ACCIDENT

Aircraft Type and Registration:	Piper PA-31P Pressurised Navajo, N95RS
No & Type of Engines:	2 Lycoming TIGO-541 piston engines
Year of Manufacture:	1974
Date & Time (UTC):	15 January 2010 at 1407 hrs
Location:	Bladon, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Fatal) Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed by post-impact fire
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	54 years
Commander's Flying Experience:	12,500 hours (hours on type not known) Last 90 days - n/k hours Last 28 days - 10+ hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft took off from Oxford for a planned flight up to FL190. The reported visibility was 2,000 m with a cloudbase of 200 ft. The pilot established two-way radio communication with Brize Radar and was cleared to climb to FL80. The controller observed the aircraft climb to around 1,500 ft then saw that it had started to descend. There were no further communications from the aircraft and two minutes later it crashed into a field. The post-mortem examination showed that the pilot had severe coronary heart disease and there was evidence to suggest that he may have been incapacitated, or died, prior to the collision with the ground. The passenger was a qualified private pilot but was not experienced with either the aircraft or flight in IMC.

History of the flight

The aircraft had recently been purchased in Germany and was flown to the United Kingdom on 11 December 2009 by the pilot of the accident flight. The new owner, who accompanied him for the flight from Germany, was a private pilot himself and was the passenger in the accident. The aircraft landed at Oxford on the evening of 11 December. The pilot reported to a maintenance organisation that there had been a problem with the brakes after landing and the aircraft was left parked outside a hangar.

Minor maintenance was carried out on 20 December 2009 and on 9 January 2010 the aircraft was refuelled, but it was not flown again until the accident flight.

On the morning of 15 January 2010 the pilot and his passenger met at Oxford Airport and prepared the aircraft for flight. The plan was to carry out an air test, although its exact nature was not established. The flight was pre-notified to Royal Air Force (RAF) Brize Norton as an air test with a requested level of FL190.

At 1344 hrs the aircraft taxied out to Holding Point C for Runway 19 at Oxford. The pilot reported 'READY FOR DEPARTURE' at 1400 hrs and was given a clearance for a right turn after takeoff with a climb initially to FL80. The pilot then requested the latest weather information and the tower controller provided the following information: '.....TWO THOUSAND METRES IN MIST AND CLOUD IS BROKEN AT 200 FEET.'

At 1403 hrs the takeoff commenced and shortly after liftoff Oxford ATC suggested that the pilot should contact Brize Radar on 124.275 Megahertz (MHz). The pilot made contact with Brize Radar at 1404 hrs, two-way communication was established and the provision of a Deconfliction Service was agreed.

On the radar screen the Brize Norton controller observed the 'Mode C' (altitude) return increase to around 1,500 ft and then noticed it decrease, seeing returns of 1,300 ft and 900 ft, before the secondary return disappeared. At 1406 hrs the Brize Norton controller contacted Oxford ATC to ask if the aircraft had landed back there and was advised that it had not done so, but that it could be heard overhead. The Brize Norton controller told Oxford ATC that they had a continuing contact, but no Secondary Surveillance Radar (SSR). The Oxford controller could still hear an aircraft in the vicinity and agreed with the Brize Norton controller to attempt to make contact. At 1407 hrs Oxford ATC made several calls to the aircraft but there was no reply. The Oxford controller told the Brize Norton controller there was no reply and was informed in return that there was no longer any radar contact either.

The Brize Norton controller also attempted to call the aircraft at 1407 hrs but without success. At 1410 hrs the Oxford controller advised the Brize Norton controller that there was smoke visible to the west of the airfield and they would alert both the airport and local emergency services.

In the meantime several witnesses saw the aircraft crash into a field to the west of Oxford Airport. A severe fire started soon afterwards and bystanders who arrived at the scene were not able to get close to the aircraft. The local emergency services were notified of the accident by witnesses at 1407 hrs.

Meteorological information

The weather during the time the aircraft was parked at Oxford was unusually cold with snow lying on the ground for several weeks. By 15 January 2010 much of the snow had melted and the main movement areas at Oxford Airport were clear.

The weather observation for Oxford Airport at 1330 hrs was: surface wind from 170º at 8 to 12 kt, visibility 2,000 m, cloud broken at 200 ft temperature 3ºC, dewpoint 2ºC and pressure 1015 hPa. Stage one low visibility procedures, principally involving a test of communications, were implemented at Oxford at 1340 hrs.

