

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-181, Cherokee Archer II, G-BXRG	
No & Type of Engines:	1 Lycoming O-360-A4M piston engine	
Year of Manufacture:	1978	
Date & Time (UTC):	12 November 2011 at about 1527 hrs	
Location:	27 nm west-north-west of Alderney	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Fatal)	Passengers - 1(Minor)
Nature of Damage:	Aircraft lost at sea	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	79 years	
Commander's Flying Experience:	150 hours estimated (all were on type) Last 90 days - 3:30 hours Last 28 days - 1:20 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft suffered a loss of electrical power during a day crossing of the English Channel to Alderney. The pilot became uncertain of his position and elected to ditch the aircraft near to a commercial surface vessel. The ditching was successful and the passenger escaped from the aircraft and was subsequently rescued. However, the pilot was unable to escape from the aircraft before it sank.

History of the flight

On the morning of Wednesday 9 November 2011 the pilot flew G-BXRG from Alderney, where the aircraft was based, to Lee-on-Solent Airfield on the English south coast. He was accompanied by his wife. The couple then travelled by car to Cheshire where they planned to

remain before making the return trip to Alderney three days later. There were no reported problems affecting the aircraft before or during the outbound flight.

The pilot and his wife retired early on the Friday evening and rose at 0430 hrs on the Saturday (12 November 2011) for the return drive to Lee-on-Solent, arriving there about 1100 hrs. After checking the weather and phoning a pilot friend on Alderney, it was apparent to the pilot that the Channel Islands were affected by fog and takeoff would have to be delayed to await an improvement.

Eventually the weather cleared and the aircraft departed Lee-on-Solent at 1418 hrs. The flight plan filed on behalf of the pilot gave an expected flight time of 50

minutes, with a fuel endurance of three hours. After takeoff, the pilot made a brief radio call and announced his intention to change to an en-route frequency, though he did not state which. Enquiries with likely ATC agencies revealed that the pilot did not contact any of them which, as the flight was planned to remain outside controlled airspace until approaching the Channel Islands, was not mandatory.

The aircraft's flight plan route to Alderney was via the reporting point at ORTAC, situated on the north-eastern edge of the Channel Islands Control Zone (Figure 1, showing the track of the accident flight on 12 November).

Normal procedures required that the pilot contact Jersey ATC when 10 minutes from ORTAC, to receive clearance into the zone. When nothing was heard from the aircraft at the expected time, Guernsey ATC¹ became concerned and contacted Jersey ATC to enquire about the aircraft with a view to starting overdue tracing action.

At about this time, an aircraft was observed on radar to the north of the zone, tracking approximately south-west. It was returning a transponder code of 7000 but with no altitude reporting. Although there was a suspicion that this aircraft was G-BXRG (based on timing), it was outside the zone and some considerable distance from

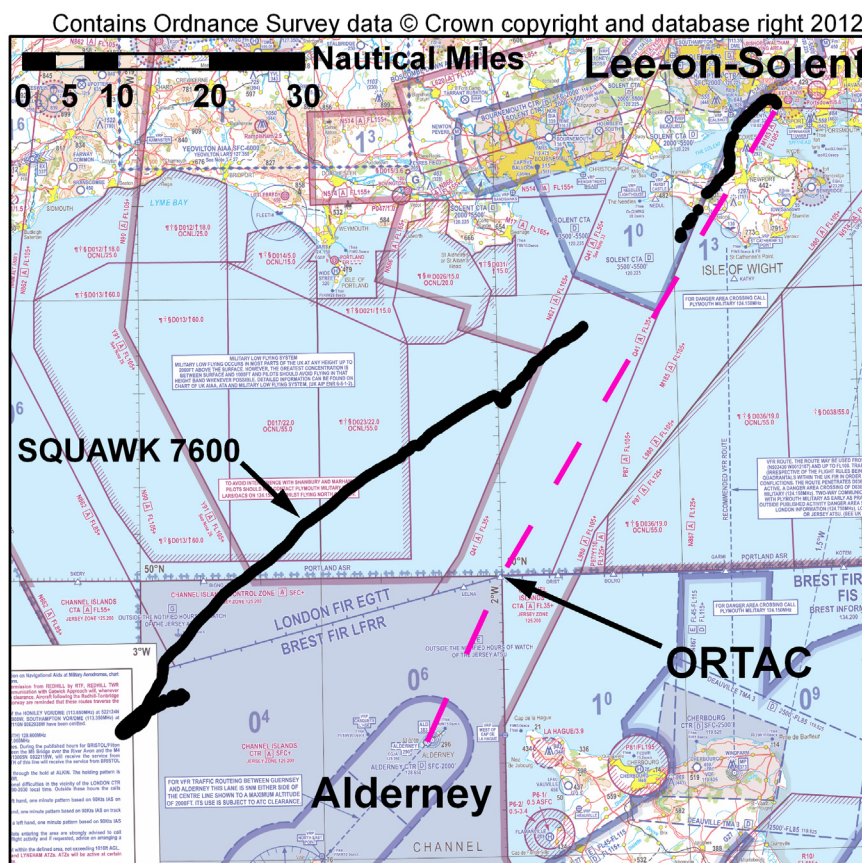


Figure 1

Radar derived plot of G-BXRG's track in black (accident flight, 12 November 2011), with expected routing via ORTAC in pink

Footnote

¹ Guernsey ATC was responsible for the airspace immediately around Guernsey and Alderney, and would have been expecting to handle the aircraft as it approached Alderney.

G-BXRG's expected route. The track could equally have been routine VFR traffic, such as a fisheries protection aircraft. Guernsey ATC made radio broadcasts in an effort to contact G-BXRG or the unknown (at that stage) aircraft, but these went unanswered.

The unknown track then displayed a 'radio fail' squawk (7600), indicating that the radio failure code had been selected on the aircraft's transponder. The aircraft, now believed to be G-BXRG (although still not confirmed) continued initially on a non-deviating track which was taking it some 25 nm to the north west of Guernsey and Alderney. Then the aircraft's track started to deviate left and right before, at about 32 nm west of Alderney, it flew a 180° turn to the right and flew back in the direction it had come from. During this manoeuvring, the aircraft's transponder returns ceased. The aircraft disappeared from ATC radar displays shortly afterwards.

Search and Rescue (SAR)

Operations

Guernsey ATC initiated its 'aircraft accident at sea' procedures. Coincident with this, the Channel Islands Coastguard received notification from their French counterparts of a 'Mayday Relay' message on the maritime distress channel from a commercial vessel, which stated that a light aircraft had been seen to ditch into the sea². This message was timed at 1527 hrs. The master of the ship later stated that the aircraft circled the vessel several times before ditching about 100 m astern of it, on a similar course of about 070°. It appeared that the propeller stopped rotating shortly before the aircraft contacted the sea surface.

