ACCIDENT

Aircraft Type and Registration:	Cirrus SR20, N470RD
No & Type of Engines:	1 x Teledyne Continental IO-360-ES piston engine
Year of Manufacture:	2006
Date & Time (UTC):	10 August 2010 at 1435 hrs
Location:	Countryside near Hornton, near Banbury, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Aircraft damaged beyond economic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	180 hours (of which 109 were on type) Last 90 days - 10 hours Last 28 days - 4 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft adopted an unusual attitude while the pilot's attention was directed to the autopilot and GPS controls on the centre console. On recognising this unusual attitude, the pilot made a brief attempt to recover control before activating the aircraft's ballistic recovery system. The aircraft descended under the parachute and landed in open ground.

History of the flight

The pilot and passenger had flown in the aircraft from its base at Weston in Ireland to Turweston Aerodrome in Northamptonshire, intending to return on the same day. Prior to departure from Turweston, the pilot telephoned a number of aerodromes to obtain weather information. He discussed the weather conditions on his route with the Turweston aerodrome manager, who sourced a variety of meteorological information from the internet. The pilot concluded that the conditions were suitable for his intended flight. The aircraft was fuelled to full tanks, and the pilot carried out a pre-flight inspection. No defects were apparent, and he carried out pre-flight checks including removal of the split pin from the Ballistic Recovery System (BRS) activation handle and a test of the autopilot system before taxiing for departure.

The aircraft took off at 1428 hours. Staff on the airfield at Turweston at the time of departure estimated that the cloud base was then approximately 1,700 ft and said that, between passing showers, the visibility was

10 km or more. The pilot established the aircraft on track towards LIPCO[1], made contact with Birmingham Approach, and gave some details about his flight, including his intention to cruise at 4,500 ft. At 1436 hrs, the controller asked him to report his aircraft type. He made a broken transmission "AIRCRAFT TYPE IS A SIERRA ROMEO TWO ZERO AND WE'RE ACT…". The controller asked the pilot to continue to pass the information, to which the pilot replied "JUST PULLED THE 'CHUTE – WE'RE OK". A short time later the pilot transmitted "WE'RE DESCENDING OVER OPEN GROUND - UNDER PARACHUTE – WE INADVERTENTLY WENT IMC". The controller acknowledged this information, marked the aircraft's location on his radar display, and alerted the emergency services. There were no further communications between ATC and the aircraft.

The aircraft descended under the BRS parachute and impacted a tree on common ground near a village. The tree restricted the opening of the right side cabin door, but both occupants vacated the aircraft without difficulty using the left side door. Neither occupant sustained injury and there was no fire. Members of the public arrived at the aircraft and gave assistance to the pilot and passenger.

The pilot made a 999 call to the Police, during which he told the police operator that he had "LOST CONTROL". Fire and rescue service personnel dealt with a fuel leak from a ruptured fuel tank.

The pilot's recollections

The pilot and passenger returned to Ireland by public transport, and were interviewed first by investigators from the Irish government's Air Accident Investigation Unit, who assisted the AAIB in this investigation. The pilot was later interviewed by an AAIB investigator.

The pilot stated that having departed from Turweston, he engaged the autopilot in vertical speed and navigation modes. Approaching 3,000 ft, he decided that the weather ahead was not suitable to continue the flight. He stated that he selected the altitude hold mode of the autopilot and pre-selected the heading bug to command a turn of 90° from his course before turning his attention to the GPS screen to programme a return to Turweston. His attention was directed for a time to the autopilot and GPS controls on the centre console of the aircraft. He stated that there was then a "huge jolt" which caused his headset to fall from his head. He then found himself looking ahead "absolutely straight down" at the ground. He stated that he immediately checked the indicated airspeed, which was 120 kt, closed the throttle[2], and pulled the BRS activation handle. Later in the first interview he added that he had attempted to pitch the aircraft nose up before activating the parachute, but that the aircraft had not responded to his control input.

The pilot stated that he used one hand to pull the BRS handle, giving a firm, sustained, pull. He commented that the parachute deployed with a loud rustling sound and that it took longer to influence the aircraft's motion than he expected. He stated that the aircraft then descended under the parachute and that during the descent he saw that the aircraft was drifting towards a built-up area. Being aware of a previous event in the USA, during which the pilot of another Cirrus had used engine power to influence the aircraft's path during a parachute descent, he re-started the engine and

Footnote

[1] LIPCO is a reporting point on the FIR boundary over the Irish Sea south-east of Dublin.

