

ACCIDENT

Aircraft Type and Registration:	MCR-01 VLA , G-TOOT	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2003	
Date & Time (UTC):	17 April 2010 at about 1622 hrs	
Location:	Weyhill, near Thruxton, Hampshire	
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:	55 years	
Commander's Flying Experience:	398 hours (of which 180 were on type) Last 90 days - 14 hours Last 28 days - 5 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft was returning from Duxford to a private airstrip near Bournemouth. The pilot reported smoke in the cockpit and that he was diverting to Thruxton. About two minutes later the aircraft crashed two miles east of Thruxton and both occupants were fatally injured in the impact. Evidence indicated that there had not been an engine compartment fire as the source of the smoke, leading to the probability that the smoke was generated by an electrical fault within the cockpit. A large and sustained post-crash fire destroyed any evidence that would have allowed a specific component to be identified as the source of the smoke.

History of the flight

The aircraft had flown from a private site near Bournemouth, Dorset, to Duxford in Cambridgeshire in order for the owner and a friend to attend a 'safety day'. They departed from Duxford at 1530 hrs and followed a direct track back towards the Bournemouth area. Initially cruising at 2,400 ft and receiving a Traffic Service from Farnborough LARS, numerous radio messages were passed relating to traffic; throughout the flight the pilot's voice appeared normal and in later analysis no unusual sounds were heard.

At 1605 hrs, while passing the town of Reading, the aircraft began a climb, reaching 4,600 ft at 1613 hrs. At 1617:10 hrs the aircraft was approaching the western edge of Farnborough's radar cover and was instructed

to squawk 7000 and 'free call' its en route frequency. Shortly after this the aircraft commenced a descent.

At 1619 hrs the Distress and Diversion (D&D) cell at the London Air Traffic Control Centre (LATCC) received a radio call from the pilot on 121.5 MHz. The pilot reported that the aircraft was at 3,600 ft, overhead Andover, that the cabin was filling with smoke and that he intended to land at Thruxton.

The aircraft continued its descent towards Thruxton, routing over Andover and the D&D controller provided a 'steer' for Thruxton as 260° at a range of 7 nm based on a two-line direction-finding fix. However, although the range and bearing were correct for Thruxton the controller mistakenly said "TURWESTON". The pilot corrected the controller and stated that he intended to make a straight-in approach. The controller then confirmed that the steer was for "THRUXTON" and the range was now (at 1620:40 hrs) 4 nm. The pilot reported "VISUAL" and that "WE MAY HAVE TO STOP THE ENGINE".

At 1621 hrs D&D received a 'carrier-wave only' transmission lasting 9 seconds, which they believed to have originated from the accident aircraft. There was no further radio contact.

Eyewitnesses

Several eyewitnesses, driving along the A303 and in the nearby village of Weyhill, reported seeing the aircraft flying normally, if somewhat lower than usual, then abruptly entering a nose-down spinning manoeuvre until passing from sight. Immediately a large ground fire and smoke column appeared. Some of the eyewitnesses were able to go immediately to the scene of the accident and located the aircraft wreckage, on the edge of a field of crop, 150 m south of the village of Weyhill, Hampshire. Both occupants had received fatal injuries.

Witnesses reported different numbers of turns during the spin, of which four was the most common estimate. One of the eyewitnesses thought the spinning had ceased just before the aircraft crashed. The only witness who felt certain of the direction of the spin believed it to be to the left. No witnesses reported seeing any fire or smoke trail before the aircraft struck the ground.

Thruxton aerodrome

At the time of the accident Thruxton Aerodrome was hosting a major motor-sports event. The airfield was operating before and after the event and sufficient runway was available for G-TOOT; however, the additional infrastructure and the considerable number of spectators would have been visible for several miles.

