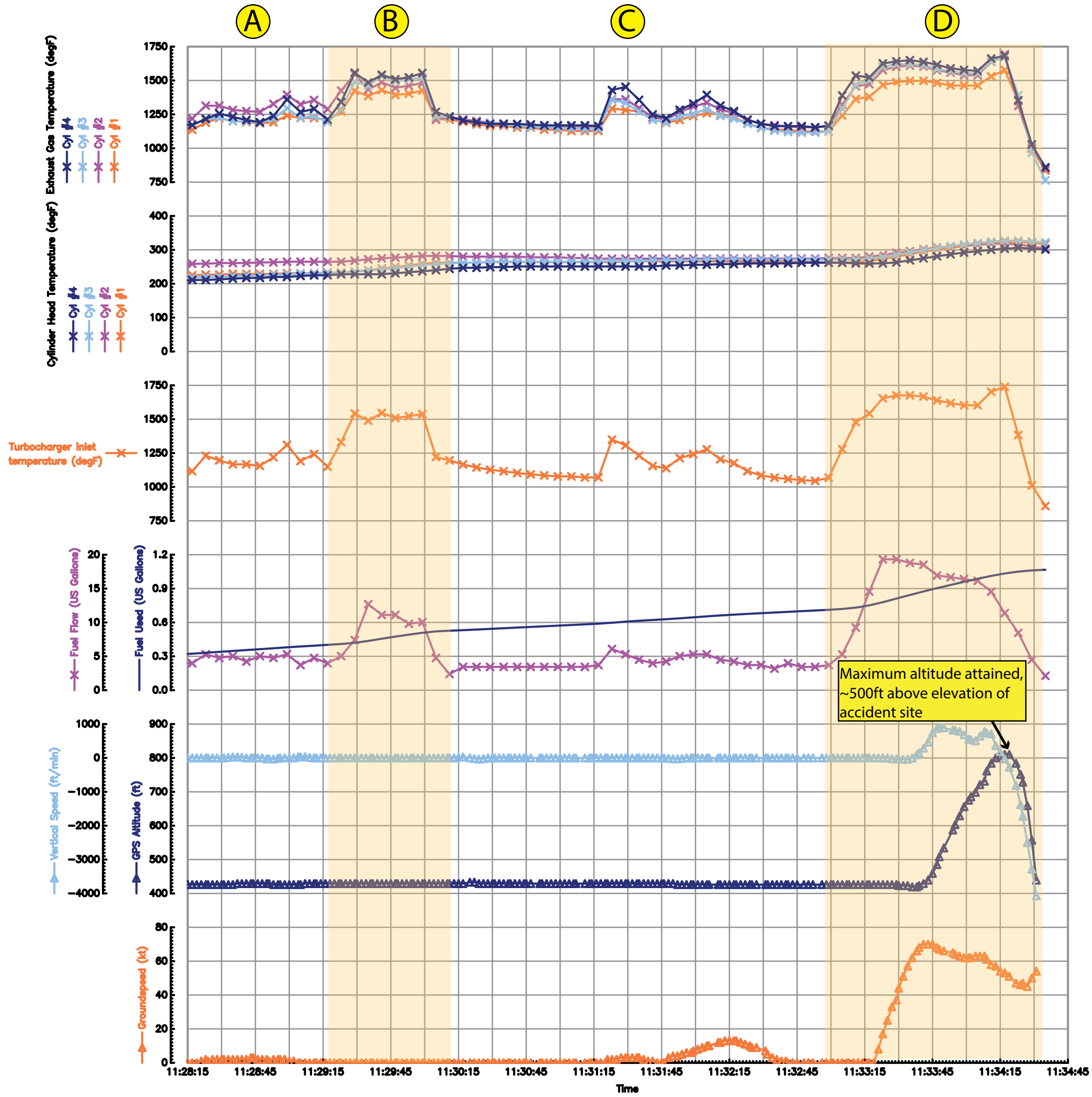


Figure 2

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).

