

ACCIDENT

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| Aircraft Type and Registration: | Piper PA-28-161 Cherokee Warrior II, G-CDER | |
| No & Type of Engines: | 1 Lycoming O-320-D3G piston engine | |
| Year of Manufacture: | 1981 (Serial no: 28-8116222) | |
| Date & Time (UTC): | 6 August 2016 at 1600 hrs | |
| Location: | English Channel, 1.2 nm from Winchelsea Beach, East Sussex | |
| Type of Flight: | Private | |
| Persons on Board: | Crew - 1 | Passengers - None |
| Injuries: | Crew - 1 (Fatal) | Passengers - N/A |
| Nature of Damage: | Destroyed | |
| Commander's Licence: | Private Pilot's Licence | |
| Commander's Age: | 44 years | |
| Commander's Flying Experience: | 98 hours (of which 48 were on type) Last 90 days - 5 hours Last 28 days - 1 hour | |
| Information Source: | AAIB Field Investigation | |

Synopsis

The aircraft was conducting a local flight over the sea when the pilot declared he had a problem with a rough running engine and high oil temperature; he flew a track towards his base airfield. Shortly after this, the pilot reported that he was unable to maintain altitude but, despite it being within glide range of land, the aircraft continued on a direct track, over the sea, towards the airfield visual reporting point (VRP). The aircraft ditched with a strong tailwind, and subsequently became inverted and sank. The pilot and aircraft were recovered from the seabed several days later. No mechanical defect was identified within the engine, but the aircraft was operating in the flight regime where severe carburettor icing could occur at any power setting. The investigation did identify a chafed wire in the engine oil temperature indication system which could explain the pilot reports of high oil temperature.

History of the flight

The aircraft, which belonged to a syndicate at Lydd Airport, was planned to make two flights that day with two different pilots; the accident occurred on the second of these flights. The first flight was of just under two hours duration with the landing at 1410 hrs. The pilot of this first flight described the flight as uneventful, with the aircraft, and its engine operating normally. After landing, when he completed the post-flight paperwork, the pilot of the accident flight was waiting to take the aircraft. They had a brief discussion about the weather, local air traffic information and that the aircraft would need to be refuelled before

the next flight. The accident flight pilot, who was considered by the pilot of the first flight to have been in good spirits, explained that he didn't have a firm plan about where he was planning to fly, he was just going for a local flight on his own. He then walked out to refuel the aircraft.

The pilot called ATC at Lydd to request clearance to taxi at 1523 hrs and he took off from Runway 21 at Lydd at 1529 hrs. The aircraft climbed to 2,200 ft and, at 1533 hrs, the pilot reported that he was at Rye VRP; he was asked to call again when he was ready to re-join the airfield.

At 1558 hrs the pilot called Lydd ATC to report that he had a problem with his engine; he stated his position was 12 nm from Lydd. His next call, just over a minute later, was that he was unable to maintain altitude as the engine was failing and, at 1600 hrs, the pilot reported that he was ditching.

Several witnesses were on Winchelsea Beach; one of whom was a private pilot, who had been flying for 25 years. He described the weather conditions as good for flying, but with a strong south-westerly wind. Around 1600 hrs he saw an aircraft at what he estimated was 1,200 ft. He could hear no engine noise, and he described seeing the aircraft descending on a straight course of what he estimated to be 040° to 050°M. There was no change in the aircraft's heading and it went into the sea, downwind in a flat configuration. It appeared to the witness as though the flaps were up. He then ran to raise the alarm.

Other witnesses reported seeing what most of them initially believed was a boat, skipping across the water, when it suddenly flipped over and they could see it was actually an aircraft. The aircraft floated for around 30 seconds before it rolled and sank from their view.

The Search and Rescue (SAR) helicopter crew, who are based at Lydd airfield, heard the radio call of the pilot stating that he was ditching, and they scrambled. They were airborne at 1606 hrs and on scene shortly afterwards. They were able to locate an oil or fuel slick in a position close to where the witness on the beach indicated that the aircraft had last been, but there were no signs of the aircraft or any survivors.

Aircraft information

The PA-28-161 is a four-seat, low-winged light aircraft. The Pilot's Operating Handbook (POH) for the aircraft contains a glide performance chart. The chart predicts that, from a height of 2,200 ft, at 2,325 lbs weight, with the propeller windmilling and at an airspeed of 73 KIAS in still air, the aircraft would be able to glide for a distance of just over 4 nm.