Crew experience

The pilot had learned to fly in 2003 in the USA and he had amassed just under 400 hours of flying experience. He had purchased the accident aircraft, G-TOOT, in October 2006 and had flown 180 hours in it. He was in current flying practice and the aircraft was based at a short, grass strip. The passenger had held a PPL (A) at one time and it is reported that in 2004 he had conducted some training towards renewing his PPL, as well as flying as a passenger with a variety of friends. He is reported to have had around 150 hours total flying time as a pilot.

Post-mortem examination

A specialist aviation pathologist conducted post-mortem examinations on both the pilot and passenger. He reported that both occupants had received instantly fatal injuries in the ground impact. There was no evidence of drugs or alcohol having been consumed or natural disease which could have any bearing on the accident.

The pathologist commented that:

'The absence of elevated carbon monoxide or cyanide levels in the blood of either occupant makes it unlikely that they have been exposed to levels of products of combustion in the cockpit capable of producing incapacitation, and the absence of visible soot in the airways means it is unlikely that they have been exposed to dense smoke containing large particles. However, this does not preclude the presence of fumes within the cockpit...'

Meteorology

The weather conditions at the time of the accident were a surface wind of 2 kt, air temperature of 16°C, dew point -2°C, no cloud and over 10 kilometres visibility. There was a Volcanic Ash Advisory valid for the time of the accident, however there was no evidence that this had any bearing in this accident.

Recorded information

Radar data from Pease Pottage radar (near Gatwick), and the Heathrow radars was available for the accident flight. The data contained positional information, together with Mode A squawk codes and Mode C heights. These ended at 1621:31 hrs with the aircraft 600 m north of the accident site and at 1,200 ft amsl (about 900 ft agl).

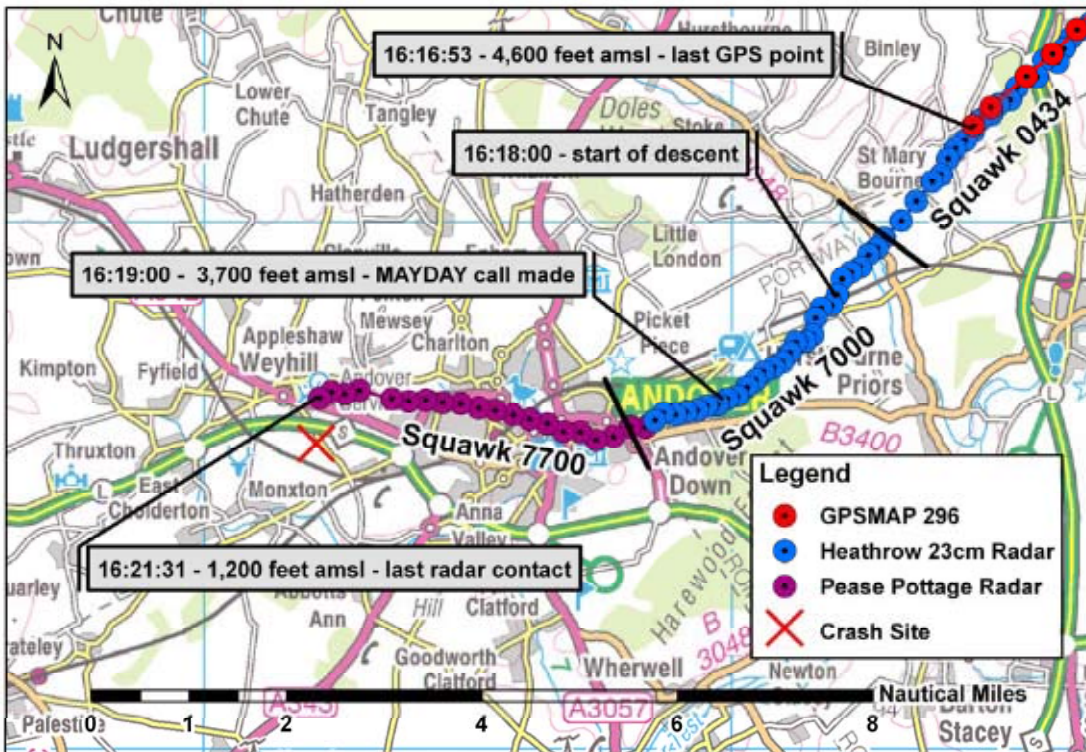
Two GPS units were recovered from the accident site. The first was a Lowrance Airmap 500 that had been destroyed during the impact and ensuing fire; no data was recovered from this device. The second was a Garmin GPSMAP 296. This was normally mounted within the instrument panel but during a search of the wreckage site on the morning after the accident, it was found clear of the main wreckage and detached from

