ACCIDENT

Aircraft Type and Registration:	AS355F2 Twin Squirrel, G-BYPA
No & Type of Engines:	2 Allison 250-C20F turboshaft engines
Year of Manufacture:	1986
Date & Time (UTC):	1 May 2007 at 2325 hrs UTC
Location:	Near Thornhaugh, Peterborough
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - 1 (Fatal) Passengers - 3 (Fatal)
Nature of Damage:	Helicopter destroyed
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	49 years
Commander's Flying Experience:	8,000 hours, estimated (of which in excess of 500 hours were on type) Last 90 days - 47 hours Last 28 days - 18 hours
Information Source:	AAIB Field Investigation

Synopsis

The accident occurred when a technically sound helicopter, with a pilot and three passengers on board, crashed into trees while engaged on a night flight from Liverpool to a private landing site near Peterborough. As it approached its destination the helicopter probably encountered an area of shallow fog and low cloud. The helicopter descended to approximately 20 feet at 60 kt and the pilot, possibly using an illuminated haulage yard and quarry for guidance, attempted to fly below the cloud to complete the flight. After descending to approximately 20 ft at 60 kt, either imminent contact with the ground or impending contact with trees ahead forced the pilot to climb, where it is possible that he became disorientated and lost control. All the occupants received fatal injuries.

Background

The helicopter was flown several times on the day of the accident. The first flight took the owner of the helicopter from his house near the village of Thornhaugh to Vanguard helicopter landing site on the Isle of Dogs in London. It departed at about 1005 hrs, arriving without incident at around 1043 hrs. The pilot then went off duty, handing over to another pilot who flew the remaining flights that day, including the accident flight. The helicopter left Vanguard at about 1412 hrs, returning the owner to the landing site at Thornhaugh. The helicopter was then flown to Conington Airfield, landing at about 1455 hrs, where it was refuelled before departing for Thornhaugh again.

On arriving at Thornhaugh the helicopter was shut down to await the owner and two other passengers for a private

return flight to Liverpool, where they were due to watch a football match that evening. Whilst waiting, a life raft and other survival equipment brought by the pilot when he took over at Vanguard, were unloaded and taken into the house. They were required for a planned flight the following day to take the owner to a meeting in Jersey. The passengers arrived at about 1621 hrs, after which the helicopter departed, arriving at John Lennon Airport, Liverpool, at about 1707 hrs.

G-BYPA was one of numerous aircraft that had flown to Liverpool that evening in connection with the football match. They were all attended to by the same handling agent, who reported that G-BYPA was refuelled after its arrival. He provided weather reports to pilots on request, but did not recall G-BYPA's pilot either requesting or being given any weather information. Whilst waiting for their passengers to return, some pilots waited in a lounge provided by the agent. The pilot of G-BYPA was seen in the lounge during the evening. A pilot who spoke with him reported nothing unusual in his demeanour.

History of the flight

The helicopter was due to depart Liverpool at 2130 hrs. However, the football match went into extra time and, as a result, the passengers returned to the helicopter somewhat later than planned. The pilot booked out with ATC for a special VFR departure and, at 2219 hrs, they departed for the return flight to Thornhaugh. The helicopter climbed to a cruising altitude of 2,000 ft and, on clearing the Liverpool zone, set course to East Midlands Airport. At 2234 hrs, the pilot transferred from Liverpool to East Midlands ATC and was given a Flight Information Service, being cleared to pass just to the south of the airport.

At 2311 hrs the following exchange was made between the pilot and East Midlands ATC.

PILOT	ER EAST MIDS ER TRIDENT ONE ER I'LL JUST STAY WITH YOU A FEW MORE MILES IF I MAY ER JUST COMING UP TO RUTLAND WATER WE'LL GIVE YOU A CALL THEN ER BEFORE HEADING INTO PETERBOROUGH TRIDENT ONE
ATC	YEAH NO PROBLEM I CAN'T SEE ANYTHING TO AFFECT YOU
PILOT	OKAY THANKS ER TRIDENT ONE
ATC	DON'T THINK THERE'S ANYBODY TO TALK TO OUT THERE ANYWAY I S- I PRESUME PETERBOROUGH ER ARE WAITING FOR YOU
PILOT	YEAH THEY ARE THANKS VERY MUCH ER TRIDENT ONE WE'LL JUST STAY A FEW MORE MILES
ATC	YEAH THAT'S FINE ER THERE'S NOTHING ON RADAR SEEN TO AFFECT YOU
PILOT	THANKS VERY MUCH TRIDENT ONE

There were no more radio transmissions until, at 2314 hrs, the following exchange was made.

PILOT	AND EAST MIDS ER TRIDENT ONE PROBABLY LOOSE RT WITH YOU SHORTLY ER AND ER WE'LL Q S Y DOWN TO PETERBOROUGH NOW THANKS VERY MUCH HAVE A GOOD NIGHT
ATC	TRIDENT ONE THANK YOU SQUAWK SEVEN THOUSAND SERVICE TERMINATES ER NOTHING SEEN TO AFFECT YOU ER THE SURFACE WIND HERE IS ZERO FIVE ZERO AT SEVEN
PILOT	OK (TWO OR THREE WORDS UNINTELLIGIBLE) SEVEN THANKS VERY MUCH SQUAWK SEVEN THOUSAND GOOD NIGHT

No evidence was discovered of the pilot making any subsequent transmissions to East Midlands or any other ATC provider.

At between 2300 hrs and 2320 hrs, three men working at a haulage yard, situated about 2 nm west of the Thornhaugh landing site, saw a helicopter flying slowly, at a height of about 100 ft, around the area of the floodlight yard. They described seeing its navigation lights and silhouette for a few minutes. They stated that the engines sounded normal and that the helicopter appeared to be lost or looking for something, before it finally flew off in the direction of Thornhaugh. One of the men recalled hearing a sound like "crashing steel tubes" shortly after it disappeared from view.

The wreckage of the helicopter was discovered the following morning, having crashed in Bedford Purlieus Wood, about 1 nm from the haulage yard. All four occupants received fatal injuries.

Helicopter information

The AS355F2 helicopter is a twin-engine, four-seat helicopter constructed largely from conventional materials. The 'shell' of the cabin (above the floor line) is mostly constructed from relatively low strength plastic materials. It has a three-bladed main rotor, and a two-bladed tail rotor. G-BYPA was configured at the time of the accident with a single set of flying controls, such that it could only be flown from the front right seat. It was equipped with an autopilot and a Stability Augmentation System (SAS), and was instrumented for flight under IFR. This allowed single pilot operation at night and under IFR conditions. As the helicopter was fitted with only a single inverter for operation of the SAS and autopilot, operations in IFR were limited to non-commercial flights only.

The instruments included a radar altimeter, fitted with a moveable bug. Should the helicopter's height go below the bugged height, an audio warning would sound and a light on the instrument panel would illuminate. Although the audio warning could be silenced by pressing a button, the light would remain illuminated until the height increased above that indicated by the bug.

The helicopter had two landing lights. One was permanently fixed to illuminate the area directly in front of the helicopter while the other could be moved during flight by the pilot to point in different directions. Only one of the lights could be operated at any one time. When not in operation, the moveable light was capable of being retracted although the operator stated that, at night, it was not unusual to leave the light extended after takeoff for the remainder of the flight in anticipation of requiring it again during the landing.

Site and initial wreckage examination

The wreckage was found in a woodland area in which the tallest trees were estimated to have been 80 ft high. Examination of the site indicated that the helicopter had struck tree tops with relatively low forward and downward speed components, whilst on an approximately south-easterly track. After that, it had descended to the ground, striking a number of trees in the process, before coming to rest semi-inverted some 50 m from the initial tree impact. The nature of damage to several trees and the main rotor blades were consistent with the helicopter being under power at the time it struck the trees. All extremities of the helicopter and rotor system were identified and recovered at the site, indicating that it had been complete at the time of the impact with the trees.

Data extracted from a GPS unit recovered from the proximity of the wreckage indicated that, prior to its

final set of manoeuvres, the helicopter had travelled at low level over ground that was gently sloping and free from obstructions, towards the edge of a forested area. The recorded track took the helicopter towards an individual tree, devoid of foliage and less visible than one in full leaf, before it made a climbing left turn manoeuvre. In doing so, it became aligned with the edge of the forested area, following which it made a sharp turn further to the left, becoming aligned with the edge of another area of trees. Each of these track areas was carefully searched to establish whether any evidence was present of the helicopter having struck trees before descending into the forest. No tree damage or ground markings attributable to the helicopter were found in these areas. Similarly, no helicopter debris was located remote from the area of the wreckage site.

During the initial examination, the Emergency Location Transmitter (ELT) unit in the cabin was found to be functioning. This unit operates in conjunction with an antenna positioned on the airframe to be able to transmit a generally unobstructed upward signal. However, since the helicopter was lying semi-inverted, with the cabin roof largely destroyed, the system was not able to transmit a location signal following the accident.