Lifeboats from Guernsey and Alderney went to the scene, and a French SAR helicopter was launched.

Footnote

² The area of ditching was just outside radio range of Guernsey Coastguard.

Guernsey ATC requested the aid of a Piper PA-28 aircraft in their visual circuit, which was vectored to the scene. Additionally, a purpose-equipped SAR Islander aircraft was scrambled from Guernsey.

The commercial vessel returned to the site of the ditching and deployed a small launch. As this was happening, the crew of the PA-28 circled the scene and saw what appeared to be a square of fluorescent material floating in the water. The crew of the launch found a sole survivor, the pilot's wife, whom they lifted into the launch. She was then winched aboard the SAR helicopter and taken to Cherbourg hospital, where she was found to be suffering from hypothermia but otherwise with no significant injuries.

The search for the missing pilot continued. Although the lifeboats and Islander aircraft were stood down later that evening, the search was continued through the night by a Royal Navy warship and a French salvage vessel which had joined the operation. However, no trace of the pilot was found and the only piece of wreckage recovered was one of the main landing gear wheels.

According to one of the lifeboat crews, there was a long rolling sea swell at the time, with a height of about 5 ft.

Survival equipment

A four-person liferaft, weighing 9.5 kg (21 lb), was carried in the cabin on the floor behind the front seats of the aircraft. The instructions for inflation stated that the inflation handle should be peeled from its Velcro retaining strip, grasped firmly and then, after pulling out approximately 3 feet of slack lanyard, be pulled firmly for inflation.

A manually-activated Personal Locator Beacon (PLB) was carried in the front passenger side pocket but was not used.

The pilot and passenger were both wearing their own Aircrew Slim-fit manually-activated lifejackets. The passenger's lifejacket successfully inflated.

Passenger's account

Pre-flight preparation and initial flight phase – accident flight, 12 November

The pilot's wife had flown with her husband on a number of occasions, including on cross-channel flights. Although she had not received any formal aviation training, she was aware of the general purpose and principles of operation of the aircraft radios and transponder and, to a limited extent, the GPS navigation display.

She recalled that the pilot's pre-flight actions seemed normal, and that he used printed checklists, which was his usual practice. The weather in the Solent area was fine after takeoff, with good visibility. The pilot made the radio call to Lee-on-Solent, but made no further radio calls at that stage. She described the height at which the aircraft flew as "typical" (radar information from the outbound flight on 9 November showed a typical cruise altitude of 1,200 ft amsl).

The pilot had a photocopied chart with flight details on it, whilst his wife held a chart with a line drawn on it; she recalled the figures "212" on the chart, which she assumed was the heading, though she was not aware of any timing markings³. She thought the pilot's photocopy included timings but he had previously explained that the times marked could be in error if there was a significant wind affecting the flight. She was used to seeing the desired track displayed as a pink line on the Garmin GNS 430 combined Communication / GPS display (Figure 2), and was aware that, if the aircraft

symbol was on the pink line, then it was correctly on track. She later recalled that on the accident flight she saw the aircraft on the pink line during the initial stages of the flight over the Channel.



Figure 2

Detail of G-BXRG's instrument panel, showing a typical navigation display (with white aircraft symbol and the pink track line). Communications/navigation control panels radios are above and transponder panel below

In-flight failures

The pilot discussed with his wife the need to call Jersey ATC when 10 minutes from the zone boundary. She thought the aircraft had reached about that point when she first noticed anything unusual. The aircraft had drifted a little to the right of the pink track line on the GPS display, and she mentioned this to the pilot. Not long afterwards, the display reverted to one displaying only the maker's name, "Garmin". At the same time, she noticed all the illuminated digits in the communications / navigation control panels extinguish. However, she also recalled seeing the digits "7000" still illuminated on the transponder display⁴.

Footnote

³ The figures '212' are consistent with the required track (or still-air heading) to ORTAC.

Footnote

⁴ The transponder was a Garmin GTX 328 unit.

The “Garmin” legend on the GNS 430 subsequently extinguished and, although the pilot made some switching selections in an apparent attempt to restore power, the display remained blank. He did not appear overly concerned and seemed to treat the malfunction as a temporary event at first.

Up to this stage the weather had been clear but now the aircraft encountered low cloud ahead and the pilot climbed the aircraft above it, such that his wife recalled being in clear weather again and looking down at the cloud tops. The pilot attempted to make radio calls but did not receive a response. He referred to a checklist, and set the transponder code to 7600, the radio fail code. In answer to a question from his wife about what they would do, the pilot responded with an assuring remark, indicating that he still had the compass (his wife recalled him gesturing in a manner to indicate he was referring to the compass atop the instrument coaming).

At a later stage, the pilot descended the aircraft through the cloud, telling his wife that they would need to do so if they were to see Alderney. However, the visibility was “not very good” below cloud and there was no sign of Alderney ahead. The pilot made a remark questioning where Alderney was, saying that they should have sighted it by that time.

Ditching, egress and rescue

After some time the pilot remarked that they would run out of fuel eventually and said he might have to ditch the aircraft. Several large ships had been seen in the Channel shipping lanes, and the pilot turned the aircraft back in order to find a ship next to which they could ditch. A ship was sighted and the pilot started circling it. He told his wife that the aircraft would sink after ditching, and reached back to bring forward the liferaft

which he placed on his wife’s lap. Both the pilot and his wife were already wearing their own lifejackets.

The pilot’s wife recalled little about the ditching itself. The cabin door (there was only one, on the passenger’s side) was opened after ditching by the pilot and the aircraft began to fill with water. The pilot assisted his wife to unbuckle her seatbelt and she left the aircraft with the liferaft. She was not aware that her husband had suffered any injury during the ditching and he said nothing to that effect. She believed that he had unfastened his own seatbelt, and was attempting to exit, but was hindered for some reason. She did not know what the problem had been, but thought he may have become entangled in something, possibly his headset lead.

The pilot was unable to exit the aircraft, which quickly filled with water and sank. His wife did not recall how to operate the liferaft, so unzipped the valise and extracted it. As she did not pull the activation lanyard, the liferaft came out of its valise uninflated and remained so. Aware that its bright colouring would assist rescuers, she kept hold of it, along with the aircraft wheel which she found floating beside her. She became aware of the ship approaching, an aircraft circling overhead and being recovered from the water into a small launch. She had become very cold and had only intermittent recollection of subsequent events.