the panel. The unit showed slight signs of damage and could be powered up for a few seconds on the residual charge left in its batteries. It was subsequently taken to the AAIB and downloaded.

The GPS-recorded track started at 1528:06 hrs at Duxford Airfield and ended at 1616:53 hrs, about five minutes before the end of the flight. The track showed that the aircraft routed to the south-west overhead Luton Airport and Reading, climbing in steps to 4,600 ft amsl south of Thatcham. The average groundspeed during the cruise portions of the flight was 110 kt. The final portion of the accident track, based on the radar and GPS data, is illustrated in Figure 1 and the altitude profile in Figure 2. For reference, the squawk codes and time of the distress call are also indicated on these figures.

Figure 2 shows that the aircraft started descending 30 seconds after the squawk code of 7000 was selected. The descent rate was approximately 1,000 ft/min. The groundspeed during the descent (not illustrated) remained between 100 and 110 kt, slowing to 80 kt over the last 20 seconds.

Figures 1 and 2 also show that the GPS stopped recording during the period the pilot was in contact with Farnborough LARS. For the GPS to stop recording in flight it was either operating on batteries, which happened to run out at that point, or the signal to the GPS satellites was lost while the GPS remained powered. The GPS was, however, panel mounted, which included a connection to the aircraft electrical power supply, and an antenna mounted on top of the instrument dash via BNC connectors and a coaxial cable. A check of the antenna at the AAIB showed that it was still serviceable.