Footnote

[2] Recorded information indicated that the engine was shut down or stopped at around this time.

attempted to steer the aircraft. He was not certain to what extent he was able to influence the aircraft's path. The aircraft then began to drift away from the built-up area and he shut the engine down again and switched off the aircraft's electrical system. The pilot said that the descent under parachute was "very gentle".

During the interviews with the pilot, he gave an account of events without mentioning having entered IMC. A copy of the RTF recording was played to the pilot during the second interview, and after listening to it he stated that he had not entered IMC but had made the transmission to indicate that he was turning because there was cloud ahead.

Pilot training

The pilot obtained a PPL(Aeroplanes) in 2007 and completed two days of Cirrus conversion training with a Cirrus certified instructor shortly after acquiring the aircraft. This training included use of the autopilot and associated systems, although the pilot acknowledged that he did not understand the operation of some autopilot selections. The pilot stated that he had no memory of a briefing on the BRS system, but that he had made himself very familiar with the system description in the aircraft documentation, and was aware of the maximum demonstrated deployment speed, which he stated was 132 kt[3]. He commented that he had developed the view that the parachute system was a "last resort". He had no qualification for flight in IMC.

Meteorological information

The Met Office supplied an analysis of the conditions in the area of Hornton, near the accident site, at the time of the event. From his study of satellite and radar images, the meteorologist concluded that Hornton lay on the boundary between an area of thick cloud cover to the south and more broken cloud with some clear areas to the north. His report stated:

> *'The location of Hornton is very close to the boundary between these two areas for much of the day, only becoming properly clear of the cloudier area in the south by the 1600 UTC frame. The nearest observation is from the METAR at Coventry airport (EGBE) which shows the cloud base lifting from 1100 UTC. However, given that the large mass of cloud moves only very slowly and erratically southwards through the day, Hornton is likely to have experienced lower cloud bases and poorer conditions later in to the day than Coventry (the satellite imagery shows the cloud to be more extensive over the Hornton area than the relatively short distance further north over Coventry). The rainfall radar also shows that Hornton was affected by rainfall on and off throughout the day, although it had cleared south by 1500 UTC. The implication of the rainfall is of a significant depth of cloud above the Hornton area.'*

There are no official meteorological observation sites close to Hornton. However, an indication of the conditions may be obtained from reports from the nearest stations. See Table 1.

The chief flying instructor at Shennington Gliding Club, 2 nm south-west of the accident site, recalled that at about 1430 hrs, the gliding club had ceased flying[4] because low cloud, rain, and drizzle had moved into

Footnote

[3] The Pilot's operating handbook states *'The maximum demonstrated deployment speed is 135KIAS…'.*

Footnote

[4] The last landing before the reported poor weather was at 1410 hrs, the first launch afterwards was at 1520 hrs)

Station	Visibility and weather		Cloud	
	1420 hrs	1450 hrs	1420 hrs	1450 hrs
Birmingham	10 km or more	10 km or more	FEW 3,000 ft	FEW 3,000 ft
Coventry	10 km or more	10 km or more	SCT 2,500 ft	SCT 2,400 ft
Gloucester	10 km or more	10 km or more	BKN 1,500 ft BKN 3,000 ft	BKN 1,500 ft BKN 3,000 ft
Cranfield	8 km	4 km, Rain	FEW 1,800 ft SCT 2,600 ft	SCT 1,000 ft SCT 2,000 ft
Fairford	4,800 m, Slight Rain, Mist (1355 hrs)	6 km Slight Rain, Mist (1455 hrs)	FEW 500 ft OVC 2,200 ft	OVC 2,200 ft
Brize Norton	3,000 m, Rain (1350 hrs)	2,500 m, Rain	BKN 500 ft, OVC 2,000 ft	BKN 400 ft, OVC 1,000 ft

Table 1

Meterological information

the area. He estimated that the cloud base was 800 to 1,000 ft above the airfield, and visibility was perhaps 1,500 m. The sky cleared promptly, after 30 or 45 min of poor weather.

ATC and emergency services response

The controller working the Birmingham Approach frequency did not, at first, recognise that the pilot's transmissions regarding the parachute having been deployed referred to a BRS parachute. He quickly realised, however, that it was unlikely that the pilot would make a radio transmission whilst descending under a personal parachute, and his knowledge of the Cirrus aircraft assisted him in realising that the whole aircraft was descending by parachute.