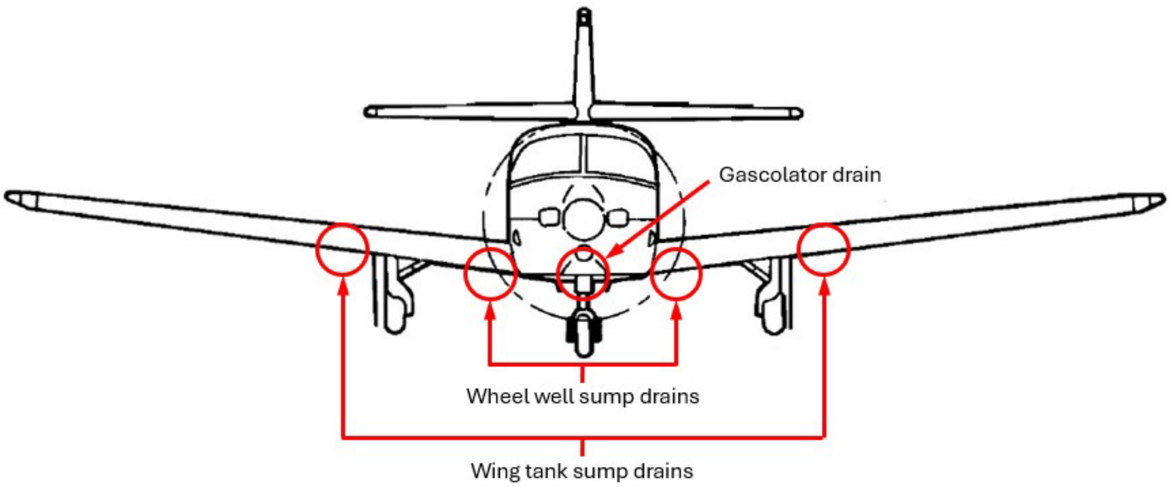


Figure 3

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.

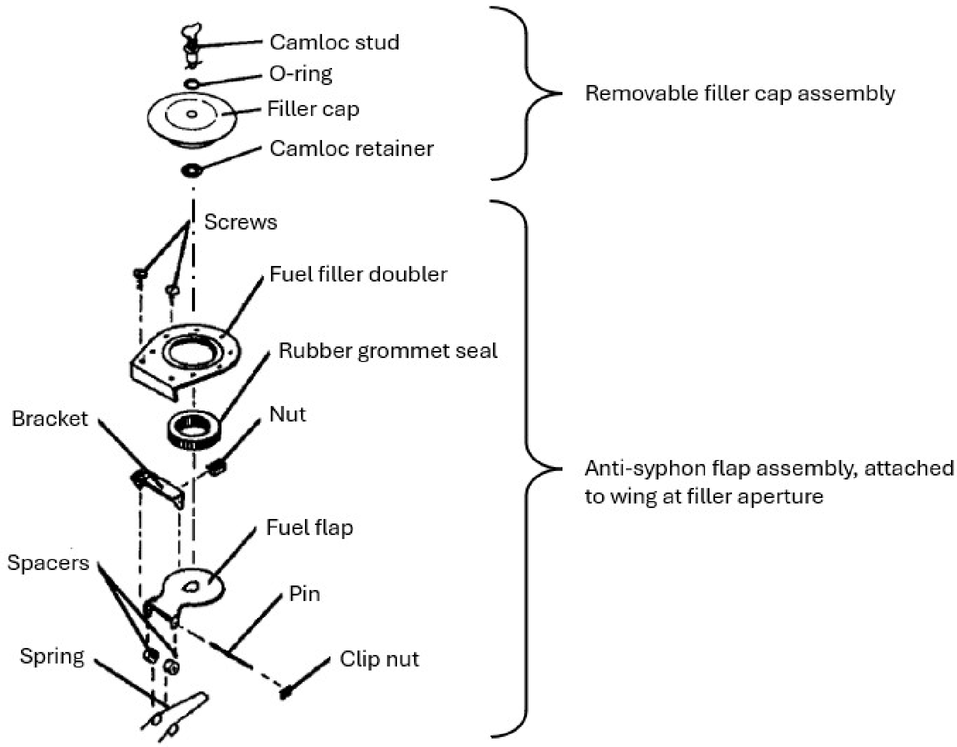


Figure 4

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.