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Figure 1

Final portion of G-TOOT accident track from GPS and radar

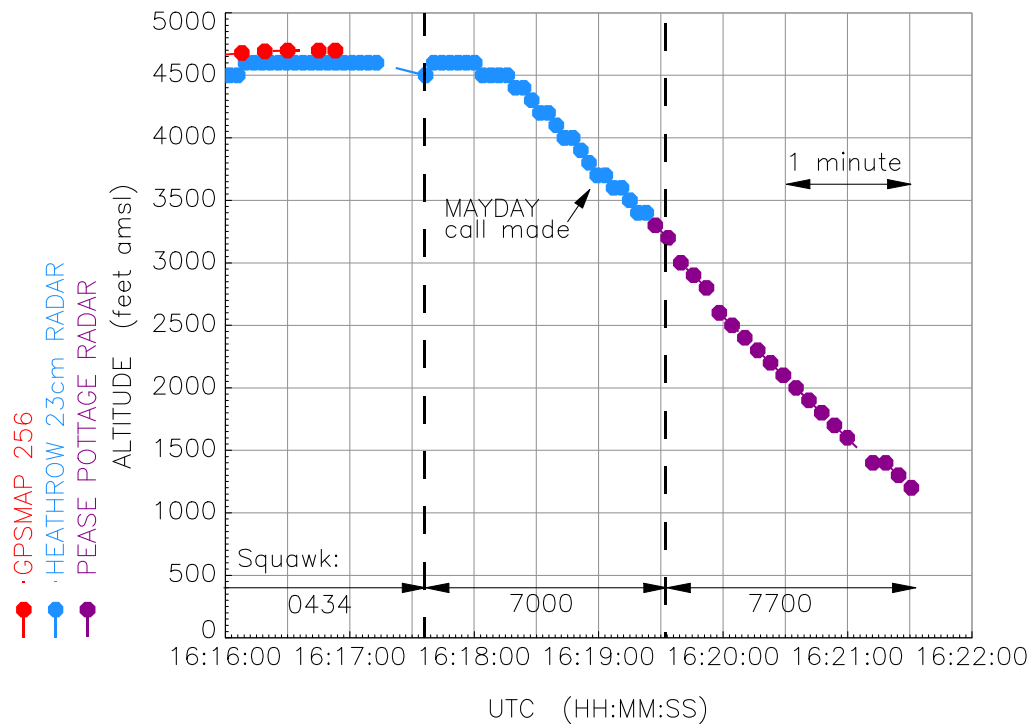


Figure 2

G-TOOT altitude and Mode A squawk codes

Both the GPS and antenna showed signs that each end of the coaxial cable had been connected at impact; however, the cable was destroyed in the post-impact fire so it could not be determined whether the cable had been damaged during the flight, breaking the connection.

It is also possible that the antenna could have been inadvertently covered over with something metallic, capable of blocking the satellite signals. However, determining what this could have been was not possible given the fire damage and disruption of the wreckage.

Aircraft description

G-TOOT had been assembled privately in the UK from a kit of parts supplied by the manufacturer in France and was operating under the provisions of a Permit To Fly. It was an early example of the type. The fuselage and tailfin were moulded from carbon-fibre reinforced plastic (CFRP), whilst the wings were of aluminium alloy skin and foam rib construction, utilising a CFRP spar. The tailplane was similarly of aluminium alloy skin. The aircraft was equipped with flaperons, each built in two sections, connected by spigots and driven mechanically from the root ends. Thus the control mechanism was positioned entirely in the fuselage and fin. Although originally built with aluminium alloy flaperons, at the time of the accident the aircraft had been retrofitted with the latest specification CFRP flaperons. The engine cowlings were manufactured from glass-fibre reinforced plastic (GFRP).

A composite/steel insulated fire-proof bulkhead separated the engine compartment from the cabin and fuel tank. A simple cabin heat system is used in the type. This consists of a pilot-operated flap, mounted on the cabin underside, which can be extended into the external airflow slightly aft of the point where air exits from the engine oil and water coolers at the rear of the lower cowling.

At the time of build, the majority of the electrical system was not supplied by the kit manufacturer, nor was there standardisation of design of electrical systems across examples of the type. Examination of another example of the type did not suggest an obvious route whereby any smoke generated in the engine compartment might enter the cabin.

General wreckage examination

Examination of the wreckage site showed that the aircraft was not greatly fragmented in the ground impact and had not inflicted a significant ground indentation. It had struck a fence, a hedge and the ground in a steep nose-down attitude and the general condition of the ground and the wreckage, together with the distribution of that wreckage, indicated that the impact was at a low forward speed. The general features were consistent with the effects of a spin.

An intense ground fire had destroyed the structure of the fuselage and the left wing. The right wing had separated as a result of impact with the fence and remained in the hedge. The largely unburnt tailplane remained attached to the burnt remains of the tailfin, correctly orientated relative to the fin and fuselage. The two carbon composite right flaperons had remained attached to the unburnt remnants of the right wing and one end of the rudder was identified attached to the burnt remains of the fin.

A number of items were projected into the field from the forward fuselage and cabin area. These included the canopy frame and fragments of transparency, a crew seat, the instrument panel and the upper engine cowling panel. Examination of the area of projection revealed singed grass and some of the projected items were smoke-blackened. This evidence was consistent with the items being ejected, at impact, through a significant fireball.

Thus, the evidence suggested that the aircraft was structurally complete at the time of the impact.

Detailed examination

Following recovery to a controlled facility, the wreckage was subjected to detailed examination. The carbon composite fuselage structure had been reduced to a mass of fibres resting on the melted remains of the skin of the starboard wing. The flying control system was disrupted and largely destroyed by fire, to the extent that control continuity could not be confirmed. The wiring within the fuselage was also massively disrupted and was entangled among the burnt carbon fibres of the fuselage, with all the insulation partly or completely melted. Electrical items, believed to be pilot equipment rather than aircraft parts, were also recovered. These were in a heat-damaged state, consistent with the effects of the ground fire.