The aircraft type has a single entry door on the right side of the fuselage which is secured by two latches; a lower latch which is operated by an external handle at the rear of the door and an internal handle in the lower forward section of the door, and an upper latch operated by external and internal handles on the top of the door.

G-CDER was fitted with a 160 hp carburetted engine. The aircraft was equipped with three instruments that enabled the pilot to monitor engine performance: the rpm gauge, an oil

pressure gauge and an oil temperature gauge. The input to the rpm gauge is provided by a cable drive from the engine's accessory module. The oil pressure gauge is operated by a high pressure oil feed from the engine. Oil temperature is measured by a sensor mounted in the oil system. As the oil temperature increases, the resistance of the sensor decreases, allowing more electrical current to pass through the electrical gauge, which moves the needle to show the increased oil temperature.

Recorded information

Sources of recorded information

Recorded radar information (Mode A and C¹) for the accident flight was available from ground-based sites located at London Gatwick and Pease Pottage. The radar provided an almost complete record of the accident flight, with the data starting just after the aircraft had taken off from Lydd and ending shortly before it struck the water. The most comprehensive record was provided by the radar at Pease Pottage, which was recorded once every six seconds.

RTF recordings relating to the accident flight were available from Lydd. These included the final radio transmissions from the pilot, who had been communicating with the controller on the Lydd Approach frequency since the start of the flight.

A tablet computer belonging to the pilot was recovered from his home and downloaded. This contained a record of four previous flights recorded by a navigation software application².

Summary of recorded data

Figure 1 shows the radar track of the flight from Lydd, Figure 2 shows the salient parameters during the final minutes of the flight and Figure 3 the final recorded radar positions.

The aircraft's track recorded by the radars correlated closely, corroborating the relative accuracy of the independent data sources. The aircraft's altitude amsl is derived from Mode C, corrected for a QNH pressure of 1028 hPa, with a tolerance of +/- 50 ft.

The first radar point was recorded at 1530 hrs, shortly after the aircraft had taken off from Runway 21. The initial route was towards the village of Rye, located 7.5 nm west of Lydd Airport. As the aircraft passed to the south of Rye the pilot transmitted a position report and confirmed the aircraft was at 2,200 ft amsl, which was the previously stated target altitude.

The aircraft then flew 1.2 nm off-shore before turning onto a south-westerly heading, to fly approximately parallel to the shore line. When the aircraft was abeam the village of Fairlight, it altered course towards the south whist maintaining an altitude of about 2,200 ft amsl. The aircraft continued to fly in a southerly direction until it was about

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¹ Mode A refers to the four-digit 'squawk' code set on the transponder. Mode C refers to the aircraft's pressure altitude, referenced to 1013.25 hPa, which is transmitted with a resolution of 100 ft.

² Skydemon.

12 nm off shore, where a left hand orbit was flown before it altered heading towards the west. Evaluation of ship movements in conjunction with the aircraft's track, indicates that the pilot may have flown out to sea to look at several vessels which were operating in the area.

At 1552 hrs, the aircraft turned onto a north-westerly course, before making a further turn onto a north-easterly track of about 040°; if maintained, this would position the aircraft back towards Rye VRP.

At 1558:47 hrs the pilot transmitted that he had a problem, stating "GOLF ECHO ROMEO LYDD LYDD (sic) APPROACH GOLF ECHO ROMEO I'VE GOT A EH A ENGINE PROBLEM HERE EH TEMPERATURES SKY HIGH AND I'VE OIL PRESSURE IS FALLING". The controller acknowledged and requested the aircraft's position (the ATS at Lydd do not operate a radar service). The pilot advised he was about 12 nm from the airport and approximately 4.6 nm east-south-east of Hastings. The nearest shoreline to the aircraft was 2.1 nm away, located between Hastings and Fairlight. This was within the glide range of the aircraft, which was at an altitude of about 2,200 ft amsl. The controller instructed the pilot to report when he was 4 nm from the airport, and provided the circuit direction and active runway, which were right-hand and Runway 21 respectively.

