ACCIDENT

Aircraft Type and Registration:	Piper PA-28-181 Archer 2, G-EMAZ
No & Type of Engines:	1 Lycoming O-360-A4M piston engine
Year of Manufacture:	1981
Date & Time (UTC):	4 September 2005 at 1221 hrs
Location:	Irish Sea, 5 nm north-west of Strumble Head, Pembrokeshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Fatal) Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	Approx 150 hours (of which approx 45 were on type) Last 90 days - Not known Last 28 days - Not known
Information Source:	AAIB Field Investigation

Synopsis

The pilot and his passenger were returning to Cardiff Airport, in G-EMAZ, from Weston Aerodrome, near Dublin, Ireland. The aircraft had not contacted Cardiff ATC at its ETA, therefore overdue action was initiated 30 minutes later and the London Area Control Centre was notified. The subsequent Search and Rescue operation used British and Irish lifeboats, search and rescue helicopters and a RAF Nimrod aircraft.

Aircraft wreckage and two bodies were found that night by the lifeboats 11 nm north of Strumble Head, near Fishguard, Pembrokeshire, having drifted with the tide for 10 hours. It was later confirmed that the wreckage was from G-EMAZ.

History of the flight

The pilot and his passenger departed Cardiff Airport, in G-EMAZ, on 1 September 2005 for Kilkenny, Ireland at the start of a weekend of flying touring. At 0958 hrs on 4 September 2005 the pilot filed a flight plan for his return flight to Cardiff, with a planned takeoff time of 1030 hrs. The flight was expected to take 2 hrs, with an endurance of 4 hrs. The flight planned route was to fly south from Weston Aerodrome along the east coast of Ireland to Wexford, on the south eastern coast of Ireland, across the St George's Channel to Strumble Head, Pembrokeshire and then via Carmarthen, to Cardiff. The intention was to fly the route under VFR.

Prior to departure the aircraft refueller at Weston

Aerodrome saw the occupants of the aircraft, who both appeared to be well. G-EMAZ departed Weston Aerodrome at 1113 hrs. The flight through Irish airspace was uneventful.

At 1146 hrs the pilot made an initial call to London Area Control Centre (LACC) but was told to standby. At 1148 hrs LACC asked him to pass his message. The pilot informed LACC of his aircraft type, the number of persons on board, that he was en route from Weston to Cardiff, and that he was currently east of Wexford at an altitude of 3,800 ft. LACC asked him to advise when he was at the FIR boundary. (The FIR boundary is 30 nm north-west of Strumble Head.)

At 1201 hrs the pilot was contacted by LACC and asked if he had crossed the FIR boundary. He replied that he was "crossing now". He was informed by LACC that he was under a Flight Information Service and that there was no known traffic to affect him.

At 1218 hrs he was asked by LACC for his ETA at Cardiff. He replied "Thirteen decimal two zero zulu". LACC asked "was that thirteen hundred" to which he replied "Thirteen decimal two zero." LACC informed him that "the airways time was presently twelve eighteen hours" to which he replied "that will be, sorry, "fourteen decimal two zero." This was the last radio contact with the pilot of G-EMAZ. At 1229 hrs LACC called the pilot of G-EMAZ to clarify his ETA at Cardiff as 1420 hrs, to confirm that he was not flying direct and to ask if he was going sightseeing. There was no reply to this call or to the subsequent two blind calls made by LACC to G-EMAZ.

Search and rescue operation

The Manual of Air Traffic Services Part 1, Section 5, Chapter 3, provides guidance for the actions to be taken when an aircraft is overdue. For aircraft equipped with a radio, the aerodrome controller should initiate preliminary overdue actions no later than 30 minutes after the next expected reporting point. If no news is received after the preliminary actions have been completed, or if one hour has elapsed since a position report should have been received, or the fuel carried by the aircraft is considered to be exhausted, whichever is the sooner, then the controller at the destination aerodrome should inform the Area Control Centre (ACC) that the aircraft is fully overdue.

The ETA at Cardiff, from the pilot's flight plan, was 1313 hrs, although his last radio call had estimated an ETA of either 1320 hrs or 1420 hrs. Cardiff ATC commenced preliminary overdue action on G-EMAZ at 1343 hrs. This action involved informing the LACC Supervisor of the overdue aircraft, and this was accomplished at 1350 hrs.

At 1358 hrs the Distress and Diversion (D & D) cell at RAF West Drayton, Middlesex, was informed by the LACC that R/T contact with G-EMAZ had been lost whilst it was over the St George's Channel. A radar replay request was made. All information was then passed to the Aeronautical Rescue and Coordination Centre (ARCC) at RAF Kinloss, Scotland.