Examination of the surviving upper engine cowling revealed sooting around the damaged edges. The aft underside was, however, in a relatively clean condition, without significant surface discolouration. Strip examination of the engine confirmed that it was operating under power at the time of the impact.

Analysis

The pilot's initial MAYDAY call was calm, providing little sense as to the scale of the emergency and showed that he was both aware of his position and had a plan of action. When the D&D controller made a minor slip, saying 'Turweston' when he meant 'Thrupton', the pilot displayed spare mental capacity by identifying the mistake and correcting it.

The pilot's second call at 1620:50 hrs remained calm, identified a deteriorating situation and included the information that he might have to shut down the engine.

The aircraft continued on a track towards Thrupton descending at a constant rate. The final ground position was somewhat displaced to the south of the track to Thrupton, leading to two hypotheses. First, it is possible the pilot had decided to turn away from the airfield and conduct an immediate forced landing. This could have been because of a deteriorating cockpit environment or alternatively the pilot may have seen the considerable ground activity at Thrupton and decided not to increase the risk to others by attempting to land there. The height of the spin entry makes it unlikely that the pilot was attempting to land in the field in which the wreckage was located; however, there were several suitable fields in the area, particularly for a pilot with short grass strip experience.

The second hypothesis was that the pilot had become disorientated by the cockpit environment and had inadvertently turned away from Thrupton.

Regardless of the reason for the aircraft being displaced to the south of the direct track to Thrupton, it would appear that the deteriorating cockpit environment led to control being lost and the aircraft entering a left-hand spin from low level.

Eyewitnesses did not report seeing either smoke or fire from the aircraft before ground impact. The examination of the underside of the top cowling revealed no evidence to suggest that smoke was being created in the engine compartment; a period of such smoke production would be expected to discolour the upper aft region of the engine compartment, including the cowling panel. No evidence of any malfunction was found during engine strip and an examination of another example of the type did not suggest a route by which smoke produced in the engine compartment could readily enter the cabin of the aircraft. The only

functional connection between the two areas was via the external flap which ducted heated air from downstream of the oil cooler and water radiator into the cabin. In view of the clear sky during the accident flight, together with the large area of transparency of the canopy, the cabin air would almost certainly have been at a temperature not requiring further heating. Any smoke entering the cabin through this mechanism would also almost certainly have been noticeable to the eyewitnesses. An engine-fed (fuel or oil) fire would be more likely to generate external smoke through cowling gaps and the burning of oil and rubber seals would have produced larger and more obvious soot particles, which the post-mortem examination suggests were not present.

As such an engine compartment fire was ruled out as the cause of the smoke.

It is likely that the source of smoke was contained within the cockpit area and the smoke generated was of a small particle size. This would be suggestive of an electrical or wiring type source. The anomaly of the GPS stopping about five minutes before the accident suggests that there may have been a developing electrical problem.

The initial impact and then the sustained post-crash fire totally disrupted the electrical system and melted most of the insulation. Similar damage affected the separate electrical items. This precluded a meaningful examination of the system, and the separate items, for the more subtle effects of pre-crash electrical faults. Thus, the wreckage examination did not identify or preclude an electrical fault as the source of the cabin smoke known to have been present in flight. However, the post-mortem examination on both occupants showed it to be unlikely that either had been exposed to incapacitating levels of the products of combustion.

Conclusion

The disruption to the aircraft caused by the post-crash fire compromised the investigation. Despite this, the investigation was able to conclude that an engine fire was not the cause of the smoke, The pilot showed spare mental capacity in his radio transmissions and it is likely that a rapid deterioration of the cockpit environment occurred between the first distress call and the loss of control.