Meteorological information

The Met Office’s aviation forecast issued at 0855 hrs (which would have been available to the pilot at Lee-on-Solent) showed a band of weak frontal weather across the area. At 1200 hrs, this would stretch from south-east England across the Channel to northern France and the Channel Islands, moving slowly eastwards (Figure 3). Within the frontal area, the forecast visibility was generally 12 km, but reducing to

3,000 m in mist or light rain and drizzle. Occasional scattered or broken low level stratus cloud was forecast between 200 ft and 1,500 ft, with further broken or overcast cloud layers above.

The orientation of the frontal feature was such that it would clear the Lee-on-Solent area before it cleared the Channel Islands. The area behind, which was forecast to include Lee-on-Solent from about 1200 hrs onwards, showed a greatly improved general visibility of 40 km, although with isolated areas down to about 7 km in rain showers. Scattered or broken cloud was expected in this area with a base of about 2-3,000 ft. The winds over the Channel at 2,000 ft were forecast to be from about 150° at 15 kt.

The pilots of the PA-28 and Islander aircraft, which were on-scene shortly after the ditching, were later asked for their assessment of the weather conditions. Their estimates of visibility varied from 6 to 10 km, with both pilots remarking that it was a little hazy, although quite acceptable for visual flight manoeuvring. There were only occasional and very small amounts of cloud.

Pilot information

The pilot started flying training in July 1999. He trained mostly on G-BXRG, a syndicate aircraft, in Alderney and it was the only aircraft he had flown in the last few years. His training was characterised by short periods of relatively intense flying interspersed by quite long periods of no flying. Periods of flying varied between one month and six months in duration, while the periods in between varied between eight months and three years, with an average of about 18 months.

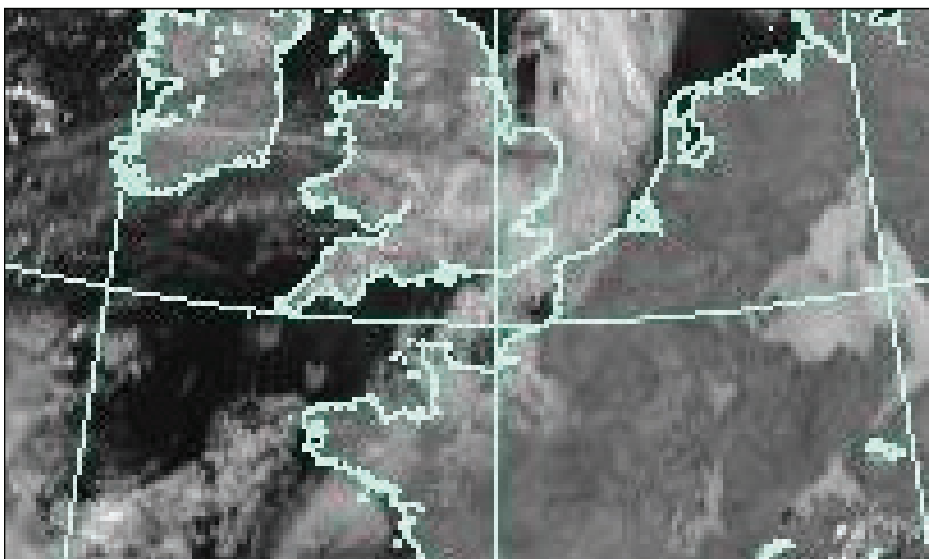


Figure 3

Visible-spectrum satellite image, taken at 1200 hrs

In July 2008 the pilot's training programme was amended to align with the requirements of the National Private Pilot's Licence (NPPL). This was necessary after he underwent a medical procedure which prevented him from obtaining the required medical category for the full Private Pilot's Licence (PPL)⁵.

In May 2010, following a break from flying of one year and ten months, the pilot commenced flying training again and, on 8 August 2010 passed the skill test for grant of an NPPL. His training records in Alderney showed that he had accumulated 102:05 hrs flying time at this point, of which 9:15 hrs were solo. He flew a further 3 hours during the remainder of 2010. The pilot is believed to have flown an additional 25 hours (approximately) at a flying school in England some years earlier, although these were not recorded on his training records in Alderney.

Footnote

⁵ The medical requirements for a NPPL are less onerous than for a JAR-FCL licence, being equivalent to the DVLA group 2 standard, applicable to drivers of large lorries and buses. A declaration of fitness must be endorsed by an applicant's General Practitioner, who must have access to the applicant's medical records.

According to the aircraft operating group's records, the pilot had flown 18:45 hrs during 2011 up to the date of the accident flight. Before embarking on the flight to Lee-on-Solent, he had flown six return trips cross-Channel during 2011. These were from Alderney to Sandown on the Isle of Wight, Exeter (twice), Lee-on-Solent (in July) and Perranporth. The pilot's wife had accompanied him on some of these flights.

The pilot had flown with the Garmin GNS 430 equipment whilst training; the group's training records showed that he received introductory training in its use on 5 August 2010, the same day as his qualifying cross-country flight and three days prior to his NPPL skill test.

Medical issues

The pilot was generally considered fit and active with no significant current health issues. Although he had undergone the medical procedure which precluded him being issued further Class Two medical certificates by the UK CAA, he had been able to meet the medical requirements for issue and upkeep of an NPPL.

Being over 65 years of age, the pilot's NPPL medical declaration was valid for one year. Medical records showed that the pilot's GP had last countersigned a medical declaration in July 2010, which would thus have been valid to July 2011. Holders of NPPLs are required to forward a copy of completed medical declarations to the appropriate National PPL administrative body (in this case, the National Pilots' Licensing Group Limited (NPLG Ltd)). Enquiries of NPLG Ltd revealed that the pilot had sent them a copy of his July 2010 declaration. However, no further copies had been received so it is probable that the pilot did not hold a valid medical declaration at the time of the accident.

In March 2011, the pilot passed a medical examination in France for a DGAC⁶ Class Two certificate, to allow him to fly to and from French airfields. In the UK, the CAA recognises DGAC Class One certificates, but not Class Two. Thus, although the pilot's DGAC medical certificate was current at the time of the accident, it was not itself valid for licensing purposes for flights in UK airspace.

Aircraft and systems description

General

The PA-28-181 Cherokee is a four-seat, low-wing monoplane aircraft powered by a 180 hp piston engine. It has dual flying controls that are connected to the flying surfaces by a series of cables and pulleys, and three-position flaps, manually operated by a lever situated between the front seats. The aircraft has a fixed landing gear.

