ACCIDENT

Aircraft Type and Registration:	Piper PA-30 Twin Comanche, G-ATMT
No & Type of Engines:	2 Lycoming IO-320-B1A piston engines
Year of Manufacture:	1964 (Serial no: 30-439)
Date & Time (UTC):	15 January 2017 at 1427 hrs
Location:	Near Aston Rowant Nature Reserve, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Extensive
Commander's Licence:	Private Pilot's licence
Commander's Age:	64 years
Commander's Flying Experience:	10,673 hours (of which 2,140 hours were on type) Last 90 days - 3 hours Last 28 days - 0 hours
Information Source:	AAIB Field Investigation

Synopsis

G-ATMT was operating below 1,000 ft in an area where the Minimum Safe Altitude (MSA[1]) was 2,200 ft. It was likely that the aircraft flew in Instrument Meteorological Conditions (IMC[2]) below MSA for at least 1 minute 45 seconds before flying into some trees standing on a ridge of high ground. The aircraft was extensively damaged and the pilot, the only person on board, was fatally injured.

History of the flight

The pilot was carrying out a private flight from Turweston Airfield to Chalgrove Airfield to pick up two passengers for an onward flight. He arrived at Turweston Airfield at approximately 1315 hrs and studied the actual and forecast weather for RAF Benson (near Chalgrove Airfield) and East Midlands Airport (near his onward destination). He also considered other weather information available online before deciding that he would continue with the flight.

The aircraft departed from Runway 27 at Turweston Airfield at 1414 hrs. The surface wind was from between 300° and 320°M at less than 10 kt, and it was estimated that

Footnote

1 See the section *Minimum Height Rule* for an explanation of MSA.
2 See the section *Visual Flight Rules and Instrument Flight Rules* for an explanation of IMC.

there was broken cloud at 800 ft agl (approximately 1,250 ft amsl) and a visibility of approximately 9,000 m. The aircraft turned right after takeoff, climbed to approximately 2,000 ft amsl, and turned onto a southerly track when east of the airfield (Figure 1). At 1419 hrs, as the aircraft passed approximately 3.5 nm east of Bicester, it began to descend to approximately 1,000 ft amsl, which it reached at 1423 hrs, 2.8 nm northeast of Chalgrove Airfield.