The investigation identified that staff members of air navigation service providers have not been informed, in any formal way, of the development and introduction of ballistic recovery systems. Whilst many staff members are aware of the systems, and some know that they are fitted to a variety of aircraft including the Cirrus, others do not.

Recorded data

The aircraft was equipped with an Avidyne Entegra Primary Flight Display (PFD) and Multifunction Flight Display (MFD). These were removed from the aircraft and the data read out at the AAIB's laboratory. The version of the PFD software installed meant that parameters relating to the autopilot were not recorded.

Recording began as the aircraft taxied at Turweston and ended with the aircraft on the ground following the accident. The later part of the accident track, based on the GPS positions and recorded pressure altitude, is presented in Figure 1. Selected recorded flight parameters are plotted in Figure 2 for the whole of the accident flight. The accelerations, which were recorded from accelerometers within the PFD, were converted to units of 'g' and corrected to the aircraft's centre of gravity position before being plotted. The altitude bug

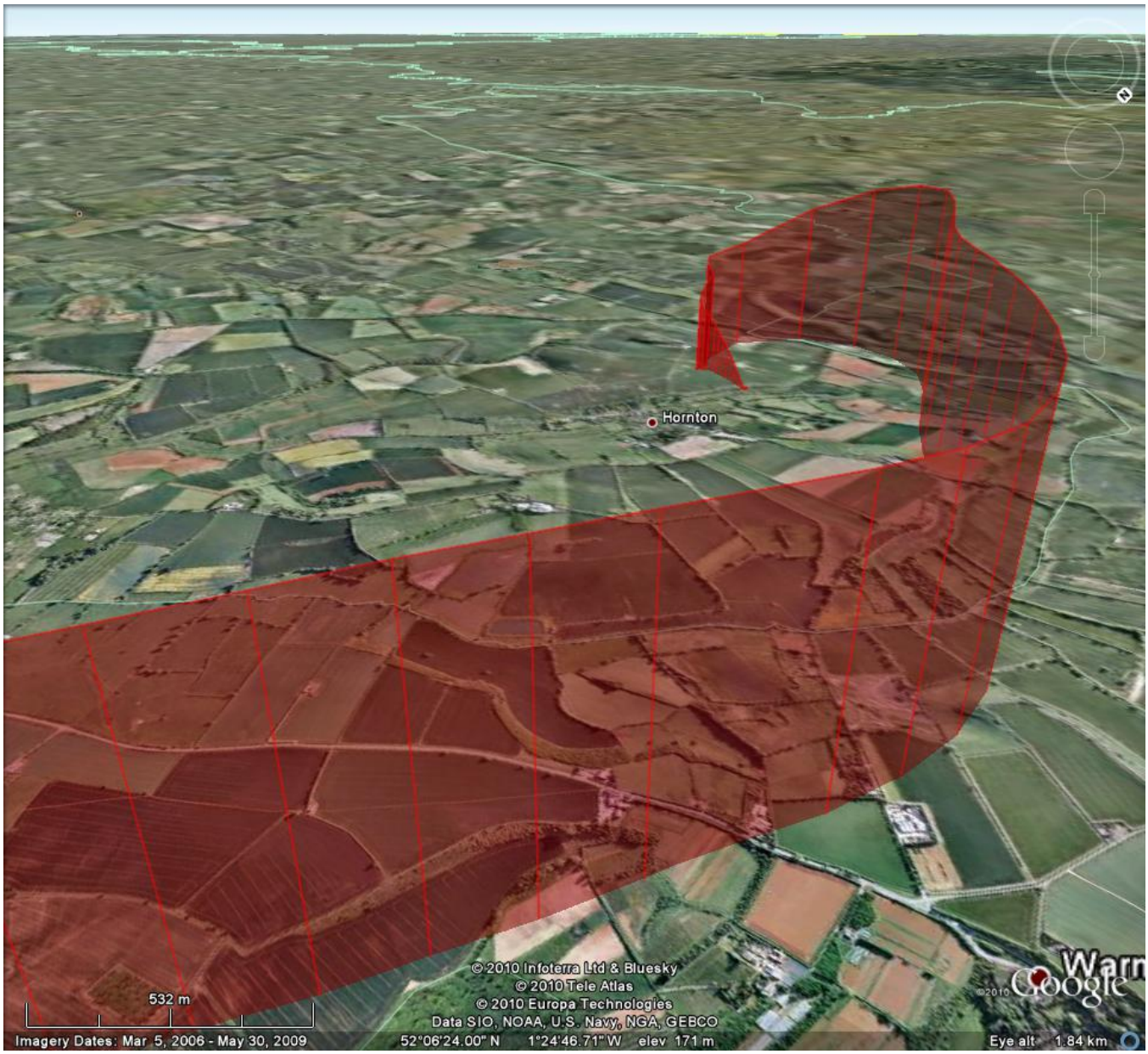

Figure 1

3D view of the latter part of the aircraft's track
from GPS position and recorded pressure altitude

and heading bug values were recorded each time either of these parameters was changed during the flight.

Figure 2 shows that between 1430:30 hrs and 1434:30 hrs, the aircraft was climbing at a constant 400 ft/min on a heading of 295ºM. The recorded engine speed was 2,530 rpm and the indicated airspeed 120 kt, reducing to 115 kt. The aircraft then began to level off. 25 seconds later, at 1434:55 hrs, the aircraft reached 3,360 ft amsl and this altitude was selected on the altitude bug. During the next 75 seconds of flight the data is smoother than data recorded up to this point. The recorded data covering this portion of the flight is presented in more detail in Figure 3, which includes the