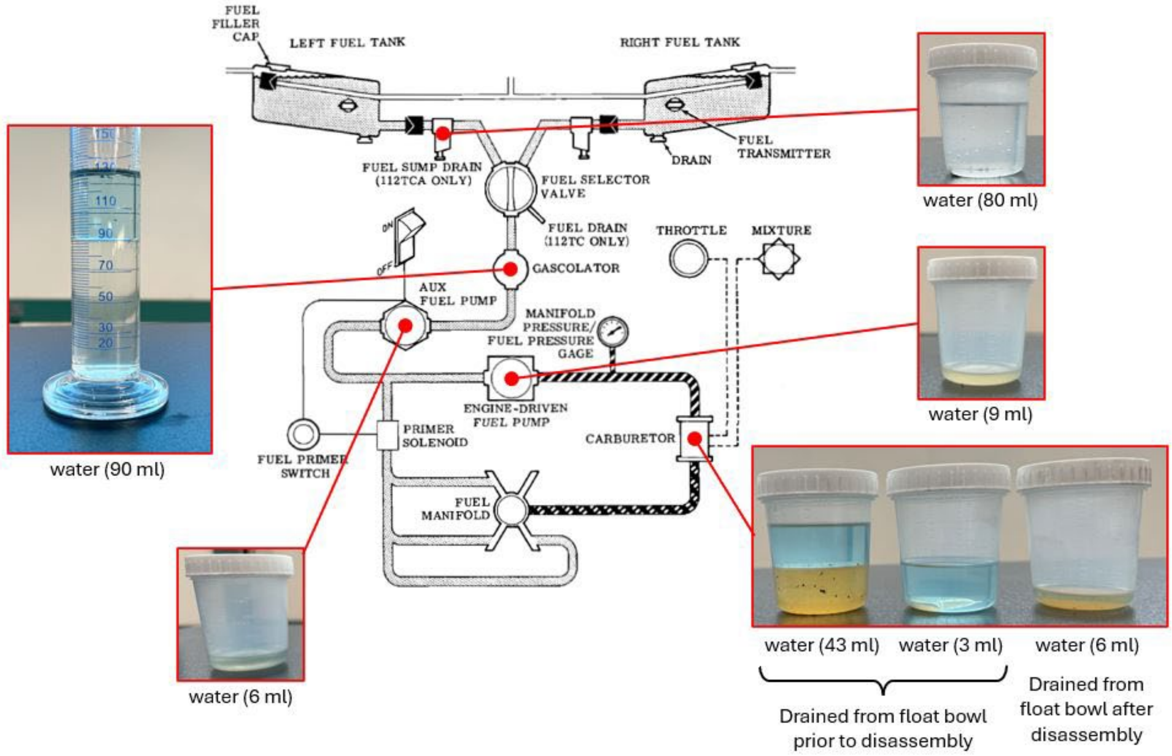


Figure 5

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.