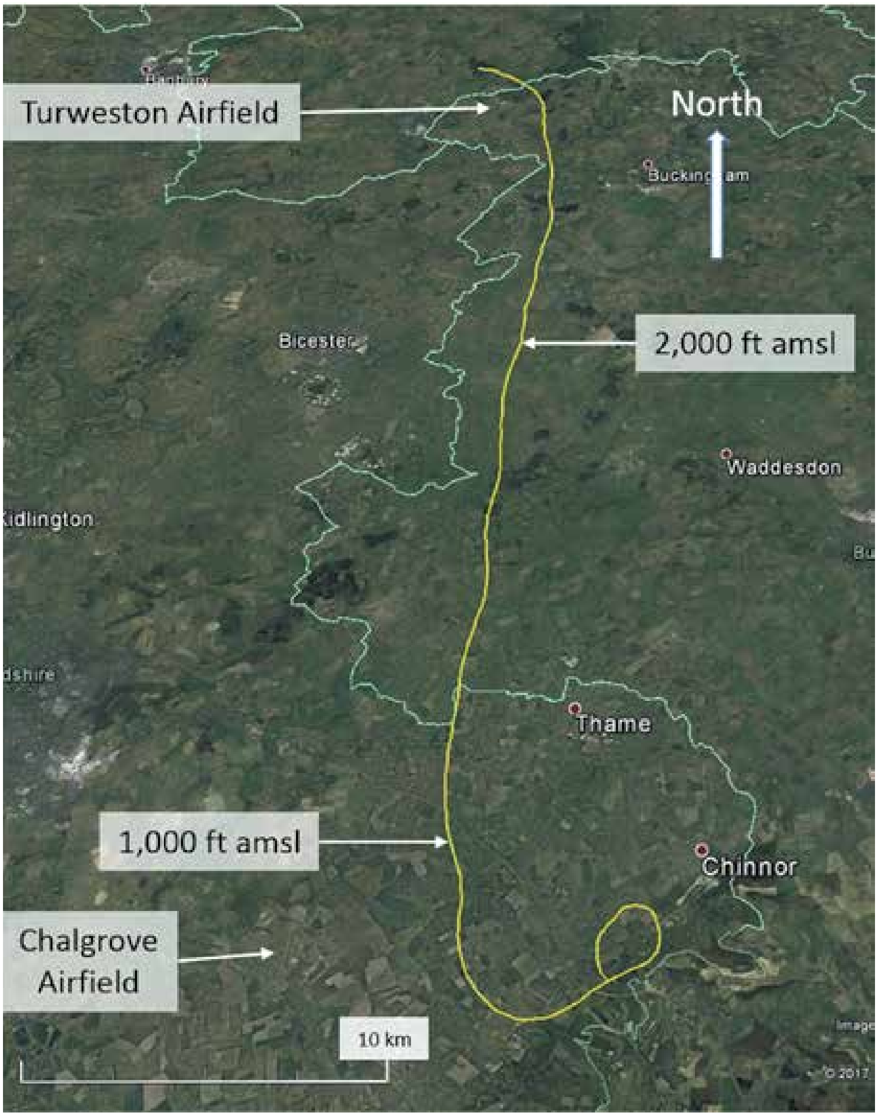

Figure 1

Track of the flight (©Google Earth)

The aircraft continued south until it was 2.7 nm east of Chalgrove Airfield, when it turned left onto a track of approximately 060°M. The turn took the aircraft from an area where the terrain was generally below 400 ft amsl towards a ridge of higher ground, with terrain up to approximately 850 ft amsl (Figure 2). The aircraft flew along the ridge for approximately 1.5 nm, at an altitude of approximately 1,100 ft amsl (equivalent to 300 to 400 ft agl), and then turned left through approximately 270°. The turn took the aircraft back over the lower ground and then towards the ridge again at between 400 ft and 500 ft agl. It continued to fly towards the rising ground until it struck the top of some trees at 920 ft amsl. The aircraft broke up as it descended through the trees and the pilot, who had been wearing a three point harness, was fatally injured during the accident sequence.

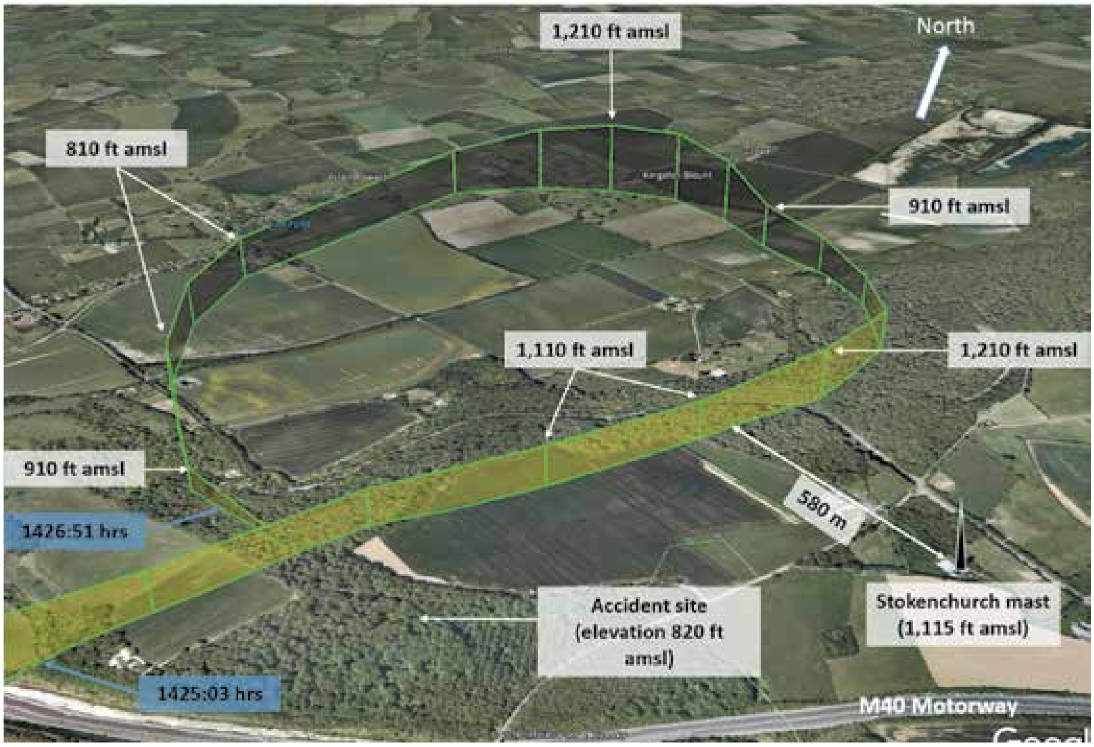

Figure 2

Final track of the aircraft (©Google Earth)

Witness information

Witnesses in the area of the accident at the time of impact reported that the weather was poor. One, who reported that the weather had been "foggy and miserable [with] non-existent visibility", heard the noise of an aircraft twice, with a gap of approximately two minutes.