The radar altimeter indicator in the instrument panel was damaged, in that the instrument glass was broken, and the shaft supporting the bug setting knob was severely bent, so that it could not be rotated. It was established that the gearing between the knob and the bug remained intact, and that the bug was positioned at 120 ft. The nature of this damage was such that the knob was unlikely to have rotated significantly as its shaft deformed, indicating that the 120 ft setting was probably close to its pre-impact setting.

The retractable landing light was in the lowered position**.** The bulb was of a type in which the condition of the filament gave no guidance as to whether or not it had been illuminated at the time of impact. The same situation applied to the bulb of the non-retractable lamp.

Detailed examination

The wreckage was recovered to the AAIB at Farnborough, where a detailed examination was carried out. Certain components were removed and subjected to specialist examination at other locations.

Structure

The fixed structure of the helicopter was confirmed as having been complete prior to initial contact with the tree tops. Although the main rotor blades (MRBs) were extensively damaged, no evidence was present to suggest they had not been complete at the time the helicopter struck the trees. Their root attachments showed evidence of the rotor system having been under power at that time. The tail-rotor blades were almost undamaged.

Impact forces applied to the rotor-head as the semi-inverted helicopter struck the ground, caused disruption and partial collapse of the main rotor gearbox support structure, allowing the axis of the gearbox to deflect substantially to the left. The plastics material and transparencies of the forward and upper part of the cabin were destroyed by ground impact, partly as a result of this deflection reducing the protection of the cabin afforded by the gearbox, had it remained in place.

Flying Controls

The mechanical linkages of the flying control systems were examined through their routing from the cabin to the main rotor control hydraulic actuators (servos). Considerable impact disruption had occurred,

particularly in the region of the gearbox mounting, but no evidence of pre-impact failure was identified in the system. The servos remained attached at their output ends to the lower swash-plate, the scissors links were undamaged and the pitch change links had remained attached to the upper swash-plate and to each MRB pitch change horn. Similarly, the tail-rotor pitch change system exhibited no evidence of pre-impact defects.

Functional tests were carried out on each of the main rotor servos and the hydraulic manifolds. No evidence of failure or incorrect operation was detected. Strip examination of both hydraulic pumps revealed no evidence of failure or excessive wear.

Transmission

The main rotor gearbox was subjected to a strip examination. No evidence of any pre-impact failure was found. The tail-rotor gearbox was also found to be free from any pre-impact defects. Its drive system had been deformed in the accident, and had suffered a single failure. The nature of this failure was consistent with being caused in the impact.

Engines

The engines were strip examined with the assistance of their manufacturer. No evidence of pre-impact failure was found in either unit. One of the two engines had ingested debris in the accident, the consequent damage indicating that it had been operating normally at that time. The other engine had not suffered comparable impact damage and thus exhibited no similar evidence of operation. However, data from one of the GPS units on the helicopter was analysed, in conjunction with the manufacturer, to assess the helicopter's performance during its final manoeuvres with respect to engine power required. This indicated that for the helicopter to have pulled up in to the climbing left turn immediately before the trees, power from both engines would have been required. In addition, as it descended into the trees, power from at least one engine would have been necessary for the recorded flight profile.

Summary

In summary, no evidence was found during the examination of the wreckage of any pre-impact defect or failure which could have caused or contributed to the accident.

Pilot information

The pilot started his flying career in 1987 when he began training in the United States. He gained a Federal Aviation Administration (FAA) Commercial Pilot's Licence and Instructor Rating for both rotary and fixed wing aircraft. He subsequently flew as an instructor and charter pilot in the USA and UK and later gained his FAA Airline Transport Pilot's Licences (ATPLs), again on both rotary and fixed wing types.

In 1990 he gained a CAA rotary wing ATPL and began working for various helicopter charter companies in the UK. During this time he gained experience of flying aerial photography tasks, pipeline and power line patrols.

In 2001, he set up his own helicopter company with a partner, owning and operating one helicopter and managing others for clients. This included the helicopter involved in the accident.

On 14 September 2006, the pilot passed a night Operator's Proficiency Check and on 26 March 2007, he renewed his Instrument Rating.

Meteorological conditions

Forecasts

The pilot had the opportunity to review available forecasts throughout the day at locations he visited. The following forecast information was available prior to the helicopter's departure from Liverpool: Form F215 chart (Appendix 1), Form F214 chart (Appendix 2) and the Central England Airmet (Appendix 3).

In addition, the pilot would have had access to forecast conditions (TAFs) and actual conditions (METARs) for various airports along the return route (Appendix 4). The helicopter's destination and arrival time was such, however, that there would not have been many valid TAFs to consult in the immediate area of Thornhaugh. RAF Wittering, the closest airfield, did not have a TAF valid beyond 1800 hrs on the day of the accident, although RAF Cottesmore, 10 nm NW of RAF Wittering, had a TAF valid to 2300 hrs. Both Luton and East Midlands Airports, the pilot's likely choice of diversion airfields, had TAFs covering the period of the flight.

The RAF Cottesmore TAF forecasted possible temporary reductions in cloudbase, between 2200 hrs and 2300 hrs, to 1,200 ft aal. Both the RAF Wittering and Cottesmore METARS reported no cloud cover below 5,000 ft aal until 2050 hrs, when both reported cloudbases for the remainder of the day of between 200 ft and 500 ft aal. The special observations recorded at 2100 hrs and 2110 hrs (see Appendix 4) were not required to be broadcast on the civilian network so would not have been available to the pilot.

The Cottesmore TAF should have been amended when a special observation, at 2100 hrs on 1 May, recorded a visibility of 6,000 m in haze, and BKN cloud at 500 ft, from which point on, the TAF remained outside tolerance[1]. According to internal Met Office procedures, an amended TAF is required as soon as possible after a TAF falls outside tolerance. An amended TAF was not sent, and there was no subsequent cancellation of the TAF when the airfield closed.

En-route conditions

A detailed aftercast was obtained from the Met Office covering the period of the accident flight, as follows:

Synoptic situation

Analysis of available information showed an area of high pressure centred north of the Shetland Islands and an area of low pressure over western Central France, resulting in a surface flow across England from (generally) the northeast. The influence of the high pressure was that the air was very dry above (generally) 1,500 ft amsl. With a flow over the North Sea, sufficiently moist conditions would exist to generate cloud and mist below (generally) 1,500 ft. The characteristics of such a situation at this time of year would be that any such low cloud/mist would penetrate inland, or form in-situ, during overnight cooling and retreat to coasts, or disperse in-situ, during daytime heating.

The orography of England would influence conditions, with the Pennines providing a location for upslope stratus formation on its windward (eastern) side, but also shelter from cloud on its leeward (western) side.

Footnote

[1] Outside tolerance means that if the conditions change beyond specified limits from the data published in the TAF, then an amended TAF should be published.

Weather

At takeoff from Liverpool Airport, conditions were CAVOK, indicating there was no significant weather. East Midlands Airport reported no significant weather during the period 2220 hrs to 2350 hrs, although fog difference imagery[2] taken at 2315 hrs indicated low cloud over the area (Appendix 5).

Surface visibility

Reports indicate that, to the west of the high ground of the central and southern Pennines, surface visibility was 10 km or greater, up until 2350 hrs. East Midlands Airport reported visibility of 10 km or more during the period 2220 hrs to 2350 hrs but, again, fog difference imagery did indicate low cloud over the area.

Cloud

Reports from Liverpool, Manchester and Birmingham airports indicated no cloud cover up to 5,000 ft aal until 2350 hrs. East Midlands Airport reported no cloud below 5,000 ft aal until 2320 hrs. At 2320 hrs, FEW cloud at 1,200 ft aal was observed and, at 2350 hrs, SCT cloud at 1,000 ft was observed. Fog difference imagery indicated cloud over the area at the time, perhaps more than might be suggested by the observation reports. Evidence from radiosonde ascents at Nottingham suggested that cloud tops would have been limited to less than 1,200 ft in the area, with isolated exceptions to slightly higher values due to topography.

A text message from one of the passengers on the helicopter, sent at 2309 hrs, read: *'We have hit some really bad fog'*. The helicopter was at this time at an altitude of about 2,000 ft and was approximately 12 nm from East Midlands Airport and 24 nm from the landing site.

Footnote

[2] A method of detecting fog or low cloud at night.

Accident site conditions

Witnesses at the haulage yard, about 1nm to the west of the accident site, described the weather at the time they saw the helicopter as being clear with good visibility and no mist or fog. A similar description was given for the landing site at Thornhaugh by members of the owner's family who were outside, at around midnight, awaiting the helicopter's return.

Weather reports were also available from RAF Wittering, about 1.5 nm to the north of the accident site, from which the following information was obtained.

Visibility

The 2250 hrs observation reported a surface visibility of 3,500 m; the automated observation at 2350 hrs reported this as 5,000 m. Automatic observations are limited in the sample area when they assess visibility so this latter figure, overall, is likely to be less accurate than a reported value. The aftercast was not able to provide visibility figures within the cloud layer but noted it was '*possibly much lower than 200 m*'.

Cloud

From 2250 hrs to 2350 hrs, cloud was reported as BKN or OVC at 200 ft aal. Infra-red satellite imagery and fog difference imagery taken at 2315 hrs suggested that any such low cloud that formed in the area would be relatively thin in vertical depth.