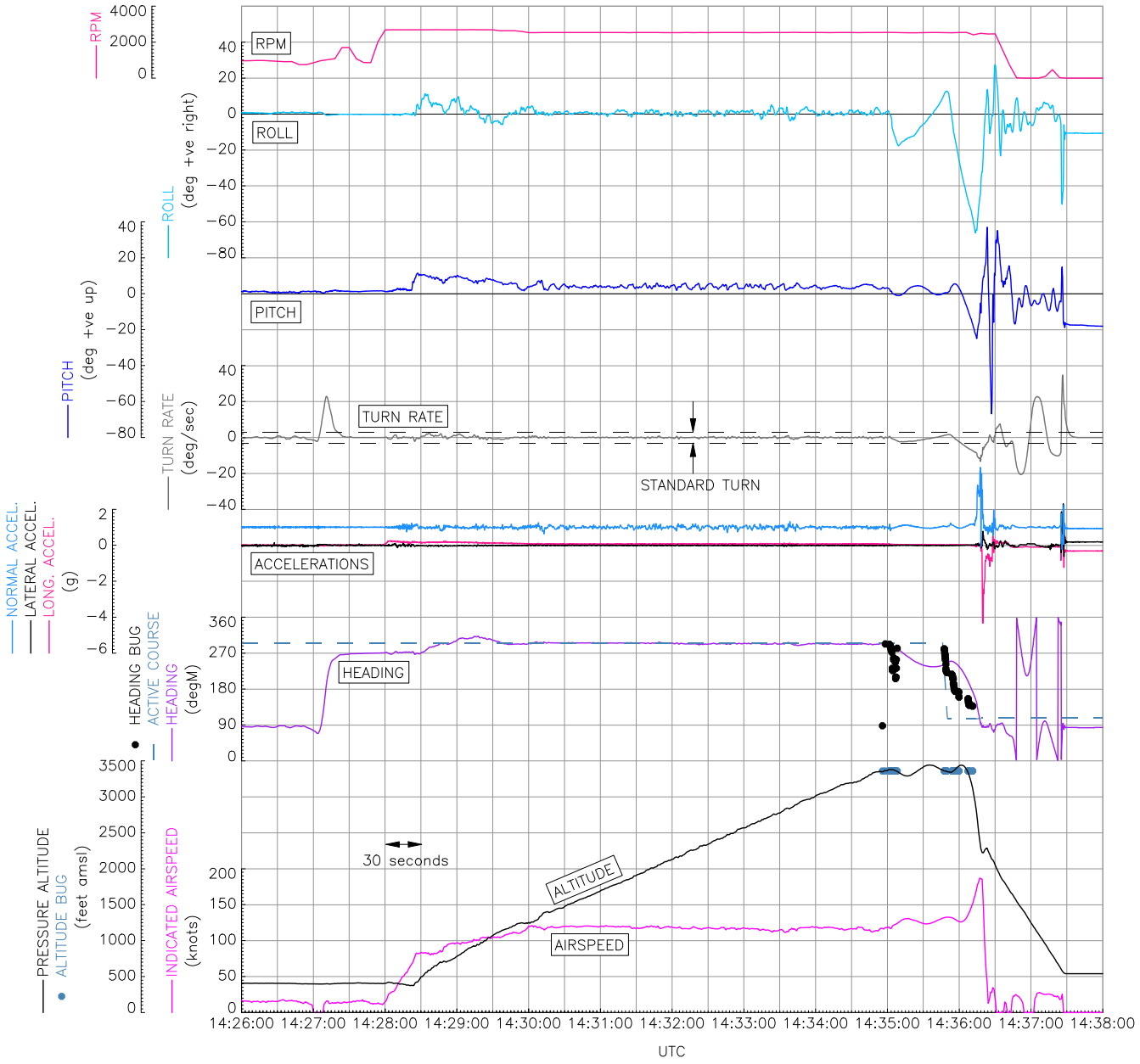

Figure 2

Salient recorded parameters from the PFD and MFD showing the whole flight

'active course bearing' from the recorded navigation data for the selected navigation source, and some of the radio calls between N470RD and Birmingham Approach.

Between times 1434:55 hrs and 1436:15 hrs, the aircraft's flight path and attitude were not stable. The altitude climbed gradually by about 50 ft while oscillating two and a half times through ±75 ft, with corresponding oscillations in pitch (±3º) and airspeed (± 5 kt and increasing by 10 kt). The roll was less oscillatory (and also not in phase with the pitch oscillations), initially rolling to 18º left wing down then to 13º right wing down, and then to the left again.