One hour after G-EMAZ's flight planned ETA, at 1413 hrs, Cardiff ATC initiated full overdue action and the LACC Supervisor was again informed. Coordination of the Search and Rescue (SAR) operation was now transferred to the ARCC. At 1520 hrs three rescue helicopters commenced a search for the aircraft and were later followed by a RAF Nimrod. Two lifeboats were launched at 1600 hrs. Initially, they were sent to the aircraft's last certain position, which was at the FIR boundary in the middle of the St George's Channel.

Having analysed the recorded radar data the D & D cell were able to pass a more accurate last known position of G-EMAZ to the ARCC. Tidal data was then applied to this position by the Maritime and Coastguard Agency and the search area was then transferred to the north of Strumble Head.

At 2215 hrs, at a position 11 nm north of Strumble Head, the lifeboat crew smelt fuel. A life jacket was then found, followed shortly thereafter by other pieces of wreckage and the remains of the pilot and his passenger. These were identified to be from G-EMAZ. Additionally, a large number of bird feathers was also found amongst the debris.

Radar information

National Air Traffic Services provided secondary radar information for G-EMAZ from two radar sources: from Mount Gabriel, County Cork, Ireland and from Burrington in Devon. Examination of the radar recordings and the information encoded in it enabled the flight profile to be reconstructed, up to the point at which radar contact was lost.

The recorded radar information indicates that G-EMAZ coasted out at 1143 hrs just north of Wexford. The radar trace continued until 1148 hrs when radar contact was temporarily lost. The next radar contact was at 1159 hrs when G-EMAZ was in the middle of the St George's Channel, just prior to the FIR boundary. There was then another break in radar contact from 1201 hrs to 1204 hrs. The remainder of the radar trace was continuous until radar contact with G-EMAZ was lost at 1220:47 hrs, 5 nm north-west of Strumble Head, with an indicated height of 2,200 ft. (See Figure 1: Radar Plot).

Between 1204 hrs and 1214 hrs G-EMAZ was at an altitude of approximately 3,500 ft with a ground speed of 80 kt. At 1214 hrs the aircraft descended to 3,200 ft, as it did so its ground speed increased to 100 kt. G-EMAZ then flew level, maintaining approximately 100 kt, for 4 mins until it entered a rapid descent at 1220 hrs. As it

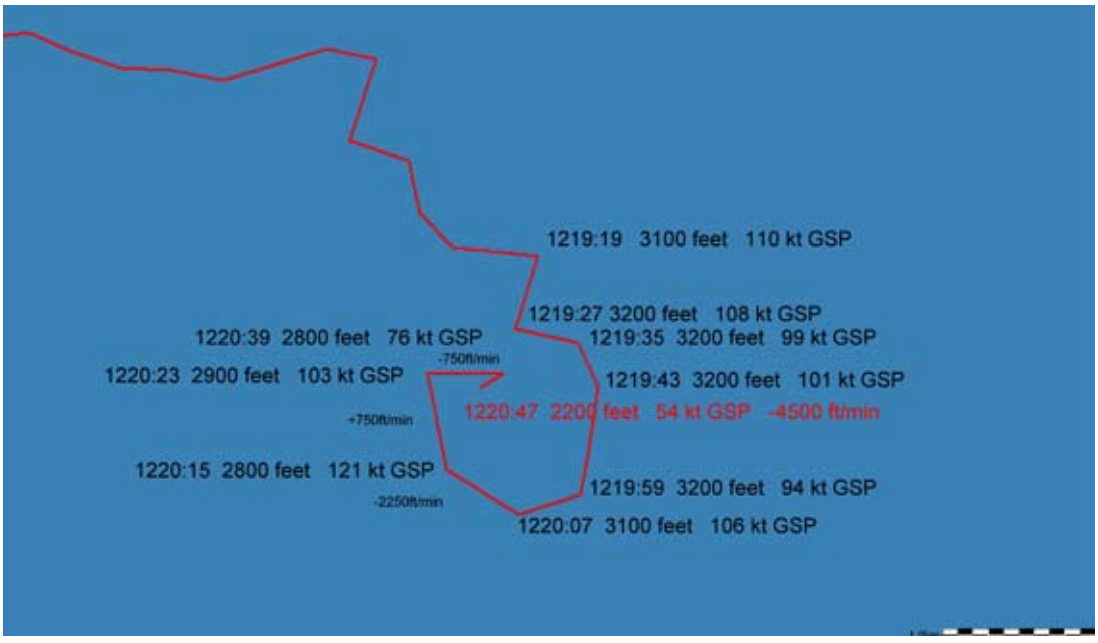

Figure 1

Radar Plot

entered the descent its ground speed initially increased to 120 kt, followed by a rapid decrease. This rapid reduction in ground speed can be attributed to the increasing angle of descent.