The aircraft proceeded to maintain its course towards the shoreline near Rye. At 1559:26 hrs, the aircraft started to descend at an average rate of 1,300 fpm and an estimated average airspeed (based on a wind from 230° at 17 kt³) of 99 KIAS. At 1559:53 hrs, the pilot transmitted "LYDD APPROACH I'M GOING TO NEED ASSISTANCE EH ENGINE NOW BEGINNING TO FAIL I'M LOSING ALTITUDE". This was acknowledged by the controller and the pilot provided a position report, advising he was 10 nm from Lydd and 3.5 nm south of Winchelsea "OVER THE SEA". He further added that he was unable to restart the engine stating that it was "POPPING". The aircraft was now at an altitude of about 1,600 ft amsl and 1.5 nm from the nearest shoreline which was near Fairlight. This was still within the glide range of the aircraft.

The aircraft maintained a track that was almost parallel to the shoreline whilst continuing to descend. At 1600:34 hrs the final radar return was recorded. The aircraft was at an altitude of 600 ft amsl, its estimated airspeed was about 100 KIAS, and 1.42 nm from the beach near Pett Level village (this was now beyond the glide range of the aircraft). Shortly after, at 1600:49 hrs the pilot made his last RTF transmission, when he stated that he was ditching the aircraft.

Based on the estimated glidepath of the aircraft, witness information and position of an "oil slick" observed on the surface of the sea shortly after the accident by a SAR helicopter, the aircraft struck the water approximately 1.2 nm from the shoreline of Winchelsea Beach.

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³ Based on the Lydd Airport METAR timed at 1550 hrs UTC.

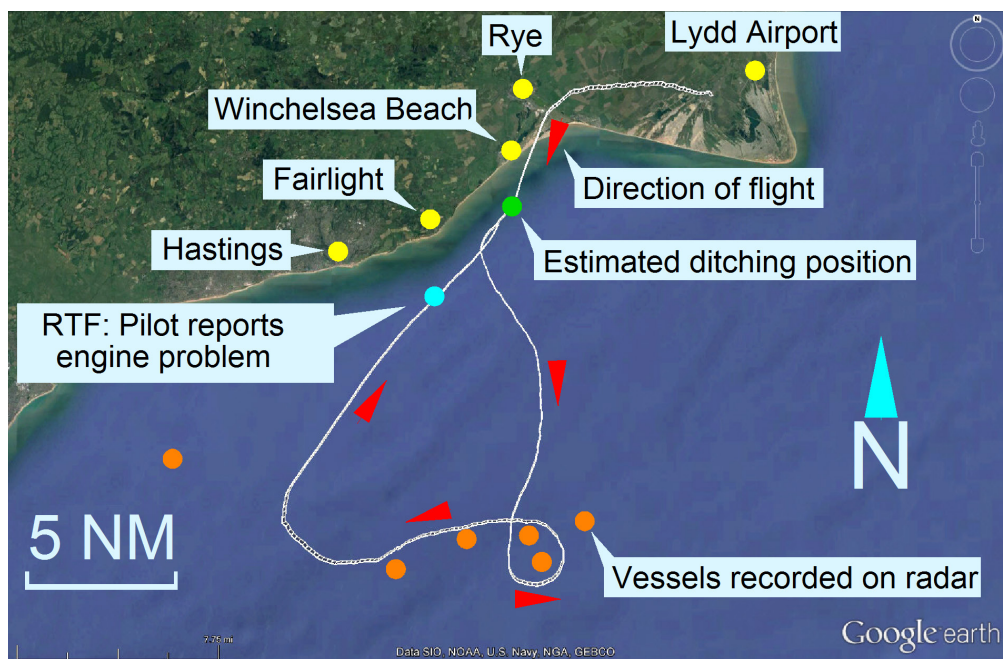


Figure 1

Flight from Lydd (Pease Pottage radar)