Entry and exit from the cabin is through a door situated on the right side, secured by two latches. The front seats are adjustable fore and aft and are fitted with a three-point harness consisting of a lap belt and shoulder strap. The male portion of the lap belt buckle engages with the female portion of the buckle, which is mounted on a strap secured to the floor between the front seats. The shoulder strap incorporates an inertia reel which is connected to the aircraft structure, just above the side window. The shoulder strap is routed over the shoulder adjacent to the windows and attaches to the lap belt buckle, in the area of the occupant's inboard hip, by a spigot and slot arrangement (Figure 4).

In order for a front seat occupant to exit the aircraft, both door latches must be moved to the OPEN position

Footnote

⁶ Direction Generale de L'Aviation Civile, the French civil aviation authority.

and the lap belt quick release buckle must be released. The occupant can then either disengage the shoulder strap from the spigot on the lap belt buckle, or remove the arm from between the shoulder strap and lap belt.

Engine

The engine is equipped with two engine-driven magnetos and a mechanical fuel pump. Once the engine has started it will continue to operate independent of the aircraft electrical system.

Fuel system

The aircraft is fitted with two 91-litre (24 US gallons) fuel tanks, one mounted in each wing. A three-position fuel selector valve is located on the left side of the cockpit, forward of the pilot's seat, which allows the pilot to select the left tank, right tank or OFF position. An electrical fuel pump can be used, in the event of a failure of the engine-driven mechanical fuel pump, to provide fuel to the engine. Two fuel gauges, one for each fuel tank, are mounted at the bottom of the instrument panel in front of the pilot. In addition, a metal 'tab' is mounted below the refuelling cap in each fuel tank to provide a visual indication, on the ground, when the quantity of the fuel in the tank is at 64 litres.

Electrical system

The electrical system in G-BXRG included a 14V 60-amp alternator, a 12V battery with a 1-hour rate of 23 amps, a voltage regulator, an over-voltage relay and a battery master switch relay. The battery and alternator are both connected to the aircraft busbar from which electrical power is provided, through circuit breakers (CBs), to the aircraft and avionic systems. The CBs are located at the bottom of the instrument panel in front of the passenger and the battery and alternator are controlled by red switches mounted on the centre instrument panel. Figure 5 shows the switches fitted to

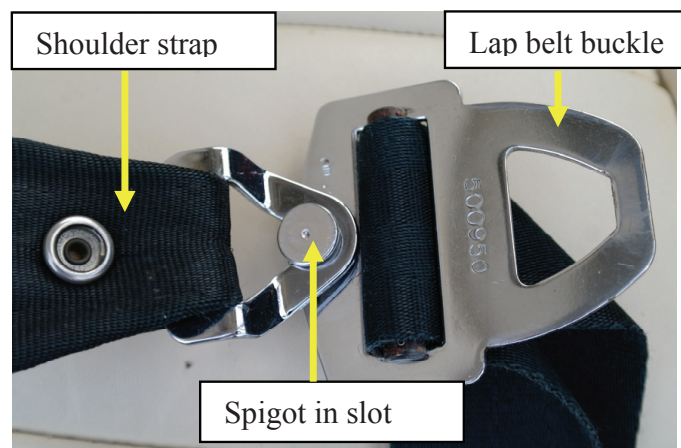


Figure 4

Seat belt buckle

another PA-28-181. The passenger believed that these switches had both been in the ON position during the accident flight.

An ammeter, located at the bottom of the pilot's instrument panel, displays the load, in amps, placed on the alternator (Figure 6). An annunciator panel above the pilot's primary instruments contains an amber 'ALT' warning caption which illuminates when the current from the alternator falls to zero amps. A non-flashing red 'Low Voltage' warning lamp, located on the left side of the instrument panel, operates when the voltage of the aircraft electrical system falls below 12.5 to 13 volts.



Figure 5

Battery master and alternator switches (red)

Avionics and flying instruments

In addition to the standard primary flying instruments that are operated by the pitot static pressure system, G-BXRG was also equipped with a magnetic compass and the electrical and vacuum-driven instruments detailed in Table 1.

In the event of a loss of electrical power, the pilot would still be able to operate, and navigate, the aircraft in day VMC conditions using the pitot-static instruments

and the directional (DG) and attitude gyro indicators. The heading on a DG drifts over time and needs to be routinely realigned with reference to the magnetic compass.

Compass deviation

A magnetic compass mounted in an aeroplane is affected by the magnetic fields created by the aircraft, which includes those produced by the electrical circuits. The error from these fields is called 'deviation' and is corrected by the use of compensating magnets and the