The 2350 hrs observation was an automatic report, and in view of this, further analysis was conducted of the 2250 hrs METAR together with that from a radiosonde ascent from Nottingham at 0000 hrs on 2 May 2007. This indicated a theoretical cloud base of 319 ft aal. This is slightly higher than the range 200 to 299 ft aal that would be reported as an official 200 ft cloud base

but, as a theoretical construction, it is within any realistic tolerance and validates the reported figures. The same analysis suggested a likely cloud top at the accident site of no more than 1,200 ft.

Wind speed and direction

There was evidence of a marked backing and easing of the wind between about 2,000 ft and the surface. An estimate of the wind direction and speed at the surface was 020º/11 kt and at 500 ft, 040º/23 kt.

Freezing level

Evidence from the Nottingham radiosconde ascent suggested it was unlikely the level of the 0°C isotherm would have been any lower than 8,000 ft.

Natural illumination

Sunset on the 1 May 2007 was at 1928 hrs and sunrise on 2 May at 0429 hrs. At the time of the accident, the moon was full and was above the horizon, resulting in good illumination levels above any cloud, but less so beneath any cloud layers.

Night VFR limits

A private helicopter flight must remain clear of cloud and in sight of the surface, with a minimum visibility of 5 km. Commercial helicopter operations are usually further restricted to a minimum cloud base of 1,500 ft.

Both private and commercial flights, in addition, have to adhere to the normal low flying regulations which prohibit flight within 500 ft of persons and structures, except when landing or taking off in accordance with normal aviation practice.

Aids to navigation

Two GPS units were recovered from the helicopter. A Bendix-King Skymap IIIC GPS unit was permanently fitted by a bracket on the right-hand side of the instrument panel placed towards the bottom. A detachable Garmin GPSmap296 unit was also recovered which would normally have been positioned on the instrument coaming.

Helicopter landing site description

The landing site at Thornhaugh is situated within the Aerodrome Traffic Zone of RAF Wittering, a military airfield situated about 2 nm to the north-west. A dual carriageway road (A1) runs north-west to south-east about 2 nm to the east, which is illuminated by streetlights at night. Another main road (A47) runs east to west about 0.5 nm to the south but is not lit at night. To the south of this road there are two quarries, one approximately one mile to the east of the haulage yard, the other about 1 mile further to the east and approximately ½ mile to the south-west of the landing site. Both are partially lit at night. A junction between the two roads, about 2 nm to the east of the landing site, stands out at night due to road lighting and is often used by pilots as an initial aiming point to locate the landing site when approaching from the south or east.

The landing site is positioned in a field next to a large house and outbuildings. The aiming point is depicted by a large white H marked on the grass; the edge of the field is lined with mature trees. The site is illuminated at night by a number of lights which can be switched on remotely by transmitting on a designated frequency as the helicopter approaches the site. These were normally activated from a range of about 10 nm and the lights remain on for 15 minutes before automatically switching off.

The lights are positioned on two sides of the field with some directed to illuminate the landing site surface and others angled upwards to illuminate the surrounding trees. In addition, two strobe lights are positioned on the roof of one of the outbuildings.

Tests revealed the remote switching function was operating normally and that all the landing site lights were working at the time of the accident. On the night of the accident, they had been seen to come on at some time after 2300 hrs, having been operated remotely.

The normal way of approaching the site at night would be to fly overhead at a height of about 800 ft agl to identify the site, before continuing the descent and approaching in to wind.

Recorded data

Sources of data

The helicopter did not carry, and was not required to carry, a crash protected recorder. However, the two GPS receivers recovered from the wreckage were successfully downloaded and provided data pertinent to the accident flight. The majority of the accident flight was also captured on radar recordings.

The three recordings correlated well until the latter stages of the flight when the Skymap IIIC altitude recordings became intermittent and deviated from the GPSmap296 and radar recorded altitudes, even though the lateral position recorded remained consistent with the other recordings. This indicated that the unit was unable to track sufficient satellites to provide an accurate three-dimensional fix. Also, the Skymap IIIC unit only recorded data every thirty seconds, which was insufficient to analyse the helicopter manoeuvres in detail. However, it did provide the details of previous flights carried out that day. Due to line of sight limitations, the radar track did not cover the last three minutes and 25 seconds of the flight.

The GPSmap296 provided data that was recorded every time the helicopter deviated from straight and level flight, creating fast updates during manoeuvring. The track of the accident flight was intermittent at the start of the flight; the message log indicated that this was due to the loss of satellite reception. However, after this initial period, the recorded track correlated with the radar data and Skymap IIIC position data, when available, and extended directly to the wreckage location. The unit had not recorded tracks for any previous flights that day.

Information from the Garmin GPSmap296 data was used to analyse the flight path of the helicopter, but all sources were referenced to review the history of previous flights and navigation aids available to the pilot.

Recorded data

The Skymap IIIC unit recorded data covering six flights that day, including the accident flight, with the recordings totalling three hours and 23 minutes. The first track recorded that day started at 1005 hrs UTC at a point correlating to the owner's private landing site near Thornhaugh. Each subsequent flight was either to or from this site; the accident flight ended approximately 1 nm south-west of the landing site.

Figure 1 shows the GPS position, altitude and derived ground speed for the accident flight. The data indicates the accident flight departed Liverpool John Lennon Airport at 2219 hrs on 1 May 2007. During its climb after departure, the helicopter initially tracked south-east for 12 nm and then turned onto a track of 120ºT. Soon after the turn, the helicopter reached a steady cruise altitude of 2,100 ft amsl and its ground speed stabilised to between 90 kt and 100 kt. When

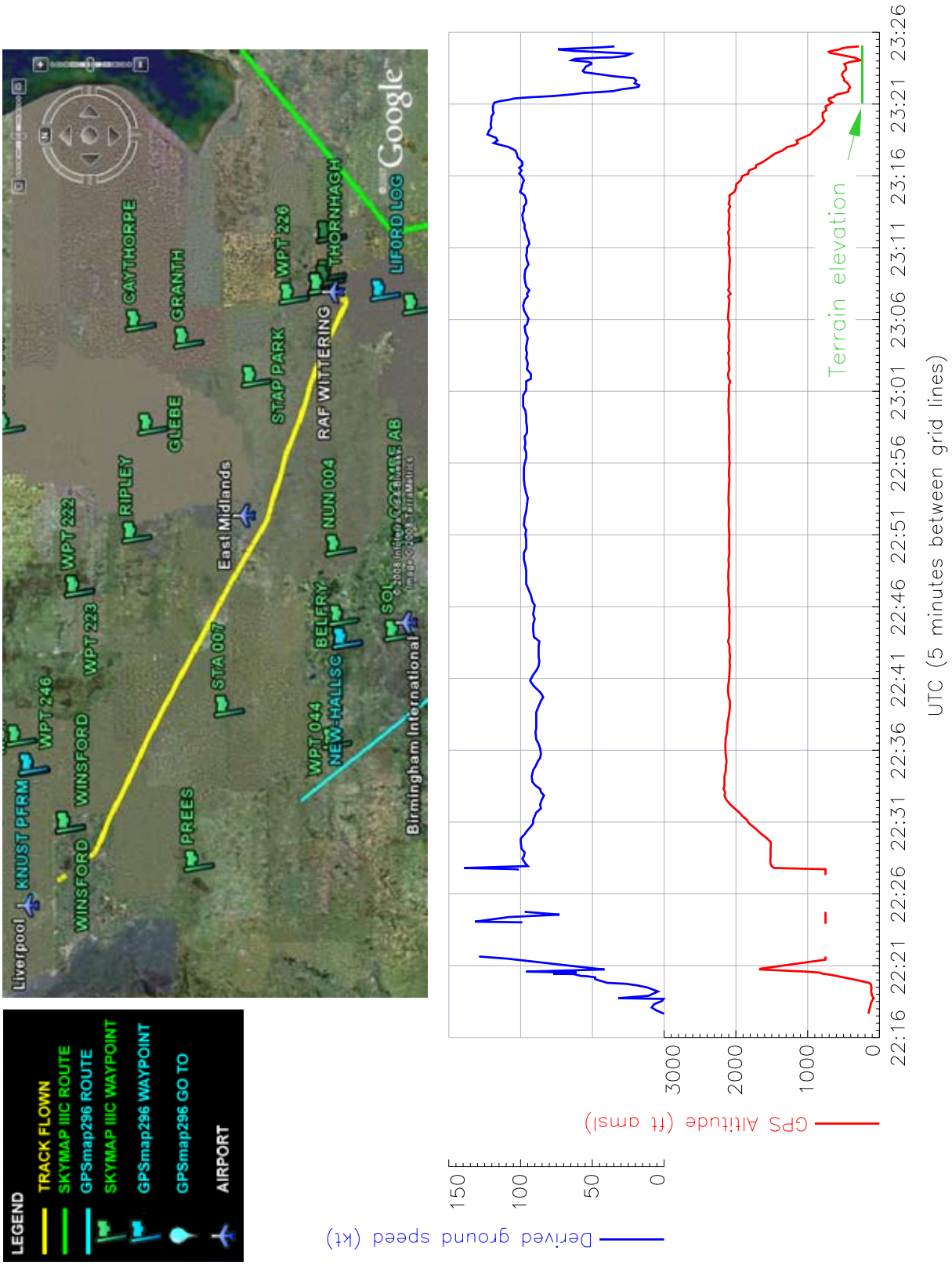

Figure 1

Track recorded by GPSmap296 and waypoint/route data in the memory of both the GPS receivers.