Two witnesses walking together heard an aircraft overhead as it flew north-east along the ridge. They saw the "shadow" of the aircraft but not the aircraft itself because of the fog. They also heard the aircraft a second time "as if it had doubled back."

One of the passengers waiting to be picked up from Chalgrove Airfield was a pilot. He described the visibility at the time of the accident as being good under a cloudbase which would have permitted visual circuits to have been flown at Chalgrove. He could see the ridge over which G-ATMT had flown and stated that it "was in cloud from about 100 ft from the top. The M40 'cut' was visible albeit not the top section of it"[3].

Footnote

3 The M40 motorway can be seen at the bottom of Figure 2. It traverses the ridge in this location through a cutting in the escarpment.

A National Police Air Service (NPAS) helicopter operating near Reading[4] was tasked to attend the accident scene at approximately 1430 hrs. The pilot reported that, as he transited towards the low-lying ground to the west of the accident location, the cloudbase lowered from approximately 800 ft to 600 ft amsl and the visibility deteriorated from approximately 10 km to 6,000 m. The low cloud, which was sitting on the ridge, prevented him from reaching the accident site.

Accident site

The aircraft crashed into a wood on the edge of Aston Rowant National Nature Reserve, on the northern edge of the Chilterns escarpment, approximately 1.5 nm west of Stokenchurch.

The wood in the area of the accident site was very dense and the aircraft initially made contact with the tops of trees just over 100 ft tall, situated on top of the escarpment. The tops of the trees were approximately 920 ft amsl and the initial impact point was 0.6 nm from the 326 ft tall Stokenchurch telecommunication tower, the top of which is 1,115 ft amsl.

The wreckage trail extended for approximately 120 m, on a track of 120º(M). The start of the wreckage trail consisted of freshly cut branches and many small pieces of Perspex from the aircraft windows and light wreckage from the nose of the aircraft. As the aircraft continued along the track, it sank lower into the trees, severing branches up to 18 cm diameter and sections of the outer part of the left wing, including the wingtip tank, which were subsequently found on the ground and in the trees. The remainder of the left wing and the outer section of the right wing were found close to the centre section of the aircraft, which was at the end of the wreckage trail. Both engines had detached from the wings and were found, with their propellers, approximately 7m further along the trail. All the fuel tanks had been badly damaged and were empty but there was a strong smell of fuel throughout the wreckage trail.

The centre section of the aircraft had come to rest in an inverted position. The cockpit was badly disrupted and items from the cockpit and pages from the technical log were found scattered around the accident site.

Aircraft information

The PA-30, Twin Comanche, is a twin-engine, low-wing aircraft equipped with flaps and retractable landing gear. It has a conventional control system operated by a system of pulleys and rods. The flaps and landing gear are electrically controlled and operated by screw jacks. The fuel is stored in metal wingtip tanks and flexible (bladder) tanks located in each wing. The engine-driven fuel pumps and an electrical auxiliary fuel pump draws the fuel from the fuel tanks, through a selector switch, to the engines.

G-ATMT was equipped with analogue flying instruments, a GNS430 communication and navigational unit, and a Skyforce GPS.

Footnote

[4] Reading is approximately 12 nm south of the accident site.

Maintenance and aircraft documentation

The technical records, which were in the aircraft, were destroyed during the accident. It was established that the Airworthiness Review Certificate was issued on 28 April 2016 at 6,187 flying hours. The maintenance organisation, which carried out the annual inspection at the same time, reported that there were no known technical problems with the aircraft. There was a note in the aircraft log book, dated 8 April 2016, stating that the ADF, DME and No 2 glideslope were shown by placard to be inoperative.

The next scheduled maintenance inspection (6 month check) was due on 19 October 2016 or at 6,237 flying hours. No record could be found of this check having been carried out, although the owner of the aircraft stated that the pilot normally carried out this inspection.

Aircraft examination

The aircraft was extensively damaged during the accident sequence. Nevertheless, it was possible to establish that the damage to the airframe was consistent with the aircraft impacting the trees in a wings level, relatively flat attitude. There was no evidence of any pre-impact damage to the aircraft and it was assessed that the flying control systems had been intact, with no evidence of a control restriction. The position of the landing gear and flap screw jacks were compared with another aircraft and it was established that they were both in the retracted position. Both engines were free to rotate and the colour of the spark plugs was normal. The fuel selector switches were found selected to the main wing tanks and the altimeter subscale was set to 1012 hPa.