The aircraft's initial track over the Irish Sea was on a relatively straight course of 112º(T), towards the Strumble navigation beacon. At 1217 hrs the aircraft turned left onto 052º(T) and held this track for 24 sec before turning right on to 091º(T), this track was maintained for approximately one minute. The aircraft's track then became erratic, with at least four large heading changes occurring over a period of about one minute.

At 1219:35 hrs, the aircraft entered a right turn through approximately 140º over a period of 40 sec: this equates to a turn rate of 3.5º/sec. The aircraft then commenced its rapid descent whilst turning very quickly through a further 150º to the right. The radar trace was then lost.

Weather

An aftercast was provided by the Met Office. The synoptic situation at 1200 hrs showed an area of low pressure lying just south-west of Ireland feeding a light, unstable, southerly flow over the route flown by G-EMAZ, with a trough line lying from the Channel Islands through Barnstable in Devon to Wexford in Ireland. It was estimated that the cloud would have been broken or overcast stratus with a base of 1,000 ft amsl and with a surface visibility of 3,000 to 4,000 m in mist or haze. Continuous cloud was expected up to approximately 3,000 ft with layered cloud above. The weather was likely to have been showers of rain. The surface wind was expected to have been from 130º at 12 to 15 kt, with gusts to 25 kt; the wind at 4,000 ft was expected to be from 160º at 10 to 15 kt. The mean sea level pressure was 1016 mb.

Recordings of the weather radar indicate that there was a line of showers extending from Strumble Head across the St George's Channel to Wexford.

Another aircraft was also flying east bound over the Irish Sea, via Strumble Head, at 3,500 ft and about 15 mins ahead of G-EMAZ. The pilot of this aircraft reported that the weather conditions across the Irish Sea were marginal for flight under VFR. He reported that the cloud base was approximately 1,500 ft amsl and the top of the first layer of cloud was approximately 3,000 ft, with layers of cloud above.

Pilot's details and flying experience

The pilots flying log-book was not recovered. It is believed that it was on board the aircraft at the time of the accident. The hours quoted are therefore approximate and have been estimated using other sources of information.

The pilot conducted training for his Private Pilot's Licence (PPL) on PA-38 (Tomahawk) and PA-28 (Warrior) aeroplanes between 2003 and 2004. The pilot successfully completed his skills test on 13 July 2004 and was issued with his PPL on 4 August 2004 having recorded 75 hours of flying. His flying instructor had assessed him as a consistently solid, average student. The pilot purchased G-EMAZ around April/May 2005 and had recorded approximately 45 hours flying in it prior to the accident. His passenger had not had any pilot training and would not have been able to offer any assistance in flying the aircraft.

Part of the PPL syllabus includes an appreciation of instrument flying. During this element of the syllabus the student pilot has his external vision artificially restricted so as to simulate flying in IMC. During the PPL skills test the pilot is required to demonstrate a turn through 180º using 15º angle of bank, under simulated

IMC, in order to demonstrate that he can safely regain VMC if he inadvertently encounters IMC.

Medical information

The pilot held a current JAA Class II medical certificate with limitations requiring him to fly by day only, due to the fact that he had colour blindness. He was also required to have near vision lenses available while flying.

The post mortem examination, carried out by a consultant aviation pathologist, revealed that the pilot and his passenger had died instantly from multiple injuries resulting from a high speed impact with the sea.

Further examination of the pilot, and consultation with his doctor, indicated that he had a complex medical history. Traces of a prescribed drug were discovered, the concentration of which is thought to have been at a therapeutic level. The pilot had been taking this drug for many years and it is believed that he did not suffer from any untoward side effects. It is unlikely that the presence of this drug played any role in the accident, but the possibility could not be excluded. The CAA was aware of the pilot's condition for which the drug was being taken, but they had not been informed that he had actually been prescribed the drug. Had they been so they would not have issued a medical certificate for him to fly due to the possible multiple side effects associated with this treatment.

In 2001 the pilot was admitted to hospital having suffered a possible fit. The discharge summary stated there was insufficient evidence to label him as epileptic. At his initial CAA medical he declared that he suffered from vertigo and dizziness but had not suffered from fitting. While there is a possibility that the pilot might have suffered a similar episode of altered consciousness at the time of the accident there was no evidence to indicate that this had occurred nor that it might have caused the accident.

Engineering

Wreckage recovered by the Fishguard lifeboat was identified as coming from G-EMAZ, although there was very little of the aircraft to conduct any meaningful technical investigation. The largest pieces were an intact (but buckled) seat and a pair of chocks with the aircraft's registration painted on them. The remainder comprised a few fragments of interior trim and carpet. The pilot's flying licence, in a plastic wallet, was also recovered. Some months later a tyre and inner tube, still inflated but with the wheel completely corroded away, was washed-up on the Irish east coast: it may have come from G-EMAZ as it was of the right size and type, but it was not possible to confirm this.