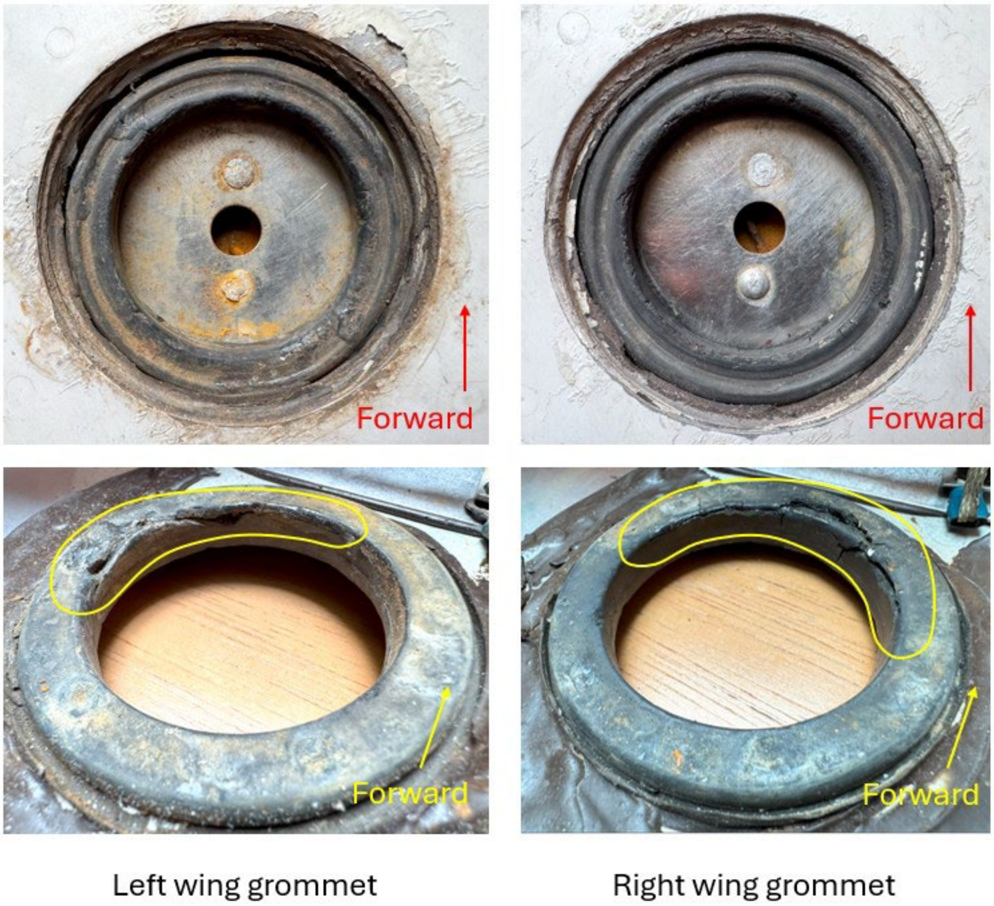


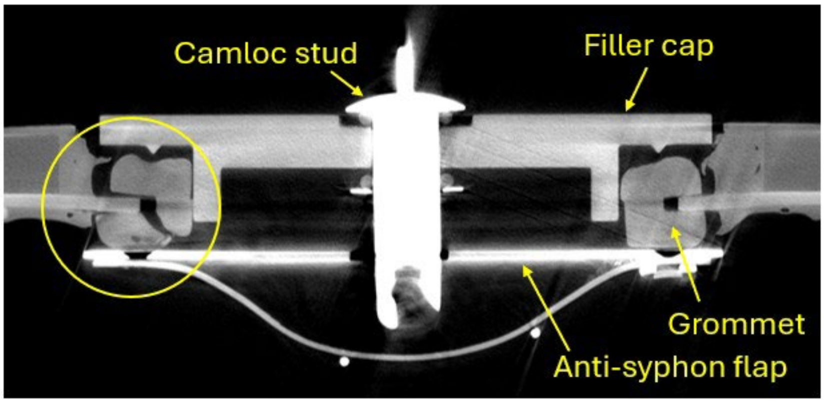
Figure 6

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

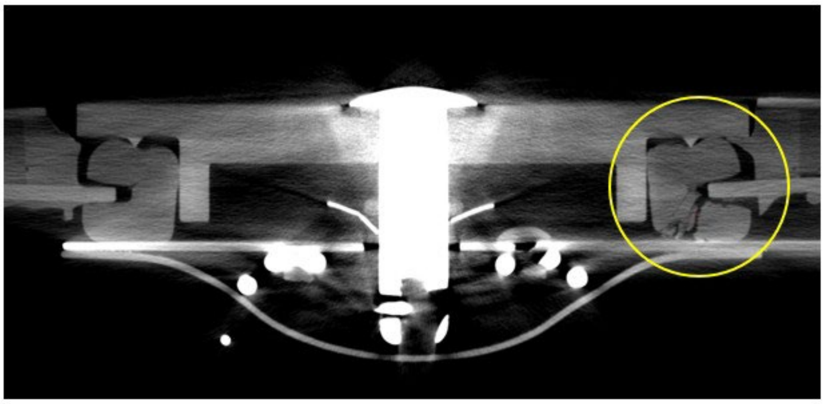
The internal condition of the sealing grommets was examined using CT X-ray[4], with the filler cap fitted. The right filler cap was fitted in the locked position, but this was not possible with the left filler cap due to the Camloc stud retaining wire having broken in the accident, so the filler cap 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