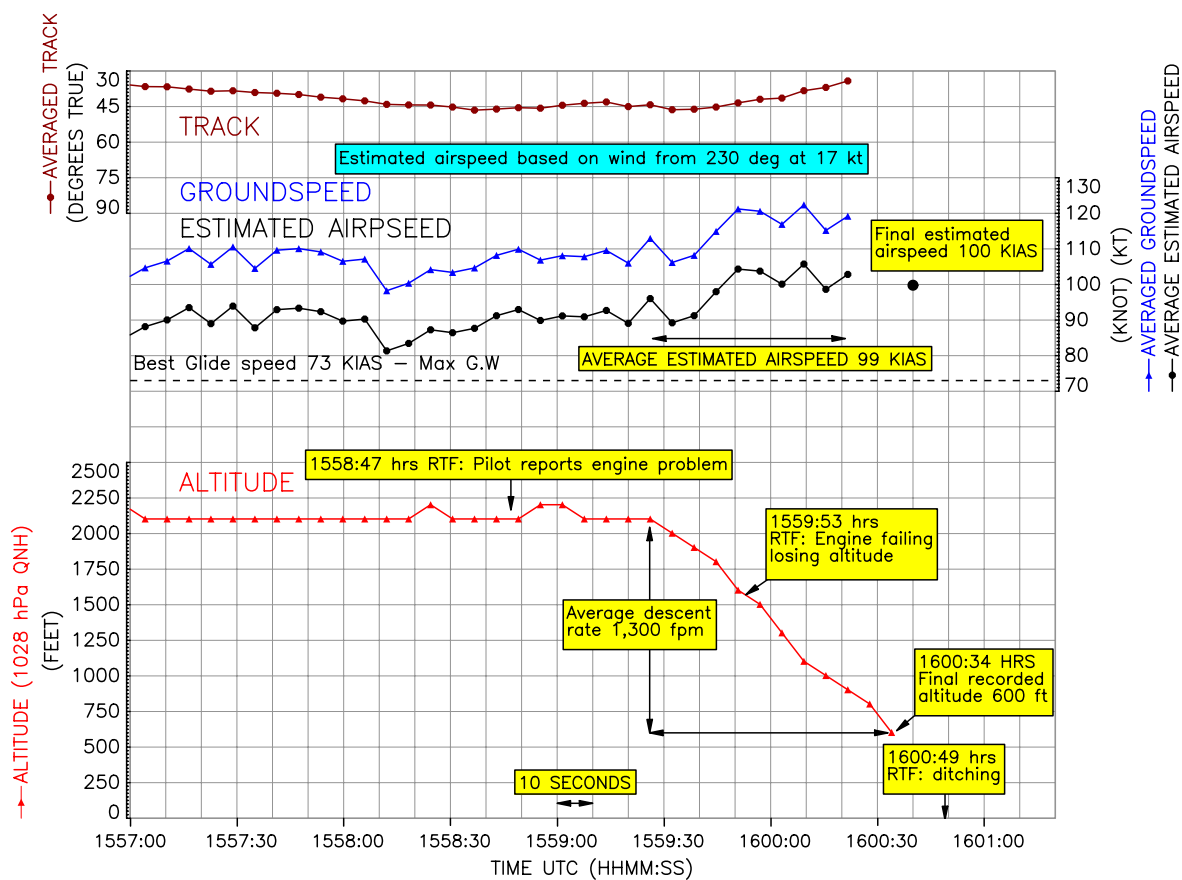


Figure 2

Accident flight data from Pease Pottage radar

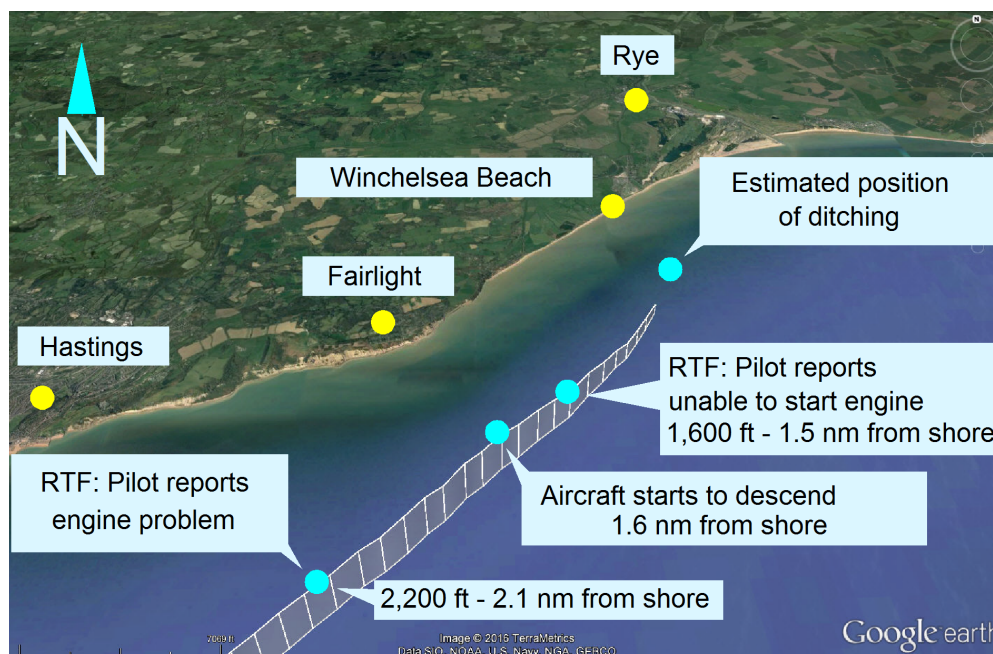


Figure 3

Final radar points (Pease Pottage radar)