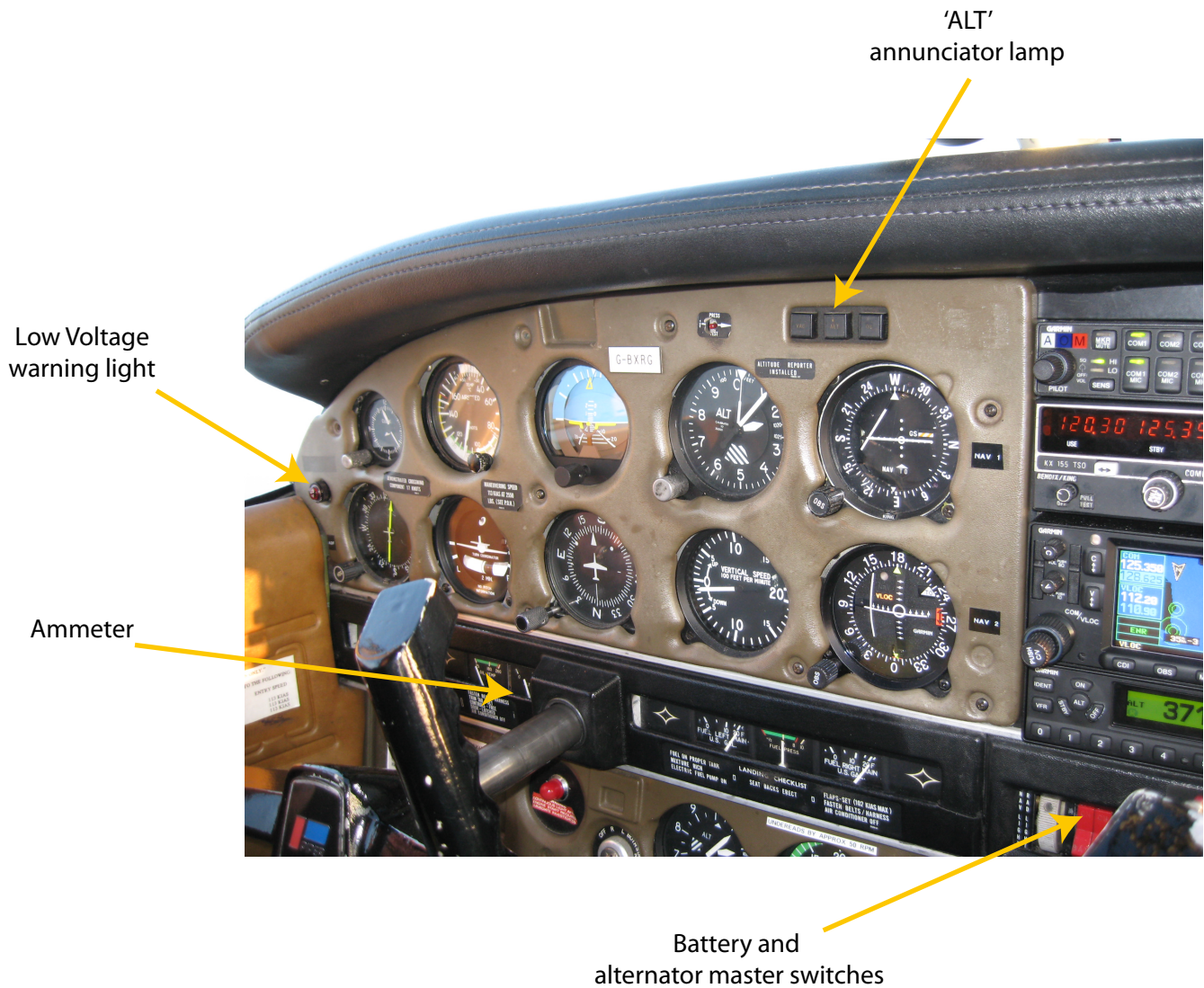


Figure 6

Pilot's instrument panel on G-BXRG

Equipment	Electrically operated
Directional gyro (DG)	No (engine-driven vacuum pump)
Radio / Nav (one)	Yes
Combined GPS/Radio/Nav	Yes
Attitude gyro indicator	No (engine-driven vacuum pump)
Turn indicator	Yes
Transponder	Yes
VORs (two indicators)	Yes
DME	Yes
ADF	Yes

Table 1

Electrical and vacuum-driven instruments

use of a compass deviation card placed adjacent to the compass. In establishing and correcting the deviation the aircraft compass is 'swung' with the engine running and the electrical system switched on.

Following this accident the AAIB recorded the deviation on a similar equipped PA-28-181 and the magnetic compass aligned with the following headings when the electrical alternator was selected ON and OFF (Table 2).

Low voltage warning system

Civil Air Publication (CAP) 747⁷ recommends that for a 12 volt dc system a red 'Low Voltage' warning light should operate when the voltage drops below 12.5V

to 13V. The battery duration should be sufficient to make a safe landing and should not be less than 30 minutes, subject to the prompt completion of any drills. Moreover, this duration need only be a reasonable estimate and not necessarily calculated by a detailed load analysis. When making this estimate, only 75% of the battery nameplate capacity should be considered as available.

The Flight Manual for G-BXRG contained supplementary information requiring that, if the 'Low Voltage' warning light illuminates in flight, the pilot should reduce electrical load and land as soon as possible as the battery duration would be approximately 40 minutes.

	Indicated Heading			
Alternator ON	000	090	180	270
Alternator OFF	012	085	168	278

Table 2

Compass deviation with Alternator selected ON and OFF (similar PA-28-181)

Footnote

⁷ CAP 747, Section 2, Part 3, GR No 6 and CAA Airworthiness Notice 88.

Electrical load analysis

The investigation was unable to obtain an electrical load analysis for G-BXRG; therefore a load analysis was undertaken by measuring the current draw on three similarly equipped PA-28-181 aircraft. The results of the tests are included in Table 3.

Fuel calculations

The aircraft was last refuelled at Guernsey on 8 November 2011, after which it made a short flight to Alderney and did not fly again until the flight to Lee-on-Solent on 9 November. The investigation established that, when the aircraft departed Alderney on the outbound flight, the fuel level was at ‘tabs’, which is approximately 128 litres. From the fuel consumption figures in the Aircraft Flight Manual, it was estimated that there would have been approximately 54 litres (46 litres useable) of fuel on the aircraft when it ditched. This equated to about 70 minutes flying time at normal cruise power setting, or about 110 minutes at endurance power setting.

Recorded information

Radar data

Recorded track information for the outbound flight to Lee-on-Solent (9 November 2011) and the accident flight (12 November) were available for analysis. The outbound flight was captured by a combination of the Jersey and Pease Pottage (near Gatwick) Secondary Surveillance Radar (SSR) heads. Their respective ranges were insufficient to capture the complete route but they overlapped south of the Isle of Wight. Mode C⁸ altitude returns showed an average cruise altitude over the Channel of 1,200 ft amsl. Gaps in the radar coverage along the route were noted and were probably due to the aircraft’s altitude.

The outbound track (9 November) contained two anomalies (Figure 7). The first occurred immediately after departure from Alderney with the aircraft not tracking towards ORTAC as planned, and this was resolved through discussion between ATC and the pilot. The second concerned the en-route phase in which the aircraft did not follow the standard route to ORTAC and subsequently tracked south of the direct track for Lee-on-Solent before turning for the airfield as the aircraft neared the Isle of Wight.

Aircraft electrical status	Battery duration at 90% capacity	Battery duration at 75 % capacity
All equipment switched on. Transmit for 3 minutes on Com 1.	36 minutes	33 minutes
All equipment switched on except for the pitot heater and fuel pump. Transmit for 3 minutes on Com 1.	54 minutes	45 minutes
Battery master and Com /Nav 1 switched on. Transmit for 3 minutes on Com 1.	199 minutes	166 minutes

Table 3
Electrical load analysis

Footnote

⁸ Mode C transmission is selectable by the pilot.