The 1350 hrs Meteorological Report for RAF Brize Norton was: surface wind from 170º at 4 kt, visibility 2,000 m, cloud overcast at 200 ft, temperature 5ºC, dewpoint 4ºC, and pressure 1015 hPa.

Airport information

Oxford has an Air Traffic Zone extending in a circle of radius 2 nm around the airfield and an Air Traffic Service. The Oxford ILS/DME/NDB RWY 19 procedure minima for this aircraft was 458 ft amsl/200 ft aal. Radar coverage for the local area can be provided by Brize Radar on request.

The airfield elevation is 270 feet. Terrain rises to 400 ft 1nm south west of the airport.

Pilot information

The pilot was an airline transport pilot whose main flying activity was working for an airline as a training captain on Boeing 737-800 aircraft. For the three days prior to the accident the pilot had been conducting aircraft training with pilots new to type. When this training is being conducted a type-qualified safety pilot is seated on the jumpseat. The pilot had returned to his home on the evening of the day before the accident.

The pilot also had various general aviation interests. He was a commercial helicopter pilot with a valid instructor rating and an active fixed-wing pilot. His Multi-engine Piston (MEP) rating was renewed on 2 November 2009. No logbook record of his recent general aviation flying activities was found so it was not possible to know precisely how much of this type of flying he had done in the recent past.

The passenger was a qualified private pilot; no logbook record of his flying experience was found. He obtained his PPL on fixed-wing aircraft in November 2008 and his PPL(H) in March 2009. He was reported to have flown his own Robinson R44 helicopter on a regular basis. He carried out a full-time training course to obtain an MEP rating in November 2009 using a Piper Seneca aircraft. It was recorded on his application form for the rating that he had 93 hours of pilot in command flight time. When he had completed his MEP course he started working towards obtaining an IMC rating; at the time of the accident he had done about 4 hours dual training, also on a Piper Seneca. His instructor gave his opinion that at his stage of training and experience he would be unlikely to have been able to successfully fly a Piper Navajo aircraft in IMC.

Medical and pathological information

Autopsy examinations were carried out on the bodies of both occupants. These examinations showed that both had suffered severe multiple injuries and that the crash was non-survivable. Death would have occurred before the onset of the post-crash fire and no alcohol or drugs were detected in toxicological tests. The autopsy report for the pilot showed that he was suffering from:

> *'a severe degree of coronary artery disease which would be capable of producing a range of cardiac symptoms including arrhythmias, angina, collapse or sudden death.'*

It also commented that there was no convincing evidence that the pilot was alive at the time of sustaining his injuries.

The pilot held a current JAR Class 1 medical certificate. His most recent medical examination took place on 29 September 2009. In September 2008 a minor anomaly was detected on his ECG (electrocardiogram) which was referred to a cardiologist who assessed it as being acceptable for certification. The ECG in September 2009 showed a similar anomaly and was passed as being acceptable without reference to a cardiologist. Following the accident both ECGs were

reviewed by an independent cardiologist who concurred that the changes would not necessarily have warranted further investigation.

Aircraft information

Background and aircraft history

The Piper PA-31P Pressurised Navajo has two geared turbocharged piston engines, with three-bladed propellers, and a pressurised cabin, giving a quoted service ceiling of over 24,000 ft. It was not possible to determine precisely the instrumentation and equipment fitted to N95RS at the time of the accident, but interior photos of the aircraft, taken at an unknown date, showed a full set of instruments on the right-hand side. Post-accident examination of this heavily fire-damaged area supported this. Flap operation is electrical, by an 'ungated' switch in front of the right control column, with flap setting indicated on a gauge positioned on the right instrument panel.

The aircraft was manufactured in the USA in 1974, initially registered there and so registered at the time of the accident. The aircraft had been purchased in Germany and ferried to Oxford in December 2009 following the change of ownership; the accident flight of 15 January 2010 was the first to take place after the ferry flight.

Recent records of the aircraft technical and maintenance history were not available and the ferry flight had carried the same pilot and passenger who received fatal injuries in the accident. A witness to the departure of the aircraft from the German base stated that the maintenance documentation relating to the complete history of the aircraft was placed in the main cabin before the departure from Germany. None of this documentation was recovered, but was probably destroyed by the sustained post-crash fire. All maintenance and aircraft information held by the FAA in their records was supplied to the AAIB but did not include recent aircraft maintenance.