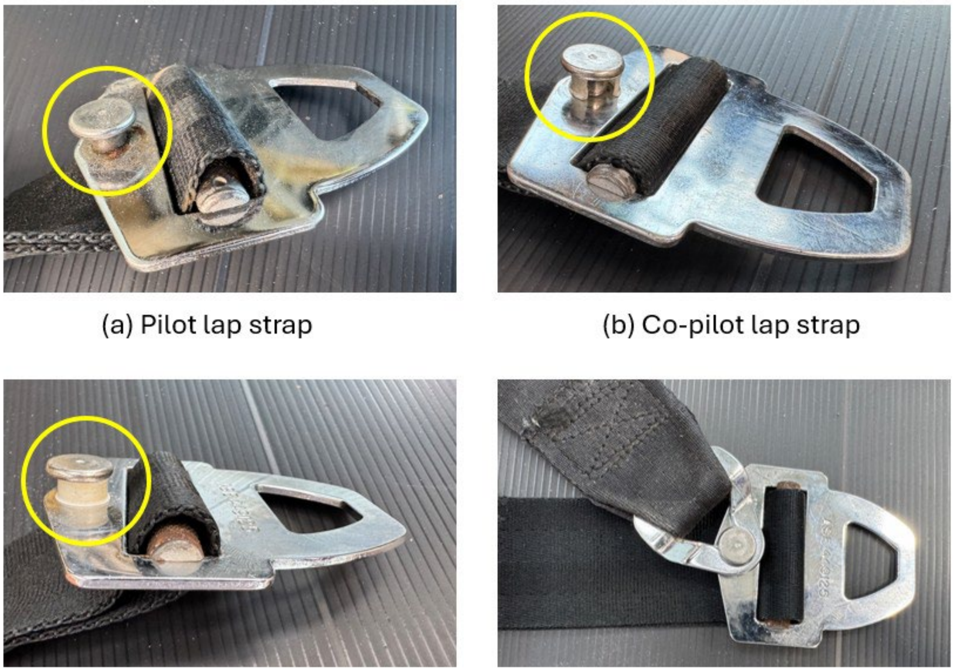
Manufacturer's comments

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.