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it passed south-west of East Midlands Airport, its track changed to an averaged 110ºT. After a further 13 minutes, a steady descent was initiated, with the track drifting to 120ºT once more.

Figure 2 shows the last portion of the flight. The helicopter was briefly levelled at approximately 800 ft amsl before it descended further, with the ground speed reducing. A left orbit was initiated and the helicopter descended to approximately 170 ft agl. The position of this orbit corresponded with the location of a haulage yard. The helicopter then flew further east at less than 300 ft agl, apparently towards a quarry, before altering course approximately 20° to the right. It then dipped to a recorded altitude equating to approximately 20 ft agl[3] with a ground speed of 64 kt, following which it immediately climbed and started a left turn. The turn reached a maximum height of 460 ft agl before continuing in a descent that led to the accident site.

Navigation data

Figure 1 also shows the waypoints and routes pre-programmed into the GPS units. No pre-programmed route covering any part of the flight from Liverpool to Thornhaugh had been stored in either GPS.

The Skymap IIIC had a waypoint marked for the intended destination. However, selected flight plans, 'direct-to' activations and map zoom levels are not recorded, so it was not possible to determine if, or how, this information was being used.

The GPSmap296 did not have a waypoint marked for the intended destination but it had the Wittering TACAN, WIT, as shown in Figure 3b, as its active 'Go-To' point at the time of the accident. Previous 'Go-To' points recorded were not related to this flight. The GPSmap296 provides a moving map display, amongst other optional displays. It was not determined which display was active at the time of the accident. However, the moving map page will retain its last zoom setting and so Figure 3a shows the display that would have been presented to the pilot had it been active. Figure 3b indicates what would have been displayed had a tighter zoom level been selected. Note the dotted grey lines which show the tracks recorded within the unit. With the zoomed display, this provides an indication of where many previous flights had started and finished, and indicates the location of the landing site.

Both GPS units were tracking position with reasonable accuracy and could have provided visual indications of the distance from the 'current position' to the intended destination.

Pathology

Post-mortem reports on the occupants of the helicopter were reviewed by an aviation pathologist. His report indicates that the accident was not survivable. He commented that the pilot was found to have had a benign brain lesion in the right temporal lobe and, whilst it was considered that this could have had the potential to trigger an epileptic seizure, it would have been highly unlikely for the post-mortem to have provided any evidence of a seizure having occurred. Therefore, consideration was given by the pathologist to the circumstantial evidence of such a seizure occurring, from which he deduced that there was a small annual risk of seizures for those with this type of lesion. In addition, his report stated:

Footnote

[3] Note that the altitudes quoted are GPS altitudes with an accuracy tolerance of greater than 20 ft. The GPS receiver horizontal error is quoted as <15m for 95% of the time. Vertical error is regarded as being on average 1.5 times horizontal error due to satellite geometry limitations. These figures are conservative manufacturer figures; normal operation is expected to be better than this. At the time of the accident the geometry of the satellite constellation was favourable for accurate horizontal and vertical positioning. However, how this was adversely affected by obstruction of satellite signals is not known.

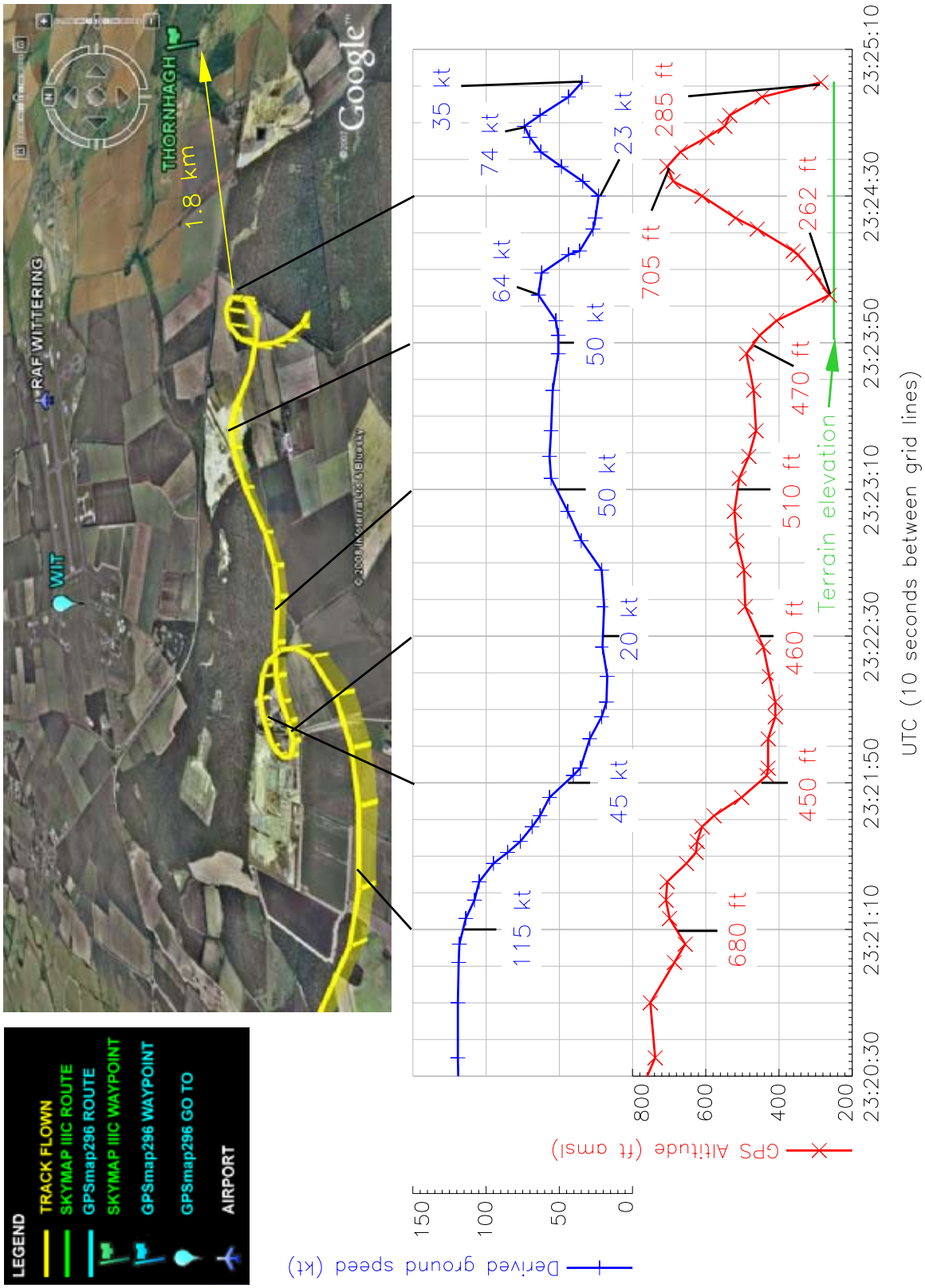

Figure 2

Last portion of track recorded by GPSmap296 and waypoint/route data in the memory of both the GPS receivers

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a)

b)

Figure 3

Photograph of map page of the GPSmap296 with:
a) the last recorded zoom level and
b) a tighter zoom level.
Note that the faint dotted lines are tracks recorded within the unit

'……seizures originating in the temporal lobe need not be associated with convulsions or disturbances of consciousness, but may have much more subtle manifestations, including abnormal bodily sensations, auditory hallucinations or disturbance of time perception. Such manifestations, while not necessarily being totally incapacitating, could certainly potentially impair one's ability to safely control a helicopter'.

Also, the pilot had a history of another condition which is associated with epilepsy. Despite this, there were no indications that he had ever suffered from epilepsy in the past.

Search and rescue

The helicopter was reported missing to Cambridgeshire Police by the owner's family after it failed to arrive at the landing site. The police attempted to trace the helicopter by first contacting the Civil Aviation Authority (CAA), who advised them to contact the National Air Traffic Services (NATS). They also called other police forces on the helicopter's route to see if they had any information on G-BYPA.

At 0116 hrs, the Air Rescue Co-ordination Centre (ARCC) at RAF Kinloss was notified. After making initial enquiries they deployed, at 0227 hrs, a RAF Sea King SAR helicopter, Rescue 128, from RAF Leconsfield to the area of Bakewell in Derbyshire where an emergency location beacon transmission had been received. However, by 0232 hrs, radar recordings had been replayed of the helicopter's flight from Liverpool which identified its last known position near Duddington, a village about 4 nm west of the Thornhaugh landing site. Rescue 128 was diverted to this new position, arriving at about 0318 hrs.