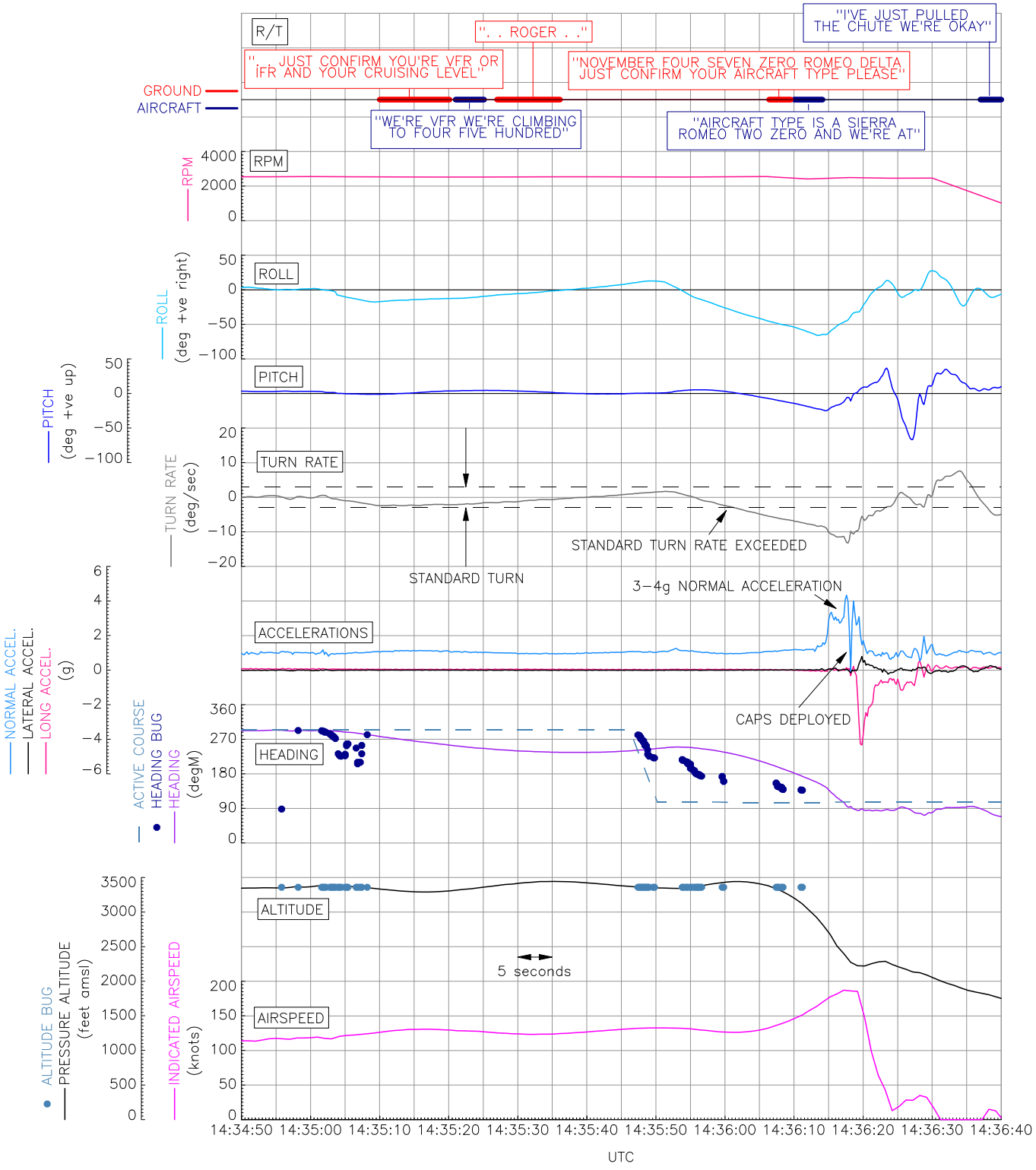

Figure 3

Salient recorded parameters from the PFD and MFD from top of climb to the CAPS deployment

A corresponding heading change can be seen as the aircraft initially turned to the left from 295ºM through 50º, at less than the standard turn rate of 3º/sec. As the aircraft started to turn there were a number of changes to the heading bug over a period of seven seconds. On reaching 235ºM in the left turn, the aircraft started a similarly gentle turn to the right through 15º during which the active course changed from 295ºM to 197ºM. The heading bug also changed in stages to 221ºM. The aircraft then started another turn to the left, during which the turn rate exceeded the standard value and continued to increase. A similar divergence was recorded in the aircraft's attitude as it banked left and pitched down, with increasing airspeed and loss in altitude. Further heading bug changes were recorded, to a final value of 137ºM.

At 1436:13 hrs, as the bank angle reached 66º left wing-down and the pitch 25º nose-down, there was a sharp rise in the normal acceleration from a nominal 1g to 3g, and then to 4g two seconds later, consistent with recovery from a developing spiral dive. A review of the recorded data made by the aircraft manufacturer confirmed that from 1436:17 hrs, the aircraft's flight profile and dynamics were consistent with the CAPS having being deployed. At the time of deployment (1436:17 hrs) the aircraft's altitude and airspeed were 2,400 ft amsl and 187 kt, respectively. The pitch attitude was 9º nose-down and aircraft was banked 45º to the left.

The recorded data provided no evidence of a significant jolt or abrupt change in the flight path prior to the moment at which the BRS was activated.

Accident site