Previous flight records

The pilot's tablet computer contained recordings of four flights made in 2015; two in August and two in September. Both of the flights in August were similar, with the aircraft flying along the coastline between Rye and Eastbourne, before returning to land at Lydd Airport. The aircraft was flown over the sea during periods of both flights, at distances of up to 2 nm from the shore and at an altitude of about 2,000 ft amsl.

The records from September contained an almost complete flight from Lydd to Bembridge on the Isle of Wight, and a partial record of the return flight back to Lydd. The aircraft was predominantly flown over the sea during both recordings, at similar distances and altitudes observed during the previous flights in August.

Recovery

During the SAR operation the RNLI lifeboat had placed a buoy at the location of the oil slick observed by the SAR helicopter. After discussion between the AAIB and SALMO⁴ it was determined that the local sea conditions and knowledge of the aircraft's approximate location provided a high probability of a successful recovery operation. As a result a survey vessel, recovery vessel and dive team were chartered on the AAIB's behalf by SALMO.

Footnote

⁴ MOD Salvage and Maritime Operations.

On 10 August 2016 a side-scan sonar equipped survey vessel, with SALMO and AAIB personnel on board, located the aircraft on the sea bed at a depth of between 5 m and 9 m, close to the marker buoy. Sonar imagery showed that the aircraft appeared to be intact and was inverted (Figure 4).

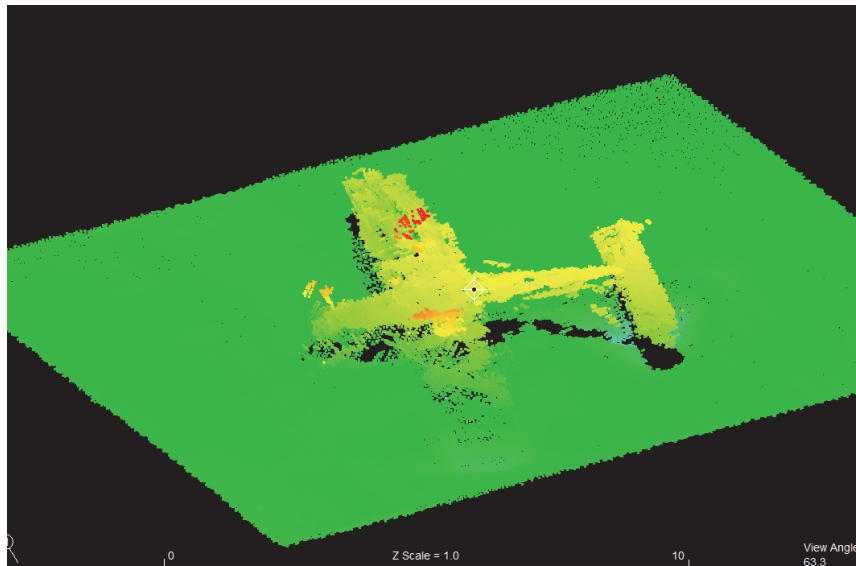


Figure 4

Sonar image of the aircraft

A recovery vessel arrived at the accident site on 13 August. After locating the aircraft, the dive team confirmed that it was intact and that the body of the pilot remained within the aircraft. During 13 August the aircraft was 'righted' on the sea bed and recovered to deck the following day. Initial examination of the aircraft identified that the flaps had been deployed to their first position (10°), that the pilot's seat belt was unfastened, the upper cockpit door latch was in the OPEN position and the lower door latch was in the LOCKED position. The body of the pilot was recovered and transported to shore by Sussex Police. The pilot was not wearing any form of flotation aid.

After bringing the aircraft to shore, approximately 2.5 litres of oil together with a large quantity of water was drained from the engine prior to filling it with de-watering fluid. Both fuel tanks were found to be intact and a large quantity of fuel, including some water was drained from the fuel tanks. The aircraft was subsequently transported to the AAIB for detailed examination.