The damage to the aircraft was such that the accident was not considered to be survivable.

Pilot information

The pilot held an EASA Private Pilot's Licence (PPL(A)) with a Multi-engine Piston Rating and Instrument Rating (Restricted) (IR(R)), valid until 31 May 2017, and had a Class 2 Medical Certificate, valid until 17 June 2017. An IR(R) is the UK IMC Rating as it appears in a UK-issued Part-FCL licence. The privileges of the rating are given in the Air Navigation Order 2016, Schedule 8:

> *'An instrument meteorological conditions rating (aeroplanes) entitles the holder to act as pilot in command … of an aeroplane flying under Instrument Flight Rules …'*

Records indicated that, on 14 August 2011, the pilot had a total of 10,400 flying hours of which 2,000 hours were on the Piper PA-30 Twin Comanche. Pilot and aircraft logbook records suggested that, since August 2011, he had flown 273.5 hours, all as PIC, of which 140.5 hours were on the PA-30. The pilot's flying logbook contained no entries after 25 February 2016. The owner of the aircraft recalled that the pilot flew on 8 and 29 November 2016 for a combined total of 2 hours 35 minutes.

Visual Flight Rules (VFR) and Instrument Flight Rules (IFR)

Minimum visibility and distance from cloud

A flight may be operated under VFR or IFR. For a flight to operate under VFR, it must remain in Visual Meteorological Conditions (VMC) which are defined in terms of minimum visibility and distance from cloud. The aircraft was operating below 3,000 ft amsl in Class G (uncontrolled) airspace, and EU Regulation No 923/2012, SERA.5001, states that, in such circumstances, the minimum flight visibility is 5 km and the aircraft must remain clear of cloud and with the surface in sight. SERA.5001 allows Member States to reduce the flight visibility requirement to 1,500 m for aircraft operating at speeds of 140 kt or less. The CAA permits this reduction in minimum visibility in Official Record Series 4 No.1067, *Standardised European Rules of the Air – Visual Meteorological Conditions (VMC) and Distance from Cloud Minima.*

During the first part of the flight the aircraft's IAS was, on average, greater than 140 kt (based on groundspeeds calculated from radar data, adjusted to account for a wind of 290º at 10 kt). A similar calculation showed that, while the aircraft was manoeuvring before impact, its average IAS was below 140 kt.

Minimum height rule

The VFR minimum height is detailed in SERA.5005(f)(2) but it is modified in the UK by the CAA in Official Record Series 4, No.1174, *Standardised European Rules of the Air – Exceptions to the Minimum Height Requirements.* Aircraft are not permitted to be flown under VFR closer than 150 m (500 ft) to any person, vessel, vehicle or structure.

If in-flight conditions deteriorate below VMC minima, a flight may not continue under VFR and must operate under IFR. SERA.5015, *Rules applicable to all IFR flights,* states:

> *'Except where necessary for take-off or landing … an IFR flight shall be flown at a level … which is at least 1,000 ft above the highest obstacle located within 8 km of the estimated position of the aircraft.'*

The altitude calculated in accordance with this rule is known as the MSA. The highest obstacle within 8 km of the accident site was the Stokenchurch telecommunication tower, the top of which is 1,115 ft amsl (Figure 2), so the MSA was 2,200 ft amsl.

Meteorological information

Figure 3 shows the Met Office forecast for weather below 10,000 ft, valid for the time of the flight.

The flight was conducted largely in zone A1. The visibility was expected to be 15 km but occasionally it was expected to be as low as 2,000 m in mist, rain and drizzle, and there would be occasional areas of hill fog. Broken or overcast cloud was forecast with a base between 1,500 ft and 2,500 ft amsl, and there would be occasional broken cloud with a base of 400 ft to 1,000 ft amsl. The cloud base would be at ground level in any hill fog.

RAF Benson (elevation 203 ft amsl) is 3.5 nm south of Chalgrove and 6.5 nm southwest of the accident site. At 1350 hrs, the wind at RAF Benson was from 290º at 7 kt, there was more than 10 km visibility and broken cloud at 800 ft agl, equivalent to approximately 1,000 ft amsl. At 1450 hrs, the cloud base was reported to be 600 ft agl.