ARCC deployed another SAR helicopter, Rescue 125, from RAF Wattisham at 0232 hrs. Rescue 125 reported initially being unable to approach the scene due to fog and mist. However, by 0324 hrs, it had joined Rescue 128 in the search area where visibility was described as "poor, in fog". The helicopters were able to search the open ground but the use of their forward-looking infra-red (FLIR) cameras was ineffective in searching the dense woodland. The low cloud base continued to hamper their search and a requested forecast predicted the cloud base would not start to lift until between 0800 hrs and 0900 hrs. At 0503 hrs, Rescue 125 withdrew to refuel and change crews, planning to return to the area in time for the predicted weather improvement. Rescue 128 also refuelled but remained in the area until 0708 hrs to continue the search. At 0628 hrs they reported a 200 ft cloudbase with visibility of about 500 m in mist, conditions suitable for a low level search over open ground but marginal over trees, due to mist.

Cambridgeshire Police had been co-ordinating the ground search, which had been joined by neighbouring police forces. Other helicopter landing sites and airfields were checked and, at 0632 hrs, an offer was accepted from ARCC to deploy a mountain rescue team from RAF Leeming to help search the woodland. Their expected time of arrival was 0930 hrs.

The police Air Support Unit helicopter had originally been unable to join the search for technical reasons but, at about 0747 hrs, it spent about 20 minutes conducting a visual search of the area whilst en-route to a maintenance facility, this being the maximum flying time it had available.

At about the same time, a civilian helicopter, owned by friends of the owner of the missing helicopter, also began searching the area. It was cleared to do so by ATC as, at the time, neither of the RAF SAR helicopters were in the area.

At 0835 hrs, Cambridgeshire police received a call from a member of the public who had seen a helicopter flying in the direction of Bedford Purlieus Quarry. This information was then passed to ARCC and RAF Wittering. As the open areas had already been searched, search and rescue assets were directed to nearby woodland known as Bedford Purlieus Wood. This included Rescue 125, which had just returned to the area, and the private helicopter, which had been searching the area since about 0720 hrs. The cloudbase

had lifted enabling a visual search to be made of the woodland and, at 0902 hrs, the private helicopter spotted a small area of broken branches in the tree canopy. Hovering low overhead they could see the crash site and passed this information to Rescue 125. The private helicopter then landed close to Bedford Purlieus Wood to allow one of its two occupants to get out and make their way to the crash site on foot. Rescue 125 meanwhile lowered a winchman to the site through the tree canopy. It was confirmed that the wreckage was that of G-BYPA and that all four occupants appeared to have received fatal injuries.

Fuel

The helicopter's technical log records showed that it had departed Thornhaugh with its fuel tanks filled to 80% of capacity (equivalent to 584 lt, or 461 kg[4]) and landed in London with 60% (equivalent to 438 lt, or 346 kg).

The helicopter was next refuelled at Conington Airfield prior to the flight to Liverpool. Airfield records show that 416 lt were uplifted. Finally, at Liverpool, the helicopter was refuelled, this time with 100 lt, the pilot asking the ground agent to put 50 lt in each of the two fuel tanks.

On departure from Liverpool, the pilot had booked out using an electronic system, declaring the helicopter's endurance as two and a half hours. The fuel required for night operations on the AS355F2, when being operated commercially by its operating company, is determined from their operations manual as the sum of the following:

- Taxi fuel 1%
- Trip fuel 27.5% per hour
- Contingency reserve 10% of planned trip fuel
- Alternative fuel
- Final reserve fuel min 15% (equivalent to 30 mins at holding speed)
- Extra fuel at the commander's discretion

Using a planned flight time from Liverpool to Thornhaugh of 55 minutes (equivalent to 26% of maximum fuel capacity), a planned diversion time of 25 minutes (equivalent to 12%) to either Luton or East Midlands and no discretionary fuel, this equates to a total requirement for the flight of 57 % (about 438 lt or 346 kg).

Although this was a private flight, an estimation was sought, from the helicopter's operating company, of G-BYPA's fuel consumption, based on a combination of experience and figures in the helicopter flight manual; this was about 225 lt/hour. The Skymap GPS on the helicopter recorded a total flight time between departing London and arriving at Liverpool of 96 minutes. Using these figures, combined with the evidence of the technical log and fuel records, the calculated fuel on board on departure from Liverpool was 594 litres. This compares with the 562 lt necessary for the pilot's declared endurance of two and a half hours and the 438 lt necessary for the flight.

Weight and balance

Using the available weight data for the helicopter, fuel and occupants, calculations demonstrated that it was within the permitted maximum takeoff weight and required centre of gravity limits for the entire flight.

Footnote

[4] Fuel figures taken from the Eurocopter flight manual

Pilot duty hours

The pilot woke at about 0400 hrs on the morning of the accident, made a hot drink and returned to bed. At about 0730 hrs, he drove to his parent's house for breakfast and, at approxiamately 0900 hrs, departed for the Vanguard helicopter landing site in London. The journey was a distance of approximately 100 miles and would have taken about two and a half hours. The flight was planned to leave Vanguard at 1300 hrs.

The pilot was occupied for the rest of the day operating the helicopter and carrying out associated functions until soon after reaching Liverpool at 1707 hrs, when he spent time relaxing in a lounge provided by the handling agent at the airport. The departure time had been planned for 2130 hrs, with a planned arrival at Thornhaugh at 2225 hrs but, due to the football match going into extra time, the actual departure time was 2219 hrs.

The planned flight came at the end of a day which represented the maximum duty hours allowable, had this been a commercial operation, of 11 hours 38 minutes, taking into account allowances for travelling times and the rest period at Liverpool. The pilot could have extended this by three hours to take into account unplanned eventualities, such as the late departure from Liverpool. However, as the flight was being operated as a private flight these restrictions did not apply.

Analysis

Detailed examination of the wreckage, stored GPS data and performance calculations, revealed no evidence of a technical failure that may have been causal in the accident. The helicopter had sufficient fuel on board and was within the correct weight and balance limits. There was nothing in the helicopter's operation to suggest a rapid onset of pilot incapacitation, such as an epileptic fit, although it cannot be entirely dismissed that the pilot could have suffered a more subtle incapacitation. In the absence of any reports of the pilot previously exhibiting any unusual behaviour, the lesion found in his temporal lobe would not have been looked for and would not have been readily detectable, during the normal medical examinations that pilots are required to undertake to maintain their flying licences.

The helicopter was seen shortly before the accident being flown apparently under control, but its height, speed and location at this time were not consistent with a planned landing at Thornhaugh, about 2 nm away. It is known that the helicopter had flown over an area of low cloud after it had passed East Midlands Airport and meteorological evidence indicates that low cloud cover extended over the location of the accident site and intended landing site. It is not known what weather information the pilot had obtained prior to the flight, but there was sufficient information available to him, prior to departure, to indicate that his destination was likely to be affected by low cloud at the time of arrival.

Reference to the 1950 hrs METARs for RAF Cottesmore and RAF Wittering would have indicated no adverse weather conditions. However, had he referred to the 2050 hrs and 2150 hrs METARs, this may have caused the pilot to re-consider the suitability of conditions for the intended flight, as these reports would have indicated that the actual conditions in the area of the destination were worse than forecast. As it is not known to what weather information the pilot did refer, the effect of not revising the RAF Cottesmore TAF cannot be established.

Eyewitnesses described the night sky as being clear. This was possibly due to transient gaps in the cloud cover, although it is more likely that the presence of relatively thin cloud was simply not apparent to a casual observer.

The assessment of cloudbase is extremely difficult at night, and requires instrumentation, experienced observers, or both, to obtain accurate values or good estimates. Equally, a thin layer of cloud may not be apparent if a casual observer looks vertically through it from ground level.

Evidence for the existence of low cloud comes from the fact that the helicopter was being flown far lower than would be expected in the area of the haulage yard at night. Its height was about 170 ft agl, against an estimated cloud base of 200 ft to 320 ft agl, and the most likely reason to operate the helicopter in this way would be to remain visual with the surface and clear of the cloud cover above. Had this been due to a mechanical or operational problem, then there was the opportunity to land in the well lit haulage yard or a nearby field. The passenger's text message indicates that, prior to starting his descent, the pilot was almost ceretainly aware of the cloud cover below. The weather at both East Midlands and Luton Airports was suitable for use as diversion airfields, and he had sufficient fuel to fly to either.

The apparent decision to continue to the planned destination might have been driven by a desire to return to Thornhaugh to facilitate the planned flight to Jersey the following day. The decision to continue might also have been influenced by the fact that it was made at the end of what had been a long working day with, possibly, a natural desire to 'get home'. Equally, the pilot may have been unaware of exactly how low the cloud was and he may, therefore, have considered the weather was still suitable to continue safely to the landing site. The lighting above the cloud was good, due to the full moon, and this may have affected his judgement of his ability to fly in the prevailing conditions. The light levels below the cloud, however, would have been significantly reduced.

The normal procedure for landing at the Thornhaugh site at night is to let down over the site once it has been identified. Radar and GPS evidence shows the helicopter making an apparently deliberate turn towards the haulage yard and it is possible that the pilot mistook the yard for the landing site. Both areas would have stood out, being brightly lit, against otherwise relatively dark surrounds, but would have been obscured somewhat and possibly misidentified when viewed from above through cloud. The GPS units on the helicopter could have helped identify the correct position of the landing site but these had been not set in the most appropriate way for doing so. It is possible, therefore, that the pilot either ignored or misinterpreted them at this point.