Maintenance history

Examination of the aircraft's maintenance records confirmed that the aircraft had been maintained in accordance with its approved maintenance program and that there were no reported defects which could have had a bearing on the accident flight.

The engine log book showed that the engine had been fully overhauled in March 2014, approximately 235 flying hours prior to the accident.

When interviewed, the pilot who flew the aircraft immediately prior to the accident flight confirmed that there had been no observed abnormalities with either the aircraft's performance or its engine indications.

Aircraft examination

Examination of the aircraft's cockpit showed that the engine throttle was in the maximum power position, the mixture control was in the **RICH** position and that the carburettor heat control was in the **OFF** position. All the electrical circuit breakers were in the closed (on) position.

Removal of the engine's carburettor confirmed that fuel was present in both the carburettor bowl and the carburettor acceleration pump. The carburettor heat valve had been jammed in the **OFF** position due to distortion of the valve casing. Tests conducted on fuel recovered from the aircraft's tanks confirmed that it met the required specification but had been contaminated with sea water.

The engine was removed and disassembled. There was no evidence of an external oil leak. No contamination or metallic debris was found in the oil filter, oil pump strainer, oil cooler or in the sump and the oil pump and oil pressure relief valve were in good condition. All the engine bearings were in good condition, with evidence of emulsified oil on all bearings. There was no evidence of bearing distress. All the oil galleries were free from obstruction and the pistons and cylinder liners were in good condition.

Tests carried out on the engine oil pressure indication system confirmed that the system operated normally. The oil temperature indicator and oil temperature sensor were removed and examined. The oil temperature indicator was contaminated with silt and corrosion. Tests confirmed that the gauge was inoperative. The oil pressure sensor was tested with a calibrated heat source and performed normally. Examination of the electrical wire which connected the oil temperature sensor and the oil temperature gauge identified an area of chafing in the insulation which had exposed the conductive core. The location of the chafe was in an area close to where the wire passed through the fuselage fire wall, adjacent to the engine mount and an earthing cable. Examination of the chafe under an optical microscope showed evidence of electrical arcing damage. Additional tests, using a serviceable oil temperature gauge, showed that if this wire to the oil temperature sensor became 'earthed' the gauge needle moved to its maximum deflection, indicating an engine oil temperature in excess of the maximum reading on the gauge. In this condition the maximum current measured through the indication circuit was 1.15 amps.

Pathology

The pathologist indicated that the pilot suffered severe multiple injuries which were probably caused when the aircraft struck the water.

There was no evidence of any significant pre-existing natural disease which could have caused or contributed to the accident. Toxicology revealed no evidence of alcohol or drugs in the pilot's body.

Weight and balance

The aircraft's weight and balance was calculated to have been within the normal operating range for the aircraft.

Meteorology

High pressure, centred over the Bay of Biscay was bringing settled weather conditions to the UK, with good visibility and virtually no cloud in the Hastings area. The surface wind at Hastings was 230° at 15 kt, the surface wind reported at Lydd was 230° at 17 kt, with a temperature of 20°C and a dew point of 15°C. The Met F214 spot wind chart indicated that the Environmental Lapse Rate⁵ at the lower levels around the accident site was around 3°C per thousand feet, a steeper gradient than the ICAO standard lapse rate of 1.98°C per thousand feet. At 2,000 ft the wind was 260° at 20 kt, with the temperature likely to have been 14°C with a dew point of around 13°C.

Carburettor Icing

The CAA issues numerous Safety Sense Leaflets. Safety Sense Leaflet 14, covers piston engine icing and contains the following chart.