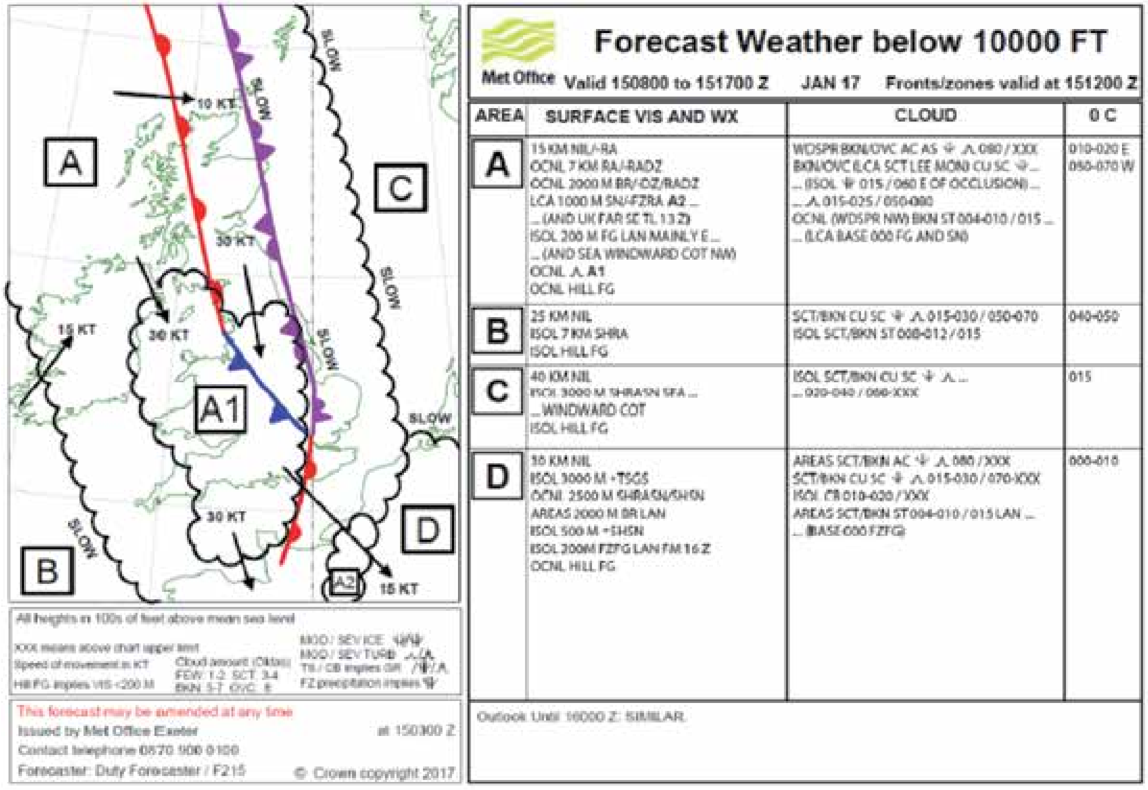

Figure 3

Forecast weather below 10,000 ft amsl (Met Office)

The Met Office produced an aftercast report into the weather conditions prevailing at the time and location of the accident. The report indicated that cloud, which covered much of the UK, was most solid across the south-east of England. There was widespread precipitation across the region and there were likely to have been thick layers of frontal cloud from near the surface to between 10,000 ft and 15,000 ft amsl. The report stated:

> *'The moist north-westerly wind blowing up the steep incline towards the accident site is the ideal mechanism for producing stratus clouds that could hide the hill tops. Overall,* [the evidence] *suggests that the cloud base would have intersected the hills at around 500-800 ft amsl in the vicinity of the crash.'*

Recorded data

The only sources of data that tracked the aircraft flight path were the NATS radar systems at Bovingdon and Heathrow. The radar data included pressure altitude information, recorded with a resolution of 100 ft, which was corrected for ambient conditions to give altitudes above mean sea level. Details from the recordings were provided earlier in the report in the history of the flight. There were no RTF recordings associated with the flight.

The aircraft was fitted with a GNS430 GPS/NAV/COM unit. The active radio frequency was found set to 125.400 MHz (Chalgrove Radio), with the standby frequency set to 120.900 MHz (Benson Approach). The active VLOC frequency was 116.40 MHz (Daventry – referenced in documentation for Turweston), with the standby set to 112.80 MHz (Gamston – the destination for the subsequent flight). The unit does not record a track but does record its last position which was in the vicinity of the accident site, indicating the system was operational leading up to the accident.

The GN430 unit did not have the terrain display features which are present in later build standards of this unit.