An alternative reason for the helicopter descending to low level at the haulage yard was not that it was mis-identified but, being so well lit, it might have presented an opportunity for the pilot to get below the thin cloud layer in order to complete the remainder of the flight to the landing site. Whatever caused him to descend over the haulage yard, he would have been well aware of the low nature of the cloud layer, having just passed through it. Irrespective of whether the flight was private or commercial, had the cloud base been as low as the evidence suggests, this should have precluded further flight or precipitated a diversion at a safe height, under such conditions. The opportunities open to the pilot at this point would have been either to land, or revert to flying on instruments and climb to a safe height. However, to attempt the latter would have risked climbing into an area ahead where he would have been unaware of any potential obstructions.

After circling the haulage yard, it appears that the pilot made the decision to continue, flying at low level. This presented the additional challenge of having to navigate at such a height whilst flying in the dark. To do so he

would have either had to rely on his own knowledge of the area or the use of one or both GPS units on board. It is not known if he used either of the landing lights to assist him, but the witnesses at the haulage yard did not recall seeing one on.

The helicopter's initial track from the haulage yard was towards a nearby quarry, which would have been partially floodlit. It is possible the pilot was using this landmark to navigate by or because he thought the lights were those of the intended landing site. Having reached the quarry, the track then turned apparently towards a second quarry, which would also have been partially floodlit. This was possibly for the same reasons that the pilot initially headed for the first quarry, the helicopter's tracks suggesting the pilot was attempting to navigate by visual means. However, the following points relating to the GPS units are of note.

The Garmin GPSmap296 GPS unit did not have the landing site recorded as a waypoint and, therefore, it would not have been marked on the screen. Also, no information on heading and distance to guide him there would have been presented. Previously recorded track lines emanating from the landing site indicated its position, but these lines would have been barely visible under the lighting conditions in the cockpit and would also have required the screen to be set to a suitable scale. It is considered this unit would therefore have been of little use, as set, in navigating between the haulage yard and the landing site.

The Bendix-King Skymap IIIC GPS unit did have the landing site recorded as a waypoint but it could not be determined if this had been selected as the 'go to' point, or what map scale was displayed on the screen. This unit could, therefore, have potentially been used to guide the pilot to the landing site but, due to its position in the cockpit, would have required him to look down to his right in order to see the screen. This would have been distracting and potentially disorientating, particularly when flying under the prevailing conditions.

However the helicopter was being navigated, after having circled the haulage yard, its height varied, initially increasing, but finally reducing from a height of about 240 ft agl, over a period of around 14 seconds, to a height of about 20 ft agl. The prolonged nature and steady rate of this descent indicates it was unlikely, for example, to be due to pilot incapacitation or interference with the controls from a passenger. It may have been the result of the pilot becoming distracted, if he were trying to read or re-programme one or other GPS unit. Also, as it is likely that the radio altimeter had been set to about 120 ft (agl), audio and visual warnings of the aircraft's descent below that height would have been provided. Such warnings could have acted as further distractions at a time when, either he deliberately chose to fly low, or possibly the local cloudbase lowered and forced him down to around 20 ft agl to remain visual with the ground. The recorded speed of the helicopter increased during this descent from 50 kt to about 65 kt, suggesting that it was unlikely the pilot was attempting a precautionary landing.

The rapid climb that occurred immediately after the descent to 20 ft agl could have been a reaction to the pilot suddenly realising how low the helicopter had become. It occurred at a position approaching Bedford Purlieus Wood so he might also have just become aware of the trees ahead. Whatever the cause, the resultant climb could not have been achieved without both engines providing power and the height achieved was likely to have put the helicopter into cloud. This set of circumstances would have been highly disorientating for the pilot and probably resulted in the helicopter

performing the descending left turn into the wood. The helicopter has a natural tendency to turn to the left under high power due to the torque effect of the main rotor.

The subsequent search for the helicopter was made difficult by the poor weather conditions and the fact that the helicopter was well-hidden beneath the tree canopy. This was compounded by the failure of the ELT due to the nature of the impact.

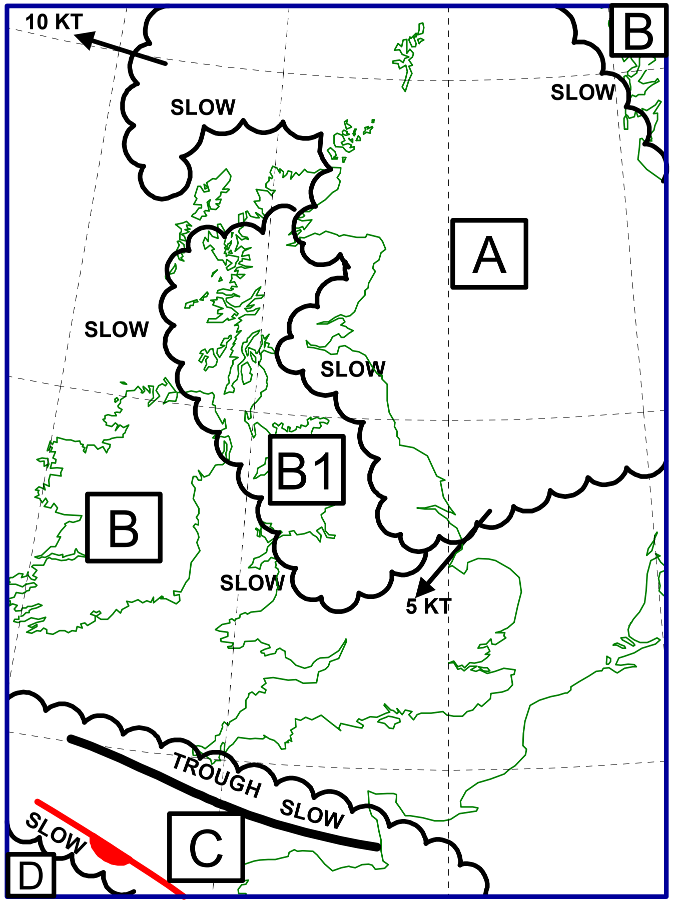
Safety action

Soon after the accident, Cambridgeshire Police reviewed their control room procedures to ensure that the Distress and Diversion unit at Swanick Air Traffic Control Centre is called once an overdue aircraft is notified to them.

Conclusions

Although the effect of a lesion discovered in the temporal lobe of the pilot during his post-mortem examination was not considered a causal or contributory factor in the accident, the aviation pathologist who reviewed the autopsy reports considered that such lesions, whilst not necessarily causing total incapacitation, could, potentially, impair one's ability to control a helicopter safely. Therefore, the possibility that the lesion could have contributed to the cause of the accident could not be fully dismissed.

In the absence of any technical defect or failure being found during the examination of the wreckage, it was concluded that after the pilot elected to continue the flight, at night, beneath a low layer of thin cloud, he was forced to make a climbing turn to the left, possibly to avoid the ground and/or an area of woodland and that, during this manoeuvre, he became disoriented and descended into trees.



All heights in 100's of feet above mean sea level
XXX means above chart upper limit
Cloud amount (Oktas) FEW: 1-2 SCT: 3-4 BKN: 5-7 OVC: 8
MOD / SEV ICE Ψ/Ψ
MOD / SEV TURB Λ/Λ
TS / CB implies GR/Ψ/Λ
Speed of movement in KT
Temperatures in DEG C
Hill FG implies VIS <200 M

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Forecaster: Duty Forecaster
Contact telephone 0870 900 0100
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Forecast Weather below 10000 FT