The tiny amount of wreckage recovered did, however indicate that the aircraft had been travelling at a high speed when it struck the water since the degree of disruption to the airframe and the occupants was clearly immense. The damage was far more than would be expected had the aircraft been ditching after, say, an engine failure or even a failure to recover from a spin.

The aircraft which had been fairly recently acquired by the pilot, had been surveyed by a professional company prior to purchase. The surveyor's report, which described the aircraft's condition in great detail, was made available to the investigation and concluded that it was 'considered to be in a very good physical condition, taking into account its age and specification'.

The report also noted the relatively high specification of the avionics equipment, including an autopilot and Global Positioning System. The pilot was described

by his instructors as enthusiastic and keen to improve his knowledge. However, they believe that he would not have had the knowledge to operate the autopilot and global positioning system effectively.

The aircraft's documentation, as examined by the surveyor, was also found to be in order.

Analysis

Radar information

The radar information suggests that the flight profile was normal until 1217 hrs. G-EMAZ had been maintaining a relatively steady track of 112º(T) but then turned left onto 052º(T) before reversing the turn to the right onto 091º(T). Approximately one minute later the aircraft's track became erratic, with at least four large heading changes occurring over a period of about one minute. At 1219:35 hrs, the aircraft entered a right turn through approximately 140º over a period of 40 sec. It is possible that at this point the pilot was attempting to maintain or regain VMC, by turning away from poor weather using the technique he had learnt during his PPL training. The aircraft then entered a rapid descent and turned very quickly through a further 150º to the right. The radar trace was then lost. The aircraft appears to have entered a steep spiral dive from which it did not recover.

Spatial disorientation

With the reported weather at the altitude at which G-EMAZ was flying over the St George's Channel it is highly likely that the aircraft encountered cloud. Whilst in cloud it would have been necessary for the pilot to fly by sole reference to the flight instruments.

Although the pilot had received basic instrument flying familiarisation training, his experience level made it unlikely that he would have been able to accurately control the aircraft in IMC, let alone recover from an unusual manoeuvre such as a spiral dive. Moreover, there is a psychological difference between performing a pre-planned manoeuvre in an artificial environment, with an instructor in the aircraft, and performing it having inadvertently entered IMC, with no instructor present to assist the pilot if he encounters difficulties. With the absence of outside visual references, physical sensations can produce compelling perceptions of the aircraft's attitude and manoeuvres that differ markedly from those indicated by the flight instruments and spatial disorientation can occur. This tends to be more likely when recent and/or total instrument flying experience is low and in a high stress situation, such as inadvertent entry into IMC by a relatively inexperienced pilot.

In the event of inadvertent entry into IMC it would be appropriate to maintain a moderate airspeed while attempting to regain VMC or, having done so, while manoeuvring to remain clear of cloud. The characteristics of the final flight path, particularly the high airspeed, the rapid descent and the high rate of turn, were consistent with the effects of spatial disorientation. It is thus considered possible that the accident may have resulted from loss of control due to spatial disorientation following inadvertent entry into IMC.

Bird strike

When the lifeboat crewmen discovered the limited flotsam they found a large number of bird feathers amongst it. Most of them were small though there were a few large ones. It is thought that the smaller ones may have come from a pillow that might have been on board the aircraft. The larger ones are thought to have come from the numerous large sea gulls that were in the vicinity.

It would be most unusual for a bird strike to occur to an aircraft at 3,200 ft whilst in cloud and, even had such a

bird strike occurred, it should not have caused the pilot to loose control of an aircraft of this type. Moreover, any bird remains are unlikely to have remained with the limited flotsam that had drifted some way from the original point of impact but were more likely to have remained attached to the major structure of the aircraft. It is therefore considered unlikely that the aircraft was affected by a bird strike.

Discussion

The National Transportation Safety Board, in the USA, have published a report on weather related flying accidents: "*Risk Factors Associated with Weather Related General Aviation Accidents*". Two of its conclusions were:

> *Pilots who start flying earlier in life are at a lower risk of being involved in a weather related General Aviation accident than those who start flying when they are older, and age at first certificate is a better predictor of future accident involvement than age at time of flight.*

> *The observed connection between age and accident risk in this study is not likely due to physical aging issues, but to other factors associated with the age at which a person starts flight training.*

Conclusions

The aircraft's last manoeuvre, derived from the radar recordings, was a rapid descent as it turned quickly to the right. The aircraft appears to have entered a steep spiral dive which led to a high energy impact with the surface of the sea.

It is considered likely that the aeroplane had inadvertently entered IMC on its planned route. While attempting to regain VMC the pilot lost control of the aircraft, possibly as the result of spatial disorientation.

The circumstances of the accident to G-EMAZ could also be explained by some form of brief and temporary incapacitation of the pilot, brought on by a medical or toxicological reason, without this necessarily leaving any evidence.