Decision making by pilots

CAA Safety Sense Leaflet

CAA Safety Sense Leaflet 23, *Pilots – It's Your Decision,* discusses factors which affect decision making by pilots. It states:

> *'Pilots who fly into terrain, under full control of their aircraft … continued flying into adverse weather conditions, and/or ignored their MSA (if indeed one had been calculated).*
>
> *Pilots who had fatal CFIT[5] accidents were typically … very experienced. Of all CFIT accidents, 82% included unwise reaction to weather conditions (such as continuing to fly into worsening weather) and 64% had not adhered to their MSA, trying to get 'below the weather' or hoping to confirm their position.'*

Academic study – decision making

Madhavan (2006)[6], citing Jensen (1982)[7], showed that there are both cognitive and motivational aspects to making a decision. The former *'describes the processes by which pilots establish and evaluate alternative [options]'* and the latter included *'gains and losses associated with decision outcomes and social and personal pressures.'* Research by Mather and Lighthall (2012)[8] revealed that, when under stress, people making decisions are likely to give more weight to information supporting the possibility of a positive outcome while discounting contrary information.

Academic study - rule vulnerability

VMC minima mark the boundary between an ability to choose to fly under VFR and a requirement to fly under IFR. If the boundary is approached, a pilot must decide whether to change the aircraft course and/or altitude to remain in VMC and continue under VFR,

Footnote

5 CFIT: Controlled Flight Into Terrain.

6 Madhavan, P., Lacson, Frank C (2006). Psychological factors affecting pilots' decisions to navigate in deteriorating weather. *North American Journal of Psychology,* 8(1) pp 47-62

7 Jensen, R., (1982). Pilot Judgment: Training and Evaluation. *Human Factors,* 24(1) pp 61-73

8 Mather, M. and Lighthall, N. R. (2012). Risk and Reward are Processed Differently in Decisions Made Under Stress. Current Directions in Psychological Science, 31 January 2012, pp. 36-41

or to cross the boundary into IMC and operate above MSA under IFR (if suitably qualified and in a suitably equipped aircraft). This rule-based decision is designed to keep the risk of collision with obstacles or other aircraft as low as reasonably practicable and it therefore acts as a risk control measure.

Clewley and Stupple (2015)[9] published a study into 'rule vulnerability' using the Stable Approach Criteria (SAC)[10] rule as a vehicle for their work. Although the SAC rule is not relevant to this accident, the underlying issues of human behaviour which the study examined are related. It was hypothesised that increasing complexity (uncertainty and dynamism) in a system would increase the likelihood of unintentional rule-based error. They wrote that '*the SAC rule ... acts as a system defence and provides a safe decision pathway for certain system states.'*

The study argued that rules may be easy to apply when circumstances are clear-cut but more difficult to apply in marginal and uncertain circumstances where they might have the most benefit. In summarising their study, the authors commented:

> *'The results suggest … high uncertainty and dynamism constrain rule-based response, leading to rules becoming vulnerable, fragile or failing completely.'*

Continuing with an original plan in changing circumstances

In his book, *The Field Guide to Understanding 'Human Error',* Dekker (2014[11] pp. 93-94) discussed why people continue with their original plan after circumstances have changed. He argued:

> *'Conditions often deteriorate gradually and ambiguously, not precipitously and unequivocally. In such a gradual deterioration, there are almost always strong initial cues that suggest that the situation is under control and can be continued without increased risk. Later cues that suggest the plan should be abandoned … even while people see them and acknowledge them, often do not succeed in pulling people into a different direction.*
>
> *Operational decisions are not based on a 'rational' analysis of all parameters that are relevant to the decision. Instead, the decision, or rather a continual series of assessments of the situation, is focused on elements in the situation that allows the decision maker to distinguish between reasonable options. The psychology of decision making is such that a situation is not assessed in terms of all applicable criteria (certainly not quantitative ones), but in terms of the options the situation appears to present.'*

Footnote

9 Clewley, Richard, Stupple, Edward J.N. (2015) The vulnerability of rules in complex work environments: dynamism and uncertainty pose problems for cognition, *Ergonomics*, 58 (6):935

10 Stable approach criteria are designed to help a pilot decide whether to continue an approach below, typically, 1,000 ft agl or to go around.

11 Dekker, S. (2014). *The Field Guide to Understanding 'Human Error'.* Farnham, Surrey, UK: Ashgate Publishing Limited.

Analysis

The aircraft's track took it to a point east of its intended destination of Chalgrove Airfield at an altitude of approximately 1,000 ft amsl. The radio was found tuned to the destination frequency, and the altimeter (which was found set to 1012 hPa) would have read approximately zero ft agl on the runway at the destination[12]. Had the aircraft slowed down and turned right it would have been in a good position to join the extended centreline of Runway 31 at Chalgrove Airfield in preparation for landing. Instead, however, it turned left towards a ridge of high ground (the Chilterns) at approximately 1424 hrs (Figures 1 and 4).