The aircraft was substantially intact and was located at the foot of a large tree. Several branches were broken and there were areas of surface damage to the aircraft in which there were transfer marks from the bark of the tree. The tree had probably absorbed some of the energy of the descending aircraft.

The parachute was still attached to the aircraft. This was inspected and found to have several scorch marks that ran in a line on the parachute canopy. These marks were consistent with the canopy having contacted overhead electricity lines that were located nearby. Local residents reported a power cut at approximately the time the aircraft landed, which further supports this. There was some minor damage to the parachute that might have been caused by high forces. Early in the recovery operation the parachute was detached from the aircraft to ensure that it did not re-inflate, move or further damage the aircraft.

The PFD and MFD were removed so that flight data information could be extracted.

The cover panel of the Ballistic Recovery System, measuring 43 x 38 cm, was recovered from a nearby field. The words '*Warning! Rocket for parachute deployment inside stay clear when airplane occupied*', appeared in two places, in black letters on an adhesive sticker which measured 4 x 17 cm.

The aircraft was recovered to AAIB for further examination.

Aircraft information

N470RD was an SRV version of the SR20 aircraft. The aircraft was fitted with two large electronic flight display units: the PFD and MFD. The aircraft had two conventional instruments: an airspeed indicator and an altimeter. The aircraft was approved for flight under VFR only.

The aircraft was fitted with a ballistic recovery system, as standard for the type. This is an emergency parachute that is deployed from a compartment behind the cabin and is activated by pulling a handle in the cockpit. The maximum parachute deployment speed demonstrated by the manufacturer was 135 KIAS. Both successful and unsuccessful deployments have been recorded at speed in excess of 135 KIAS.