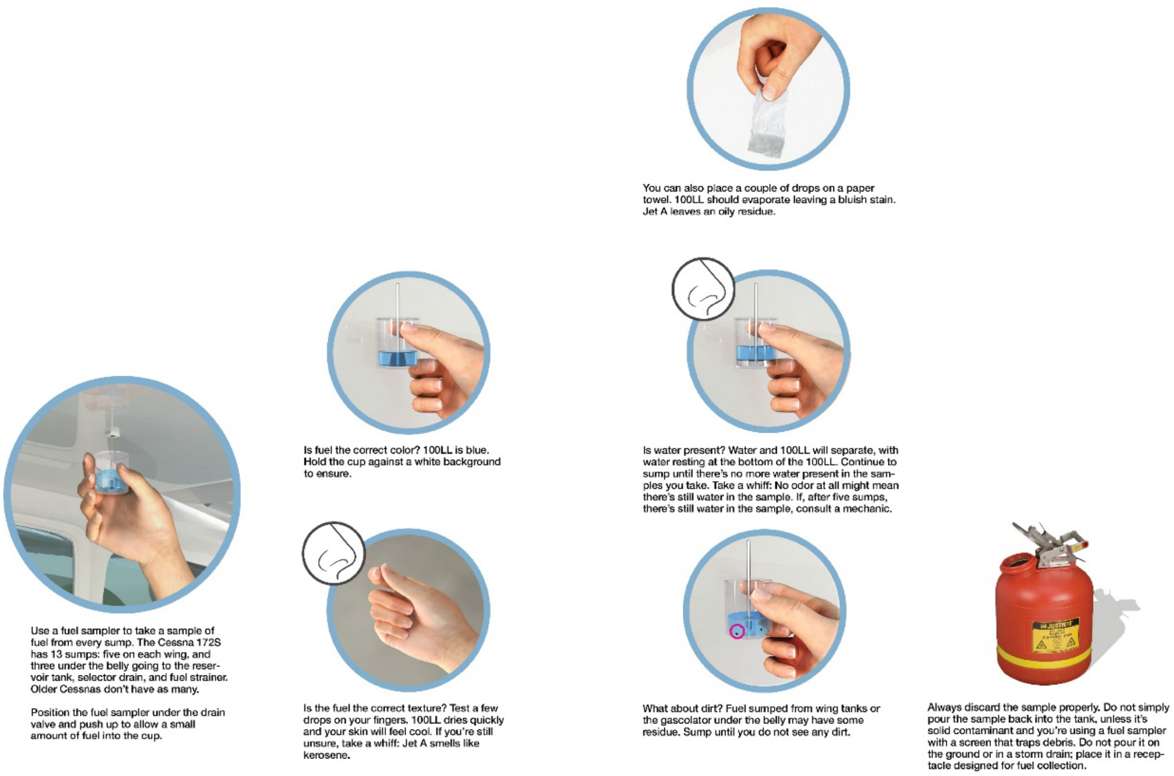


Figure 10

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.

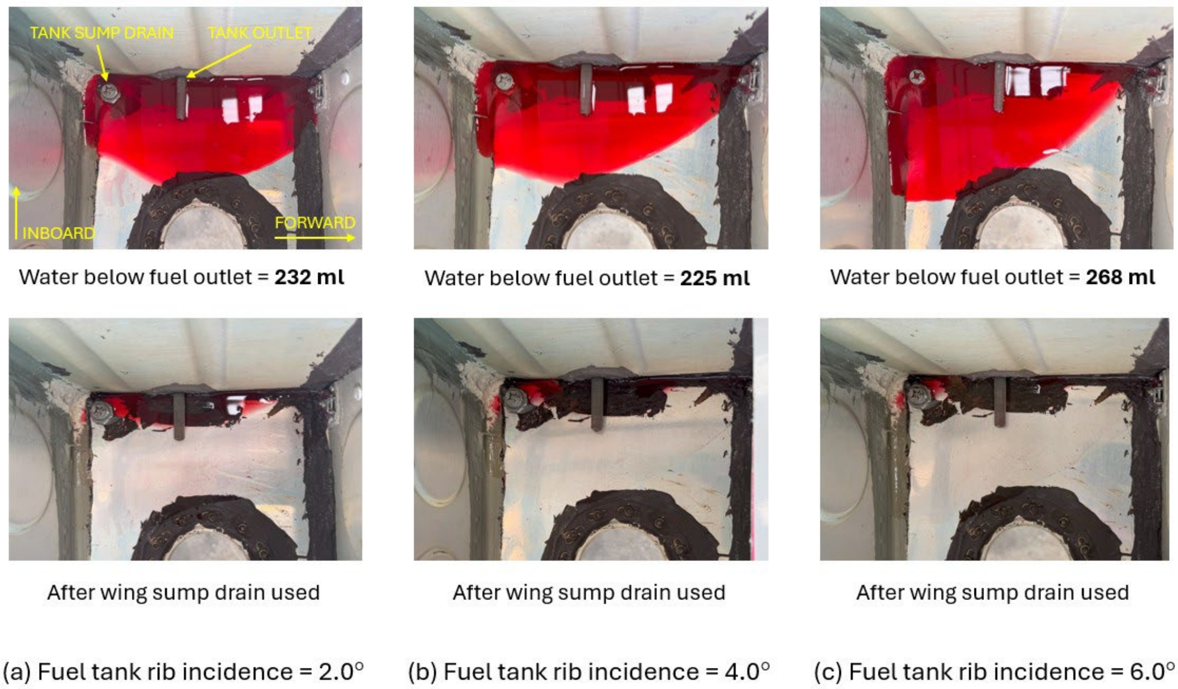


Figure 12

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

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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.

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