Figure 4

G-ATMT's track relative to the extended runway centreline at Chalgrove Airfield (©Google Earth)

The weather reported at RAF Benson at 1350 hrs was broken cloud at 800 ft agl, equivalent to 1,000 amsl, which lowered to 800 ft amsl by 1450 hrs. The Met Office reported that the cloud base was probably 500 to 800 ft amsl near the accident location. Witness evidence showed that weather conditions in the area near Chalgrove Airfield were better than those in the vicinity of the ridge near Stokenchurch, and yet the pilot turned away from his destination towards the poorer conditions. It was concluded that the aircraft was probably in IMC at 1,000 ft amsl when it turned towards the ridge and the pilot was unaware of the slightly better conditions on his right, near his intended destination. It was also considered likely that the pilot was uncertain of his position relative to Chalgrove Airfield.

12 The QNH at RAF Benson was 1021 hPa (QNH: the altimeter sub-scale setting to show airfield elevation with the aircraft on the runway). The QFE at Chalgrove would have been approximately 1012 hPa based on the RAF Benson QNH adjusted for Chalgrove's elevation (240 ft) (QFE: the altimeter sub-scale setting to show zero ft agl with the aircraft on the runway).

The aircraft flew northeast along the ridge at approximately 1,100 to 1,200 ft amsl, below the MSA and equivalent to approximately 300 ft to 400 ft agl. As it turned left, back towards the ridge, it was at about 400 ft to 500 ft agl (approximately 800 ft to 900 ft amsl). The aircraft then flew approximately level over rising ground until it struck the top of a tree at 920 ft amsl (100 ft above the local ground level). According to the Met Office, the cloud base would have intersected the hills at an elevation of approximately 500 to 800 ft amsl, in the vicinity of the accident. Witness evidence was of poor visibility and cloud (fog) on the ridge and that, when it flew overhead, the "shadow" of an aircraft could be seen, but not the aircraft itself. If the aircraft was 400 ft above the witnesses and only visible as a shadow, it suggests that the forward visibility was significantly below 1,500 m[13].

The passenger waiting at Chalgrove Airfield stated that the top of the ridge was in cloud at about the time of the accident. Also, the NPAS helicopter was unable to reach the accident site approximately 30 minutes after the accident because of low cloud sitting on the ridge. It was concluded, therefore, that G-ATMT was in IMC as it flew northeast along the ridge and as it approached the ridge for the second time.

No evidence was found that the aircraft was subject to a technical failure which could have contributed to this accident. Physical evidence from the accident site suggested that the aircraft struck the trees in a wings level, flat attitude consistent with controlled flight. Radar data (Figure 2) showed slightly erratic altitudes during the turn back towards the ridge, just before the accident, but they remained within a band of approximately 400 ft and it was considered likely that this indicated that the pilot was making conscious inputs to the flying controls. It was concluded that the pilot was probably consciously flying the aircraft as it flew into trees at the top of rising ground.

Rule-based decision making – flight from VMC to IMC

G-ATMT took off in weather conditions estimated to be broken cloud at 800 ft agl (1,250 ft amsl) and a visibility of 9,000 m, and climbed to 2,000 ft amsl. The aircraft therefore departed in VMC and was permitted to operate under VFR but, at some point before flying northeast along the ridge, the aircraft crossed the boundary from VMC to IMC. The aircraft was operating within Class G airspace and, in this environment, pilots must make rule-based decisions if they encounter deteriorating weather:

a. If the conditions deteriorate towards VMC minima, change course and/or altitude to maintain VMC.

b. If the conditions deteriorate below VMC minima, continue the flight under IFR[14].

Footnote

[13] The applicable minimum visibility for flight under VFR at or below 140 kt IAS was 1,500 m.

[14] Option b. requires the pilot to be suitably qualified, and the aircraft suitably equipped, to operate under IFR. Should VFR-only pilots inadvertently enter IMC, the only realistic option is to turn through 180°, a manoeuvre which is taught in the PPL syllabus but which also carries the risk of collision in the turn.

The VMC rule therefore acts as a system defence intended to guide pilots into making a decision which minimises risk (in this case, the risk of collision).