The aircraft was fitted with an S-TEK 55SR autopilot driving a roll trim servo and a pitch trim servo. Pilot inputs to the stick mounted trimmer button are also fed into the autopilot. The roll computer function of the autopilot receives signal input from the PFD and from the turn co-ordinator. The latter is a standard gyroscopic instrument mounted behind the instrument panel and is not visible to the pilot during flight.

The pitch computer function in the autopilot receives input from the altitude transducer (which receives input from the static pressure port), an accelerometer inside the autopilot unit, glideslope deviations and pilot input speed selections.

Aircraft manufacturer's analysis of the recorded data

The manufacturer analysed the recorded data and reported that in the minute or so prior to the BRS activation, the data showed that either the autopilot was not engaged, or it was engaged but was malfunctioning, or there was some other influence on the flying controls (possibly from pressure inadvertently applied by the pilot or passenger to the side control sticks).

Engineering investigation

The three primary flight controls were checked for continuity, and full and free movement. No anomalies were identified.

The autopilot system was ground tested with inputs to the altitude transducer, the turn co-ordinator, the accelerometer in the autopilot unit and the PFD. The autopilot was tested in various modes and the functioned normally.

The turn co-ordinator was tested at a specialist instrument facility and functioned normally.

Analysis

The background to the flight, preparation, and departure, all appear to have been unremarkable. The aircraft was apparently airworthy, and the pilot qualified. Whilst poor weather was reported not far from Turweston, there is no evidence that the pilot departed in inappropriate conditions.

As the aircraft climbed towards the pilot's intended cruising altitude of 4,500 ft, the pilot apparently decided to turn back towards Turweston, perhaps as he approached the poor weather which had caused the gliding club at Shennington to stop flying. He selected the altitude mode of the autopilot and attempted to command a turn back towards Turweston.

In doing so, the pilot adjusted the heading bug and programmed the GPS. During this time, the aircraft began a series of manoeuvres, slight at first but becoming more dynamic. The pilot's attention was directed towards the controls on the centre console of the aircraft, which might explain why he was not aware that the aircraft was not performing as he intended.

The cause of the subsequent manoeuvres could not be identified. The pilot reported that the autopilot was engaged at the time, but the aircraft manufacturer's analysis of the recorded data shows that it was either not engaged, was malfunctioning, or there was some interference with the controls.

The pilot recalled feeling a jolt and then looking up and seeing that the aircraft was pointed at the ground. Examination of the recorded data showed no evidence of a jolt prior to activation of the BRS, and the engineering investigation found no mechanism by which a jolt would have occurred.

The BRS was activated shortly after the aircraft reached an attitude 25° nose down and 66° left wing-down. The pilot's remarks are consistent with his realisation that the flight path was abnormal at that time. Recorded information shows that the aircraft's nose then pitched up with a 3 g and then a 4 g normal acceleration, which was probably the result of the pilot's attempt to recover the aircraft's attitude, as he mentioned when interviewed.

It was not possible to determine if the aircraft had entered IMC inadvertently, as the pilot reported initially.

The pilot recalled seeing an indicated airspeed of 120 kt before he pulled the BRS activation handle. Recorded data shows that it was 187 kt at the time. This speed is considerably in excess of the maximum demonstrated deployment speed stated by the manufacturer.

The engineering investigation identified no abnormalities in the aircraft or its systems. An intermittent or occasional malfunction of the autopilot could not be ruled out, although all tests indicated that the autopilot and associated systems functioned normally.

Discussion

Pilots using automatic flight devices must monitor those devices constantly to ensure correct functioning, and intervene promptly if abnormalities occur. Confusion about the active modes of such devices, and failures to recognise malfunctioning automation, have been reported as causal in several accidents.

Recorded data was useful in the investigation. Although it was unfortunate that some parameters, such as autopilot engagement and mode, were not recorded, recorders are not mandatory on this type of aircraft, so no Safety Recommendation is appropriate in this regard.

Safety action

In realising that the whole aircraft was descending under parachute the Birmingham Approach controller was guided by his personal knowledge of ballistic recovery systems, not any formal information or training. The absence of information or training for air navigation service providers' staff on ballistic recovery systems was discussed with the Civil Aviation Authority, and appropriate information will be published on the topic.