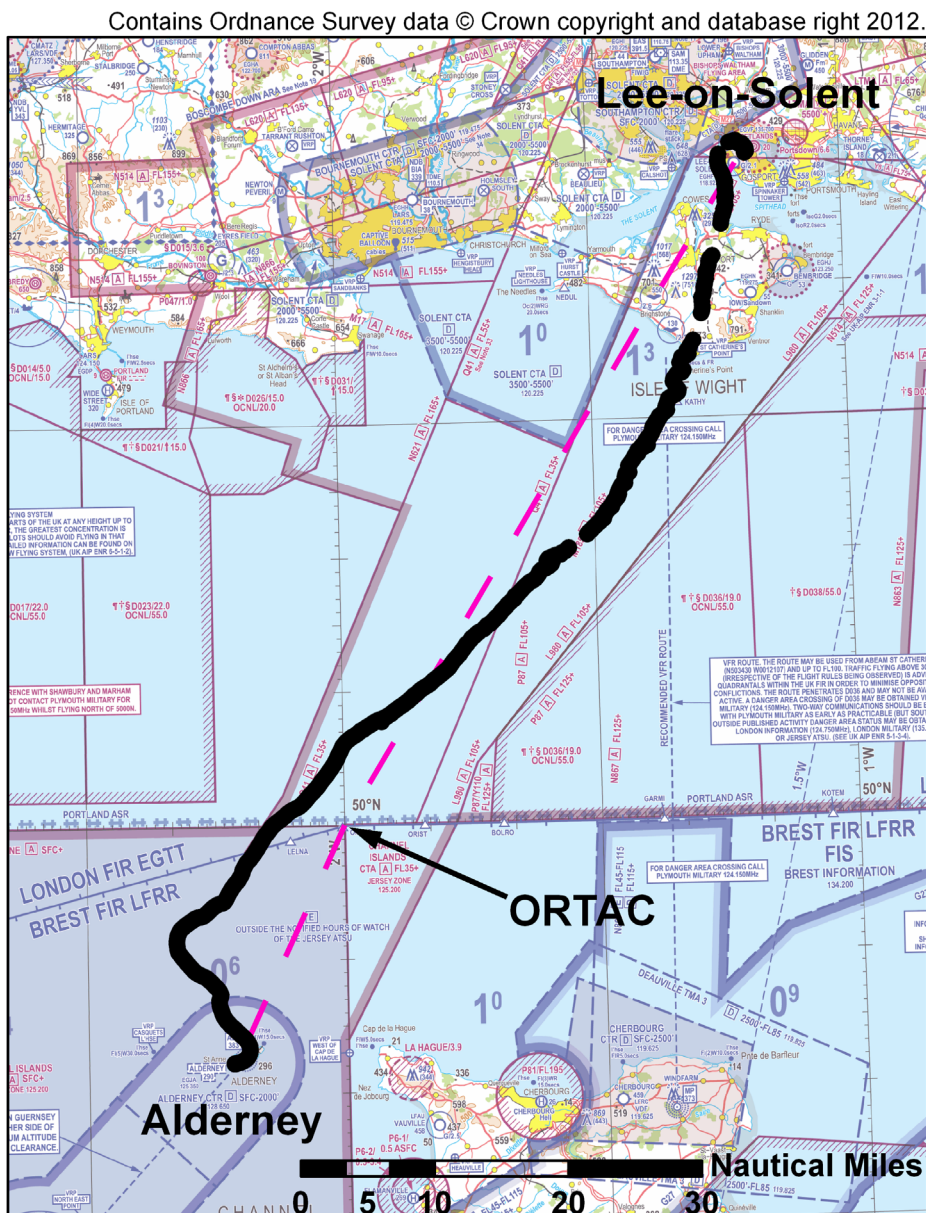


Figure 7

Radar derived track in black showing flight to Lee-on-Solent on 9 November 2011.

Flight plan route shown by broken pink line

The whole recorded track of the accident flight (12 November) is at Figure 1. The track was again recorded by Pease Pottage and Jersey SSR heads, but no Mode C altitude information was recorded. Gaps in the track again suggest that some of the flight was flown at similar, or lower, altitudes to that of the outbound flight. The final portion of the track was only recorded by the Guernsey Primary Surveillance Radar (PSR) head since the Jersey radar head's view of the aircraft at low

altitude would have been obscured by Guernsey. The secondary radar returns ceased at 15:16:34 hrs, whilst the primary radar returns continued intermittently, showing the aircraft making a series of orbits centred about a point moving slowly north-east. These returns ceased at 15:27:38 hrs, within 4 nm of the reported ditching position. Based on the reported radar coverage in the area, the aircraft altitude would have been about 600 feet when it ceased to be detected by the Jersey SSR.

The initial portion of the accident flight is shown at Figure 8. The initial tracking out of Lee-on-Solent is as described by the pilot's wife, with a significant track adjustment occurring over the Isle of Wight. However, the aircraft then appeared to establish on a track which deviated to the right of the track for ORTAC. The track anomaly at 14:45 hrs occurred 20 nm north of ORTAC which, had the aircraft been tracking towards ORTAC, would have equated to the point where an initial call to Jersey ATC was required (ie 10 minutes from ORTAC). The pilot's wife thought that the anomaly was most probably due to inadvertent turning which occurred as the pilot was attempting to resolve his initial problem with the GPS display.

Radiotelephony information

Recordings of all relevant frequencies and landlines were available for analysis. Of note was an exchange between Jersey ATC and the pilot shortly after takeoff outbound from Alderney on 9 November. On observing the track discrepancy, the controller queried the pilot's intentions. After a delay, the pilot replied "JERSEY G-BXRG SORRY I HAD A LITTLE TROUBLE WITH THE GARMIN I'VE JUST SORTED IT OUT". The aircraft then turned right onto a more appropriate track (ie towards ORTAC – about 14 nm away) which it maintained for about 4 nm.

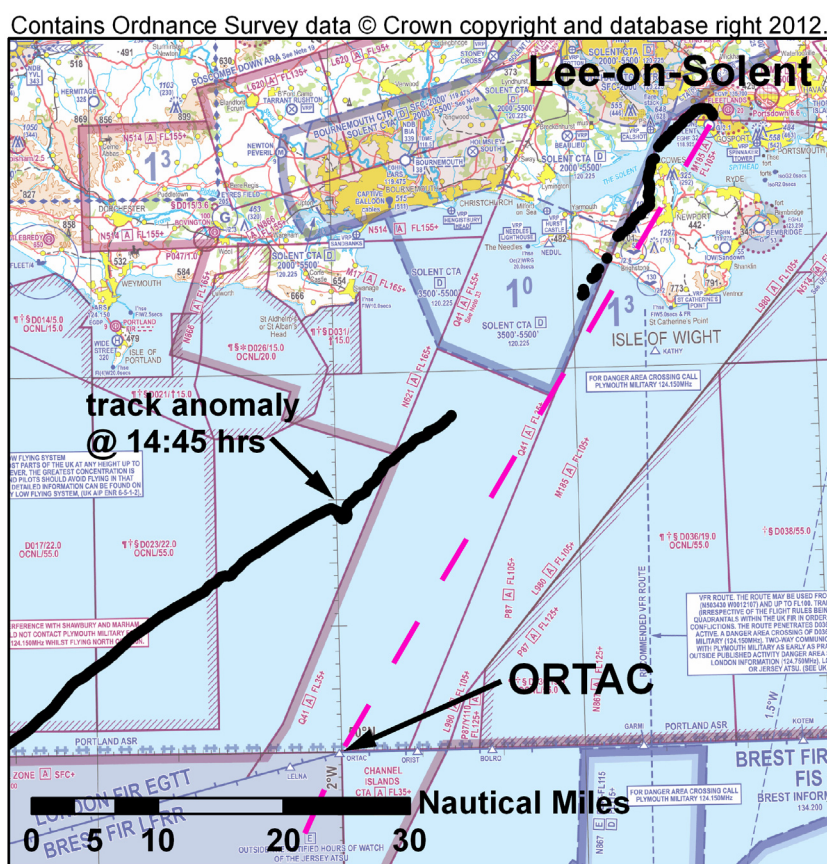


Figure 8

Initial portion of accident flight, showing departure from Lee-on-Solent and tracking anomaly.
Flight plan course for ORTAC is highlighted in pink