Clewley and Stupple argue that '*poorly defined and uncertain system states'* increase the likelihood that rules will fail. In the case of VFR flight, with the system state defined as either VMC or IMC, the boundary between the two is uncertain: it is not easy for a pilot to differentiate between 4.8 km and 5.2 km visibility, or 1,400 m and 1,600 m. Dekker (2014) argues that, often, a gradual deterioration of conditions, even when noticed, does not cause people to change their plan. A decision is often the result of a series of re-assessments of the situation none of which are likely to account for all criteria, especially quantitative criteria. It is possible that this partly explains why some pilots, perhaps including the pilot of G-ATMT, faced with a gradual reduction in visibility below the quantitative (and difficult to assess) VMC limits, cross the boundary into IMC.

Rule-based decision making – the IFR minimum height rule

From the evidence available, G-ATMT was in IMC as it passed over the accident location, heading northeast, until impact, a time of approximately 1 minute 45 seconds (Figure 2). It had probably also been in IMC from the time it turned towards the ridge. Aircraft operating in IMC are subject to the IFR minimum altitude rule, which acts as a system defence against collision by guiding pilots to make a safe decision to stop a descent at MSA (if VMC has not been achieved) or climb to MSA (if entering IMC below MSA).

The pilot took neither of these options but appears to have remained in IMC below the MSA of 2,200 ft amsl. It was considered highly unlikely that he did not realise he was flying in IMC, given his experience and qualifications, and there should have been no uncertainty as to whether or not the flight could continue under VFR. In these circumstances, a rule-based decision to climb to MSA might have been straightforward and yet the aircraft did not climb or turn through 180º and route back towards the north.

The CAA has stated that, in 64% of all CFIT accidents, the pilots did not adhere to the MSA. A corollary of this is that pilots who do not adhere to the MSA put themselves at significant risk of flying into terrain. Apparently, this risk (if considered), along with other cues suggesting that the pilot of G-ATMT should climb to MSA (even if they were seen and acknowledged), did not outweigh the considerations used to justify continued flight at low level in IMC.

Decision making – continued flight below MSA

Having taken off in VMC, it was not determined when the pilot passed into IMC or why, having done so, he remained below MSA. However, CAA Safety Sense Leaflet 23 confirms that some pilots do, in fact, remain below MSA after flying inadvertently from VMC into IMC. Some considerations which might explain a decision not to climb above MSA are discussed below, although it was not possible to determine whether any of them were applicable to the pilot of G-ATMT.

a. Although in IMC, pilots might be able to see the ground immediately beneath their aircraft leading to an impression that the visibility ahead of them, which is difficult to gauge, is better than it actually is, and the risk of collision with an obstacle is correspondingly low.

b. If a destination airfield has no instrument landing procedure, a decision to climb to MSA would amount to an acknowledgment that the aircraft would probably not be able to land at its destination and the aim of the flight would not be achieved.

c. Pilots might be concerned that they would encounter icing conditions in a climb to MSA with an attendant degradation of aircraft performance and handling qualities.

d. Flight in IMC below MSA is stressful – especially if lost – because of the risk of collision. Research[15] suggests that stress can cause people to over-emphasise cues suggesting a positive outcome. It is possible that this tendency influences pilots' decisions to remain below MSA.

Conclusions

The aircraft was on a private flight from Turweston Airfield to Chalgrove Airfield and climbed to approximately 2,000 ft amsl after departure. Shortly after reaching 2,000 ft amsl, the aircraft descended to approximately 1,000 ft amsl and, at a point where a right turn would have been appropriate for a visual approach to its destination, turned left towards high ground which was in cloud. It was not determined when the aircraft transitioned from VMC to IMC but it flew in IMC below MSA for at least 1 minute 45 seconds before flying into trees on the top of rising ground. It was not established why the pilot turned away from his destination or remained below MSA while flying in IMC.

Research suggested that, when there is a gradual deterioration of weather conditions from VMC to IMC, it can be difficult to identify when the boundary between the two has been crossed, and this might explain why VFR pilots sometimes enter IMC inadvertently. Information from the CAA showed that, after entering IMC inadvertently, some pilots do not climb to MSA. Although this seems inexplicable, given the risk of collision, research into human performance provides some insight:

a. When under stress, people tend to place a greater emphasis on positive outcomes when making decisions.

b. When conditions deteriorate gradually, cues suggesting that a course of action be abandoned often fail to change that course.

Footnote

[15] Mather and Lighthall (2012).

This indicates that, if intending to remain in VMC, it is better to anticipate the need to avoid the boundary between VMC and IMC than to fly towards it and, perhaps inadvertently, across it.

CAA Safety Sense Leaflet 1e, *Good Airmanship,* Leaflet 5e, *VFR Navigation,* and Leaflet 23, *Pilots – It's Your Decision*, provide guidance for pilots operating VFR in the lower levels of Class G airspace and in poor weather.