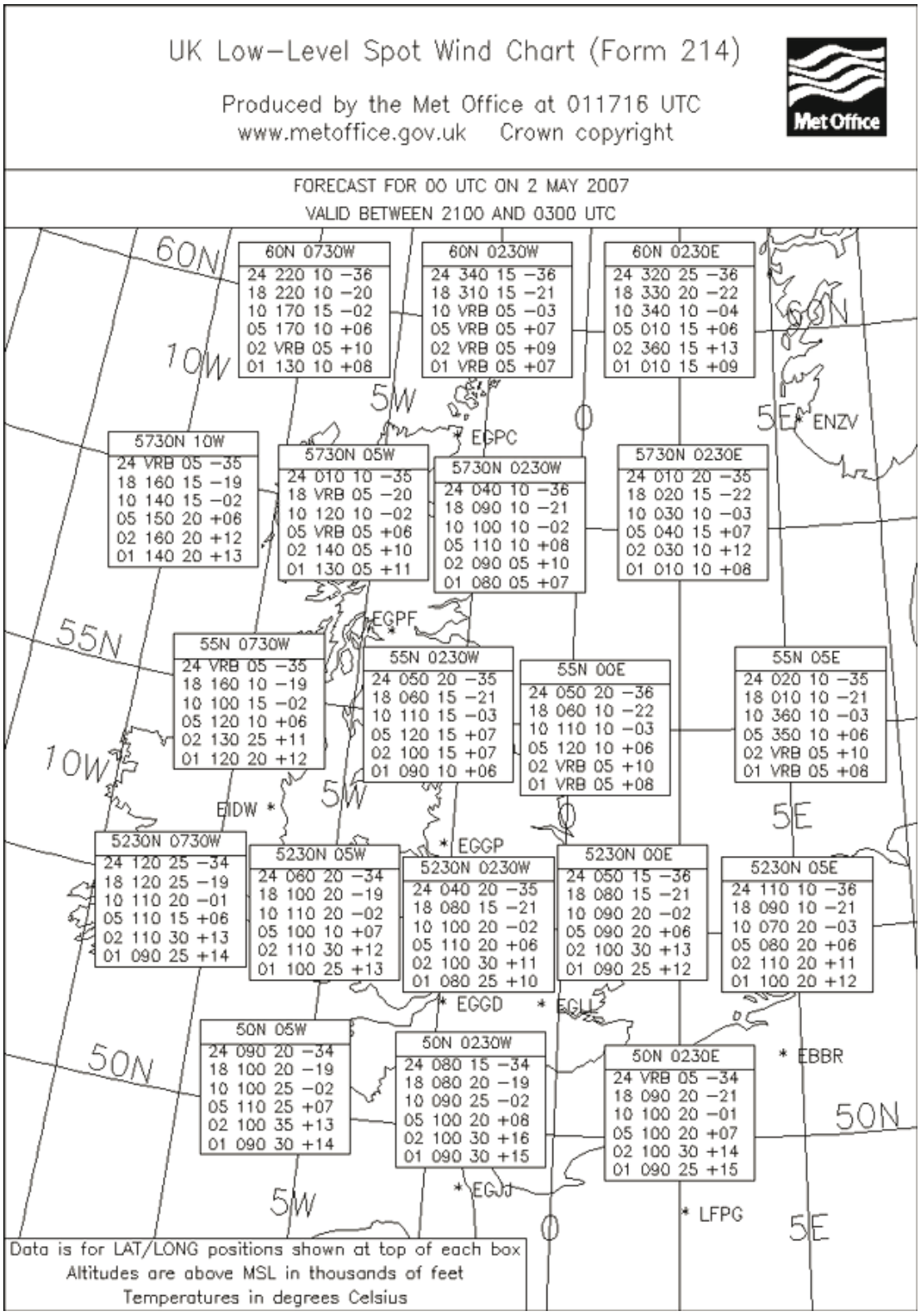
Met Office

Valid 012000 to 020500 Z MAY 07. Fronts/zones valid at 020000 Z

AREA	SURFACE VIS AND WX	CLOUD	0 C
A	20 KM NIL OCNL 3000 M BR ISOL 200 M FG OCNL HILL FG	BKN/OVC ST 003-010 / 015-020 ... ... (BASE 000 FG)	080
B	20 KM NIL OCNL 7 KM HZ **B1** ISOL 3000 M BR LAN FM 00 Z **B1** OCNL Λ S OF 52N	NIL	070 E 090 W
C	15 KM NIL ISOL 7 KM SHRA/RA ISOL 3000 M +TSRA ISOL 2000 M BR SEA COT ISOL Λ ISOL HILL FG	SCT/BKN CU SC AC Ψ Λ 040-060 / XXX ISOL CB 040 / XXX ISOL BKN ST 004-010 / 015 SEA COT	080
D	30 KM NIL ISOL 7 KM SHRA	AREAS BKN CU SC Ψ Λ ... ... 015-025 / 060-080	060

Outlook Until: 021200 Z
BR in zone B clearing. ST BECMG confined to sea/COT.

Appendix 1



Appendix 2

AIRMET AREA FORECAST, CENTRAL ENGLAND,
VALID MAY 01/1700Z TO 02/0100Z.

MET-SITUATION: HIGH PRESSURE N OF SCOTLAND BRINGS A STABLE E FLOW TO THE AREA.

STRONG WIND WRNG: OCNL GUST 25-30KT BECMG ISOL GUST 20KT OVERNIGHT.

WINDS:
1000FT: 080/25KT BECMG 30KT IN S. PS13 BECMG PS09.
3000FT: 100/20-25KT BECMG 30KT IN S. PS09.
6000FT: 110/20KT OCNL 25KT IN S. PS04.

FREEZING LEVEL: 9000FT.

WEATHER-CONDITIONS: 2 ZONES AT 18Z:

ZONE 1: NE OF A LINE MORAY FIRTH DOWN THE E COAST TO N-YORK-MOORS, MOVING INLAND IN A SW'LY DIRECTION AT 10KT FM 18Z:

GEN 15KM, WITH 4-7/8ST 1000FT/1500.
OCNL, 3000M IN BR OR DZ, WITH 7/8ST 300FT/2000.
ISOL, 200M IN FG, WITH 5-7/8ST SFC/1500.

WRNG: CLD ON HILLS.

ZONE 2: ELSEWHERE:

GEN 30KM, WITH 0-2/8SCAC 5000FT/8000.
ISOL N OF 52N FM 20Z, 7KM IN HZ WITH NIL CLD.

WRNG: OCNL MOD TURB BELOW 6000FT S OF 52N.

OUTLOOK: UNTIL MAY 02/0900Z:

AREAS BR/ST AND ISOL FG IN THE NE CORNER AT DAWN MOSTLY CLEARING BY 09Z. ELSEWHERE LITTLE CHANGE.

Appendix 3

Luton (elevation 526 FT AMSL):

TAFs
EGGW 011202Z 011322 09017KT CAVOK TEMPO 1321 09020G30KT=
EGGW 011504Z 011601 09017G28KT CAVOK BECMG 1821 06012KT=
EGGW 011802Z 011904 07014KT CAVOK PROB40 TEMPO 1920 08016G27KT=

METARs
1650Z 01/05/07 EGGW 011650Z 10016KT CAVOK 17/02 Q1014=
1720Z 01/05/07 EGGW 011720Z 08016KT CAVOK 17/03 Q1014=
1750Z 01/05/07 EGGW 011750Z 08016KT CAVOK 16/03 Q1014=
1820Z 01/05/07 EGGW 011820Z 08014KT CAVOK 16/05 Q1014=
1850Z 01/05/07 EGGW 011850Z 08014KT CAVOK 15/05 Q1014=
1920Z 01/05/07 EGGW 011920Z 07010KT CAVOK 14/05 Q1014=
1950Z 01/05/07 EGGW 011950Z 06009KT CAVOK 13/05 Q1015=
2020Z 01/05/07 EGGW 012020Z 06009KT CAVOK 12/05 Q1015=
2050Z 01/05/07 EGGW 012050Z 06011KT CAVOK 12/05 Q1015=
2120Z 01/05/07 EGGW 012120Z 06010KT CAVOK 11/04 Q1015=
2150Z 01/05/07 EGGW 012150Z 05010KT CAVOK 10/05 Q1015=
2220Z 01/05/07 EGGW 012220Z 05010KT CAVOK 09/06 Q1015=
2250Z 01/05/07 EGGW 012250Z 05011KT CAVOK 09/06 Q1015=
2320Z 01/05/07 EGGW 012320Z 04010KT CAVOK 09/06 Q1015=
2350Z 01/05/07 EGGW 012350Z 04009KT CAVOK 07/06 Q1015=
0020Z 02/05/07 EGGW 020020Z 04010KT CAVOK 07/06 Q1015=
0050Z 02/05/07 EGGW 020050Z 04009KT CAVOK 06/06 Q1015=
0120Z 02/05/07 EGGW 020120Z 03009KT CAVOK 06/05 Q1015=
0150Z 02/05/07 EGGW 020150Z 03009KT CAVOK 06/05 Q1015=
0220Z 02/05/07 EGGW 020220Z 03009KT CAVOK 06/05 Q1015=
0250Z 02/05/07 EGGW 020250Z 03009KT CAVOK 06/05 Q1015=

East Midlands (elevation 306 FT AMSL):

TAFs
EGNX 011207Z 011322 09013KT CAVOK PROB40 TEMPO 1318 11015G25KT=
EGNX 011502Z 011601 09013KT CAVOK PROB30 TEMPO 1618 11015G25KT PROB30
2301 7000=
EGNX 011801Z 011904 09013KT CAVOK BECMG 2301 7000 PROB40 0104 4000 BR
BKN004=
EGNX 012103Z 012207 04009KT CAVOK PROB30 0407 5000 BKN005=