Analysis

Aircraft status

The aircraft had been recently maintained, had no significant fault history and there had been no recent reports of technical problems. The pilot made no mention of technical problems with the aircraft after he landed at Lee-on-Solent and the available evidence indicates that the engine operated normally throughout both the outbound and accident flights. The witness report that the propeller stopped rotating immediately before the aircraft ditched is consistent with a deliberate action by the pilot.

Electrical failures

It was evident from the passenger's account that there had been problems with the electrical and navigation equipment during the accident flight. The passenger was familiar with some of the avionic equipment and later recalled the transponder, radios and GPS being selected ON and operating during the early part of the flight. This is supported by the transmission of the transponder code 7000 and the radio call the pilot made to Lee-on-Solent shortly after takeoff. The passenger's account of the GPS screen subsequently changing to the 'Garmin' start-up screen is consistent with a deterioration in the electrical power supply to the GPS/Com/Nav 2. The passenger's report that the GPS/Com/Nav 2 screen and the illuminated numbers on the Com/Nav 1 display then went blank indicates that full electrical power to these units had been lost. However, at this time the transponder was still transmitting, which indicates that there was still some electrical power at the busbar. The electrical power for GPS/Com/Nav 2 and Com/Nav 1 are provided from the busbar through independent circuit breakers, which meant that there was no common electrical path between the busbar and these units, and thus no single point of electrical power distribution downstream of the busbar.

Therefore, the most likely explanation for the loss of power to GPS/Com/Nav 2 and Com/Nav 1 is that at some point during the flight the electrical output from the alternator was lost, leaving the battery to provide power to the busbar. As the battery discharged, its output voltage would decrease until the operating threshold for the different avionic units was reached and they would turn off. With the load on the battery reduced, the interaction between the electrolyte and the battery plates would result in a small recovery in the battery voltage, which might rise sufficiently above the operating threshold for some of the avionic units causing them to turn back on. However, the load would once again result in the voltage reducing and for units to switch off. This is the most likely reason why the passenger noticed that the GPS screen had changed to the start-up page before going blank. Eventually the battery voltage would reduce to a level where all the avionic and electrical equipment would no longer be able to operate. However, the pilot would still have been able to fly the aircraft using the magnetic compass, attitude indicator and primary flying instruments and the engine would continue to operate.

The 'Electrical load analysis' (Table 3) shows a predicted battery life of between 33 and 36 minutes, provided no actions are taken to reduce electrical load following a loss of alternator output. From the passenger's account, the initial onset of electrical problems can be linked to the track anomaly at 1445 hrs, or 27 minutes after takeoff. It is not known when the aircraft's engine was started, but an estimate of 5 to 10 minutes before takeoff is reasonable. This indicates that there had probably been no alternator output at all since the engine was started, or a point very early in the flight, either due to a failure or because the alternator was not selected ON. The passenger believed that the alternator had been selected ON, and that the pilot's use of checklists and usual diligent manner, would have resulted in him identifying an incorrect switch position prior to takeoff.

Loss of electrical power from the alternator would result in the amber 'ALT' warning lamp and the red, steady, Low Voltage Warning lamp illuminating. The ammeter would also lose power and the needle would move to the left stop on the gauge.

Compass deviation

The compass deviation would have been corrected, and the deviation card produced, using compass readings taken with the electrical system and equipment operating normally. With the alternator selected OFF, or not operating, the compass deviation would differ from when the electrical system was operating normally. A flight trial of another PA-28-181 determined that with the alternator selected ON and OFF the compass heading would vary by 12° on a southerly heading and 8° on a westerly heading. Therefore, if the pilot had

used the compass either to steer the aircraft or align the Directional gyro (DG) after the electrical failure had occurred, then the actual heading could have been around 9° to the right of the desired heading.

Navigation issues

The information available suggests that the pilot was using the GPS as his primary navigation aid, and that it was functioning satisfactorily in the early stages of the accident flight. His wife reported seeing the aircraft symbol on the GPS track line before drifting slightly right of it, which suggests that the GPS track guidance may have been based on an erroneous destination. One possibility examined was that the selected destination was Brest Airport. Figure 9 shows the aircraft's track with a track to Brest overlaid. There is no evidence that the pilot had inadvertently selected Brest as a