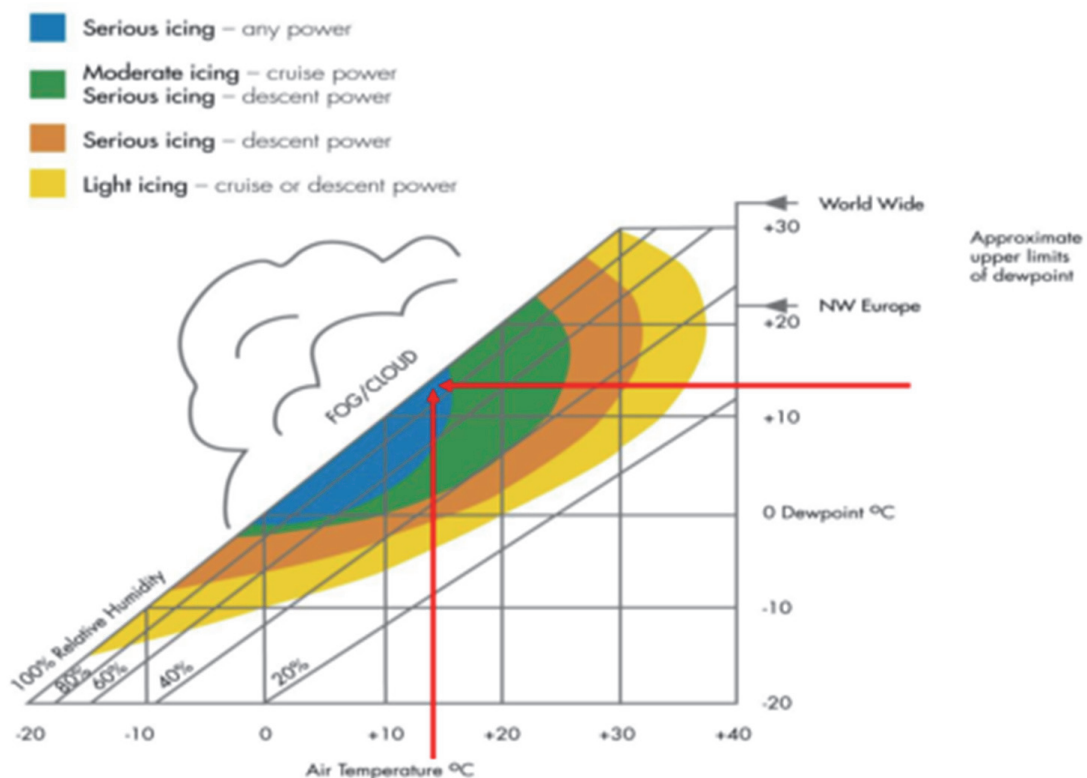


Figure 5
Carburettor Icing

Footnote

⁵ Temperature drop with altitude.

At a temperature of 14°C with a dewpoint of 13°C the aircraft is in the area where severe carburettor icing can occur at any power. In order to minimise the possibility of carburettor icing becoming a problem, pilots are taught to apply carburettor heat at routine intervals. In addition to applying carburettor heat the pilot would also check that all engine indications were normal.

Pilot's history

The pilot first started to fly in 2006, but the flying frequency was initially sporadic, until 2010, when he flew reasonably regularly until he gained his PPL in March 2013. He then started to fly G-CDER, and all but one of his flights since then were in this aircraft.

He flew two training sorties in March, with an instructor. The instructor confirmed that on those flights they covered Practice Forced Landings (PFLs) and the use of carburettor heat. The instructor recalled the pilot was very enthusiastic about aviation and generally flew to an above average standard, but he observed that on his first PFL, he allowed the aircraft's nose to go too far below the horizon, which resulted in a higher glide speed than the 75 KIAS his instructor recommended. This was corrected and subsequent PFL's were flown to a high standard. The instructor confirmed that ditching was discussed at the flying school, and their recommended technique for the PA-28 included opening the door, if possible, before impacting the water.

Other relevant incidents

On the weekend of the accident, the southern part of the UK was subject to a moist south-westerly airflow. The temperature and dewpoint of this air mass was such that aircraft flying around 2,000 ft were operating in the area of the carburettor icing forecast graph where severe carburettor icing could occur at any power.

The AAIB is aware of one other accident and several anecdotal reports of engine problems that occurred that weekend where carburettor icing was likely to have been a factor.

Analysis

Engineering

Examination and testing confirmed that the aircraft's fuel was not contaminated prior to the accident and the presence of fuel in the carburettor indicated that fuel was available to allow engine operation. The damage to the carburettor heat valve casing was consistent with impact forces so it was concluded that the carburettor heat valve was in the OFF position when the aircraft struck the sea.

Given the lack of evidence of an external oil leak from the engine, the low quantity of oil within the engine after recovery is thought to have been as a result of oil being purged from the engine breather system whilst the aircraft was submerged. This may have been the cause of the 'slick' observed by the SAR helicopter immediately after the aircraft sank.

Disassembly of the engine showed no evidence of a mechanical defect, the engine oil system was free from contamination and the oil pump and oil pressure relief valve were

in good condition. There was no evidence of any deterioration which would be normally associated with a lubrication system failure.