METARs
1650Z 01/05/07 EGNX 011650Z 06018KT CAVOK 17/M02 Q1015=
1720Z 01/05/07 EGNX 011720Z 06015KT CAVOK 17/M02 Q1015=
1750Z 01/05/07 EGNX 011750Z 06015KT CAVOK 16/M02 Q1015=
1820Z 01/05/07 EGNX 011820Z 06014KT CAVOK 15/M00 Q1015=
1850Z 01/05/07 EGNX 011850Z 06014KT CAVOK 13/02 Q1016=
1920Z 01/05/07 EGNX 011920Z 05010KT CAVOK 12/03 Q1016=
1950Z 01/05/07 EGNX 011950Z 05010KT CAVOK 11/04 Q1016=
2020Z 01/05/07 EGNX 012020Z 05010KT CAVOK 11/05 Q1017=
2050Z 01/05/07 EGNX 012050Z 05011KT CAVOK 10/06 Q1017=
2120Z 01/05/07 EGNX 012120Z 06011KT CAVOK 09/06 Q1017=
2150Z 01/05/07 EGNX 012150Z 06009KT CAVOK 08/06 Q1017=
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2320Z 01/05/07 EGNX 012320Z 04008KT 9999 FEW012 07/05 Q1018=
2350Z 01/05/07 EGNX 012350Z 05007KT 9999 SCT010 07/05 Q1018=
0020Z 02/05/07 EGNX 020020Z 04007KT 9999 SCT010 07/05 Q1018=
0050Z 02/05/07 EGNX 020050Z 03003KT 9999 SCT010 06/05 Q1018=
0120Z 02/05/07 EGNX 020120Z 02003KT 9999 SCT010 06/05 Q1018=
0150Z 02/05/07 EGNX 020150Z 02004KT 9999 SCT010 06/05 Q1018=
0220Z 02/05/07 EGNX 020220Z 02006KT 9999 SCT010 06/05 Q1018=
0250Z 02/05/07 EGNX 020250Z 02006KT 9999 SCT010 05/04 Q1018=

Cottesmore (elevation 461 FT AMSL):

TAFs
EGXJ 011108Z 011221 08017G27KT CAVOK BECMG 1921 07012KT=
EGXJ 011328Z 011523 06017G27KT CAVOK BECMG 1921 07012=
EGXJ 011654Z 011823 06017G27KT CAVOK BECMG 1921 07012KT PROB30 TEMPO
2223 7000 BKN012=
(note, there was a typo in the 1523 TAF where 'KT' was omitted from
the wind group at the end ('07012' should have read '07012KT').

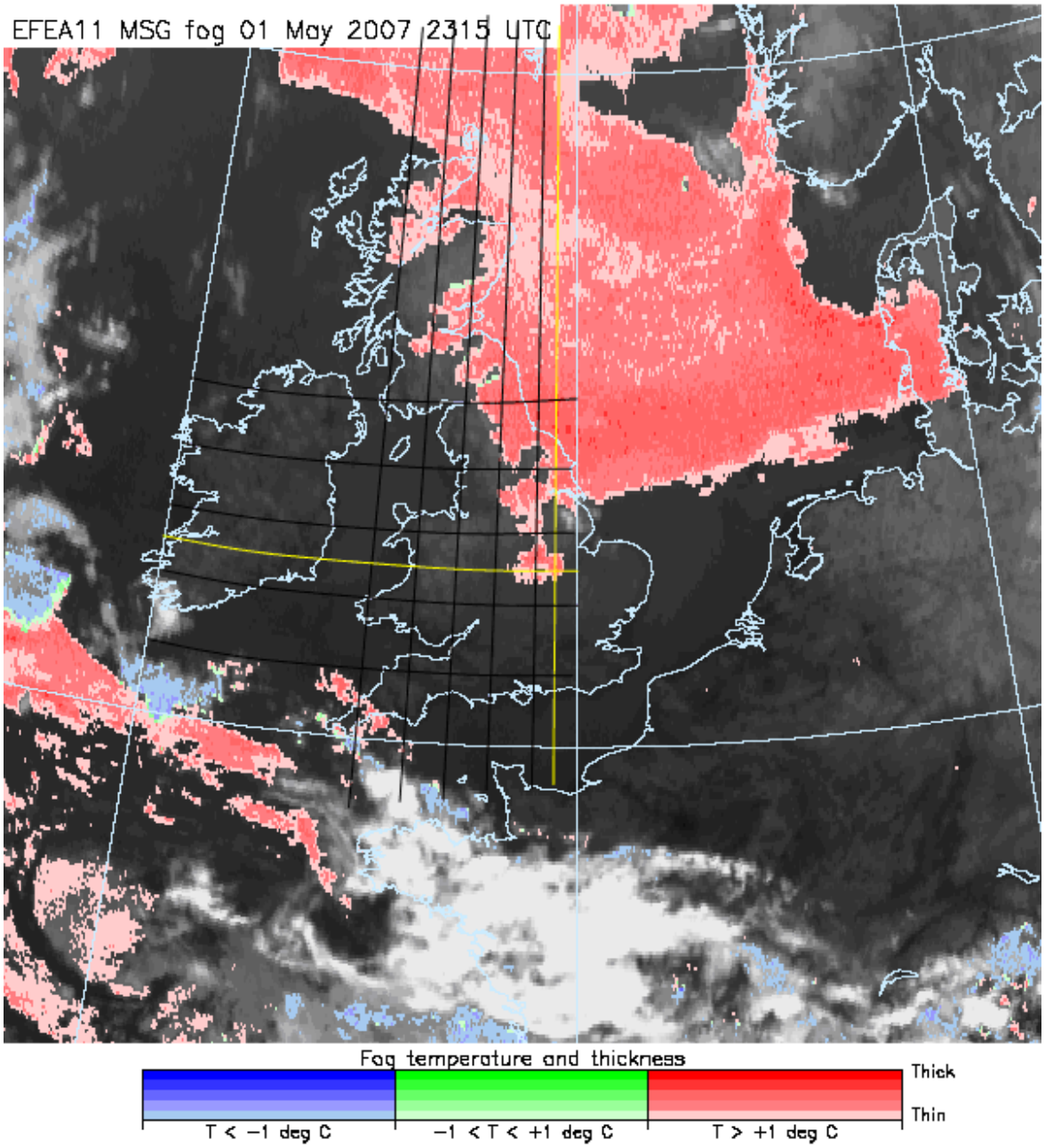
METARs
1650Z 01/05/07 EGXJ 011650Z 05017KT CAVOK 16/M00 Q1016 BLU NOSIG=
1750Z 01/05/07 EGXJ 011750Z 05018KT CAVOK 14/01 Q1016 BLU NO SIG=
1850Z 01/05/07 EGXJ 011850Z 06016KT CAVOK 12/04 Q1016 BLU NO SIG=
1950Z 01/05/07 EGXJ 011950Z 06015KT CAVOK 10/07 Q1017 BLU NOSIG=
2050Z 01/05/07 EGXJ 012050Z 04012KT 8000 HZ FEW003 08/07 Q1017 BLU
BECMG 5000 HZ SCT002 AMB=
SPECM EGXJ 012100Z 05013KT 6000 HZ BKN005 08/07 Q1017 YLO1 BECMG
BKN002 AMB=
SPECM EGXJ 012110Z 05015KT 5000 HZ BKN002 08/07 Q1017 AMB NOSIG=
2150Z 01/05/07 EGXJ 012150Z 05014KT 5000 HZ BKN002 08/07 Q1017 AMB=
2250Z 01/05/07 EGXJ 012250Z 05013KT 5000 HZ BKN002 08/07 Q1018 AMB=
2350Z 01/05/07 EGXJ 012350Z AUTO 03010KT 7000NDV BR OVC002/// 07/06
Q1018=
0050Z 02/05/07 EGXJ 020050Z AUTO 03009KT 5000NDV BR FEW003/// 06/06
Q1018=
0150Z 02/05/07 EGXJ 020150Z 02009KT 5000 HZ FEW004 06/05 Q1018 WHT=
0250Z 02/05/07 EGXJ 020250Z 01009KT 5000 HZ SKC 05/05 Q1018 WHT=

Wittering (elevation 273 FT AMSL):

TAFs
EGXT 011031Z 011218 09015G25KT CAVOK=
EGXT 011345Z 011518 08015G25KT CAVOK=
No more TAFs issued, due to airfield closure.

METARs
1650Z 01/05/07 EGXT 011650Z 04016KT CAVOK 17/04 Q1015 BLU=
1750Z 01/05/07 EGXT 011750Z 05015KT CAVOK 15/05 Q1015 BLU=
1850Z 01/05/07 EGXT 011850Z 04012KT CAVOK 12/07 Q1016 BLU=
1950Z 01/05/07 EGXT 011950Z 04012KT CAVOK 11/08 Q1016 BLU=
2050Z 01/05/07 EGXT 012050Z 04012KT 9999 BKN005 09/08 Q1017 YLO1=
2150Z 01/05/07 EGXT 012150Z 03010KT 5000 HZ BKN004 09/08 Q1017 YLO2=
2250Z 01/05/07 EGXT 012250Z 02011KT 3500 HZ BKN002 08/07 Q1017 AMB=
2350Z 01/05/07 EGXT 012350Z AUTO 02011KT 5000NDV BR OVC002/// 08/07
Q1017=
0050Z 02/05/07 EGXT 020050Z AUTO 02011KT 5000NDV BR BKN002/// 07/07
Q1017=
0150Z 02/05/07 EGXT 020150Z 01012KT 3000 BR BKN002 07/06 Q1017 AMB=
0250Z 02/05/07 EGXT 020250Z 02012KT 3000 BR BKN002 07/06 Q1017 AMB=

Appendix 4



Appendix 5

Fog Difference Image
10 minutes prior to the accident
(Intersection of the yellow lines identifies RAF Wittering)