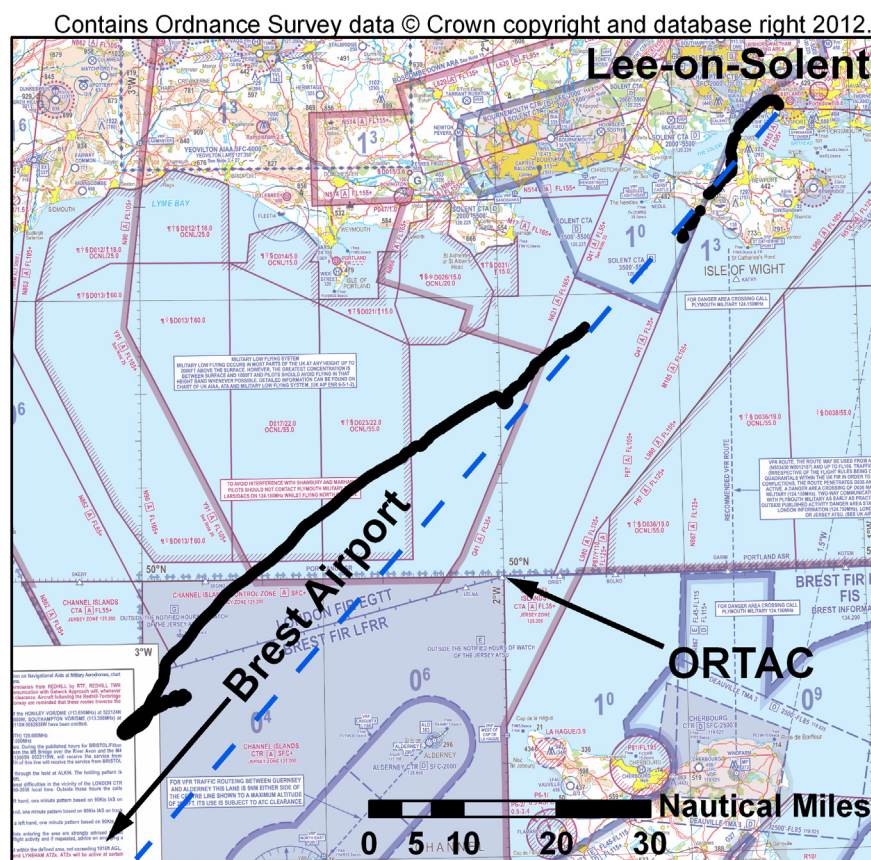


Figure 9

Accident flight with track for Brest Airport overlaid

destination but such a scenario offers a good correlation with the pilot's wife's account of being on track initially before drifting slightly right of track shortly before the electrical problems occurred.

It is known that the track anomaly seen on departure from Alderney on the outbound flight (9 November 2011) was due to the pilot experiencing a problem with the GPS, which was established when ATC queried the routing. A possible explanation for the track error is that an incorrect GPS destination had been selected. Figure 10 shows the aircraft's actual track, with an overlaid track to Exeter Airport, to which the pilot had previously flown. This offers a possible explanation for the GPS-related problem on the outbound flight and supports the theory that incorrect GPS programming may also have occurred on the accident flight.

Once the aircraft had become established on its cross-Channel route on the accident flight, the

opportunity for the pilot to identify a navigation error would be limited since, without ground features, only a cross-check of actual heading against planned heading or a check of position using shore-based radio navigation aids would have been likely to expose the error. It is uncertain whether the pilot carried out pre-flight planning for the wind conditions of the day which, if uncorrected, would have caused the aircraft to drift to the right of the desired track. If he did not suspect that he had made a GPS programming error, the pilot would have had no reason to doubt that he was on track for ORTAC, as the GPS display would have appeared to confirm.

Once the GPS had ceased operating, the pilot appears to have relied on visual navigation techniques. Even if shore-based radio navigation aids could still be received, there is no indication that the pilot had been using them on either flight. He did not appear concerned about navigation at this stage, so it is likely that his intention

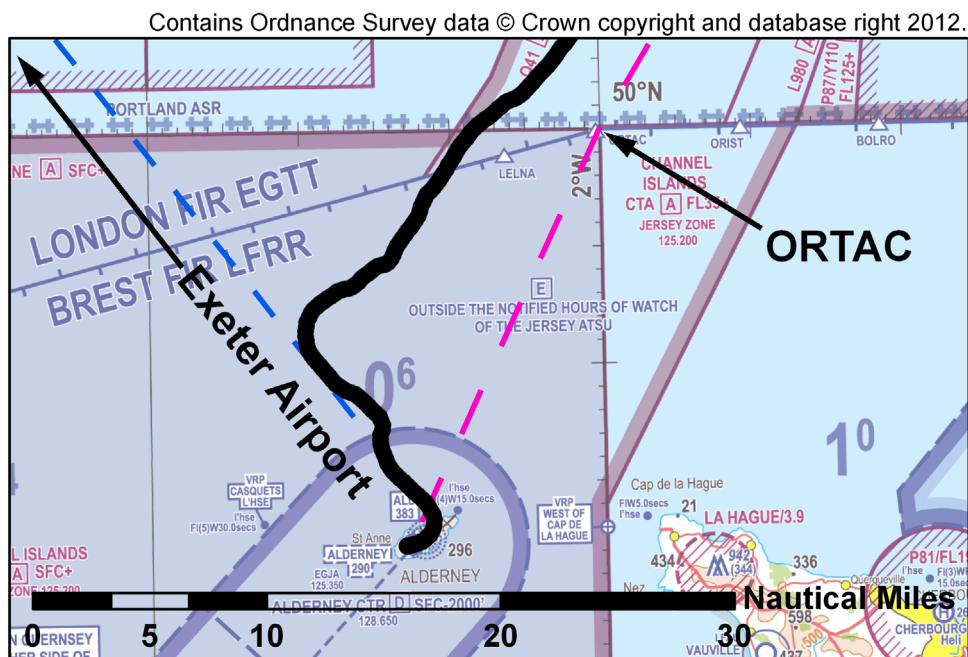


Figure 10

Navigation anomaly after takeoff from Alderney (9 November 2011),
with direct track to Exeter overlaid

was to hold an appropriate heading until such time as Alderney appeared ahead, as his comment and gesture to his wife seem to have confirmed. Even if drift due to the wind was not allowed for, it is likely this would have been a successful strategy since, had the aircraft actually been positioned correctly on track for ORTAC at the time the GPS was lost, the wind would have given a maximum track error of about 5 nm by the time the aircraft was approaching Alderney.

In fact, the aircraft's track deviated further to the right after the loss of the GPS. Up to this point the pilot would have only needed to fly a heading to satisfy the track requirement as demanded by the GPS, but afterwards the pilot would have to fly by heading only, which would need appropriate correction to allow for wind. The aircraft track observed after the GPS loss is consistent with what would result from the effect of the wind, combined with the compass deviation due to the electrical failure.

Weather conditions are likely to have contributed to the outcome. There had been a marked improvement in visibility in the Solent area and the fog in the Channel Islands had been reported as clearing, so it is probable the pilot initially expected to gain visual contact with Alderney relatively easily. This may account in part for his apparent lack of concern when the electrical problems first occurred. However, as Figure 3 shows, the frontal feature may not have fully cleared the area. As the pilot was forced to climb above the cloud, he would not have

realised that Alderney was not where he expected it to be until he descended again, by which time Alderney would have been passing well to his left.

Aircraft ditching

Any analysis of the pilot's decision to ditch must observe that the aircraft did have sufficient fuel to remain airborne for a considerable time and that conventional techniques for dealing with uncertainty of position could have produced a course of action which would have stood a good chance of finding land, even if not an airfield initially. The decision to ditch was one which guaranteed loss of the aircraft and a high chance of injury or loss of life.

However, the pilot found himself in a confusing situation with apparently few options. His decision to follow a ship and ditch next to it would thus have been balanced against the option of remaining airborne and possibly finding himself in an even less favourable situation.

The ditching itself appears to have been well executed, giving both occupants the best chance of survival. The problem that prevented the pilot vacating the aircraft is not known. From his wife's account, it may have been a relatively simple problem, such as entanglement with headset or harness, which would normally be a minor hindrance but which, in the circumstances, cost vital seconds.