The engine oil pressure indication system functioned normally. Tests showed that the chafed wire found in the oil temperature indication system could result in the gauge incorrectly reading oil temperature beyond the 245°F maximum marking on the gauge. Testing also indicated that, in this condition, the current passing through the gauge would not be high enough to open, or trip, the relevant circuit breaker. This circuit breaker also provided power to a number of other aircraft electrical systems. The evidence of electrical arcing damage to the chafed cable confirmed that the circuit had been earthed whilst power was applied.

The carburettor icing chart, Figure 5, indicated that the aircraft was operating in conditions where carburettor icing would be expected at any engine power setting. Other events, both reported and anecdotal, from aircraft operating in the same weather system confirmed that carburettor icing may have been prevalent.

Given the evidence from the examination of the aircraft, the pilot's report of "SKY HIGH OIL TEMPERATURE" was probably due to the oil temperature gauge reading in excess of 245°F as a result of the effect of the chafed wire. In this situation, some pilots can become focussed on the abnormal indication to the detriment of other checks and actions. Given the atmospheric conditions, if carburettor heat was not routinely applied, ice would have built up in the barrel of the carburettor and the engine would begin to lose power and run roughly until eventually it would stop. It would not be possible to restart the engine until the ice had melted which could take several minutes. As the oil pump is driven by the engine's crankshaft, any reduction in engine rpm would produce a corresponding reduction in engine oil pressure. The combination of high oil temperature indication, a rough running engine and reducing oil pressure are usually symptomatic of a failure of the engine lubrication system. Therefore, it is not unreasonable to assume that the pilot, when confronted by this situation believed that the aircraft's engine was about to fail due to lack of lubrication.

Operations

The evidence suggests that the pilot suffered an engine malfunction, probably as a result of carburettor icing. The aircraft's position, when the pilot indicated he was unable to maintain altitude, was within glide range of land, but the pilot continued towards the Rye VRP. The aircraft was flown at an airspeed estimated to be at least 20 kt faster than the published best glide speed, which would have adversely affected its time in the air. The pilot did not attempt to turn the aircraft into the wind which would have reduced his groundspeed by around 34 kt, nor did he select full flap, to reduce the airspeed at which the aircraft ditched. The investigation considered that this was probably because of the pilot's relative inexperience, and becoming fixated on trying to return to the airfield. The investigation was unable to determine why the pilot's seatbelt was undone, but considered it probable that the door was unlatched by the pilot prior to the water impact in accordance with his training.

The CAA issue a number of Safety Sense Leaflets; Number 21(d) concerns ditching and contains useful advice for pilots on how best to survive a ditching. The General Aviation Safety Council (GASCo) publish some advice on forced landing⁶. In that advice they publish statistics which indicate the survivability of a forced landing is greater when the aircraft comes down on land rather than water.

Conclusion

The aircraft suffered an engine malfunction, with additional indications of high engine oil temperature and reducing oil pressure. This would have appeared to the pilot as though the engine was suffering a mechanical failure. The engineering investigation found no evidence of a mechanical defect with the engine but did identify a chafed wire which may have caused an erroneous indication that the oil temperature was extremely high.

The aircraft was within glide range of land, but the relatively inexperienced pilot, perhaps distracted by the abnormal engine indications, elected to return towards the airfield rather than the nearest land. The aircraft continued downwind and consequently ditched with a high groundspeed. The forces involved in the impact resulted in the pilot sustaining severe multiple injuries, and the aircraft then sank.

The cause of the engine malfunction was not positively determined, but the aircraft was operating in a regime of flight where severe carburettor icing was forecast and a number of other aircraft were involved in incidents which may also have been attributable to carburettor icing. The investigation noted that the Met F214 spot wind chart indicated that the Environmental Lapse Rate at the lower levels around the accident site was around 3° per thousand feet, a steeper gradient than the ICAO standard lapse rate of 1.98°C per thousand feet.

BULLETIN CORRECTION

There was a typographical error in the opening sentence of the last paragraph on page 25 of the Bulletin. The text should read:

‘The aircraft then flew 1.2 nm off-shore before turning onto a *south-westerly* heading, to fly approximately parallel to the shore line.’

The online version of this report was corrected on 12 January 2017.

Footnote

⁶ http://www.gasco.org.uk/safety-information/flight_safety_extra_june_16/forced-landings.aspx