The only recent maintenance of which full details were available was the rectification of a brake defect, identified during the landing at Oxford following the delivery flight from Germany, together with replacement of two lights and the aircraft battery. This work was carried out on 20 December 2009. None of these actions involved any physical work on parts of the aircraft relevant to its flight performance or handling characteristics. A work pack covering inspections and maintenance carried out in Germany approximately 11 months before the accident, was recovered by the Bundesstelle für Flugunfalluntersuchung (BFU, the German air safety investigation body) and supplied to AAIB. This appeared to cover those actions necessary to issue an Airworthiness Review Certificate.

The airport operators informed the AAIB that N95RS was refuelled at Oxford on 9 January 2010, six days before the accident. The fuel sample taken on the day the aircraft was refuelled was recovered by the AAIB and subjected to analysis; it was found to conform fully to the required specification.

Wreckage and accident site

The aircraft struck the ground on an approximately level, snow-covered, cultivated field at an elevation of about 300 ft and examination of the wreckage site confirmed that the aircraft had struck the ground whilst structurally complete. It was erect, flying in a slightly nose-down and slightly right-wing-down attitude, with the landing gear retracted. At the time of impact the aircraft had a higher rate of descent than would be accounted for as a direct consequence of the pitch angle. The heading at impact was approximately

westerly and the flaps were set at 15º. The aircraft was largely destroyed by a sustained ground fire.

Both propellers showed evidence of having been rotating at similar speeds at impact. However, no direct evidence of blade pitch position was found, so the power setting could not be determined. Strip examination of the engines revealed no evidence of internal failure and the components were in a condition consistent with correct engine operation at the time of impact. Examination of the flying controls revealed no evidence of pre-impact failure. The extent of fire damage, however, precluded a realistic examination of the aircraft instruments.

Air traffic control

RAF Brize Norton provides a Lower Airspace Radar Advisory Service (LARS), Brize Radar, in the accident area. The pilot established two-way RTF contact with Brize Radar and the provision of a Deconfliction Service was agreed. This is a surveillance-based service, which may be in VMC or IMC, whereby the controller issues headings and/or levels aimed at achieving planned deconfliction minima.

The following paragraph regarding identification of aircraft receiving a Deconfliction Service is provided in the Manual of Air Traffic Services (MATS) Part 1:

> *'The controller shall identify the aircraft, inform the pilot that he is identified, and maintain identity. If identity is lost, the pilot shall be informed and the controller shall attempt to re-establish identity as soon as practicable.'*

Recorded information

Radio communication recordings between the aircraft and both Oxford ATC and Brize Radar were available to the investigation.

A limited amount of radar data for the accident flight, covering a period of 48 seconds, was recorded by Clee Hill radar, 58 nm to the northwest. The first contact was at 1405:09 and the last at 1405:57; however, contact with the aircraft was lost during this period for two consecutive sweeps of the radar. The aircraft was fitted with a Mode S transponder that transmitted true track angle, groundspeed and altitude (with 100 foot resolution) information. This information was recorded for all the returns except the first, which contained altitude information only[1]. The radar track is presented in Figure 1 together with the time, groundspeed, altitude (adjusted to 1015 mb QNH) and track information.

The groundspeed and adjusted altitude data are also presented in Figure 2.

During the 24-second period that radar contact was lost, the aircraft turned to the left through 200º (see Figure 1) and gained 700 (±100) feet, as well as losing 48 kt groundspeed in the turn and climb. Radar contact was probably lost because the radar coverage was initially obscured by rising terrain between the radar head at Clee Hill and the aircraft, and in the latter part of the turn the aircraft's antenna was out of sight of the radar as the aircraft was in a bank to the left.

Footnote

[1] Mode S radar has two methods of interrogation: All-Call and Selective. All-call interrogations are transmitted regularly at a steady rate in a similar way to conventional Secondary Surveillance Radar. When a Mode S transponder replies to an all-call interrogation it transmits its unique 24-bit aircraft address together with altitude data (if available). Once the 24-bit aircraft address is known, from the initial interrogation, the Mode S radar can then selectively interrogate the transponder, whose reply then also includes airborne data (if available).

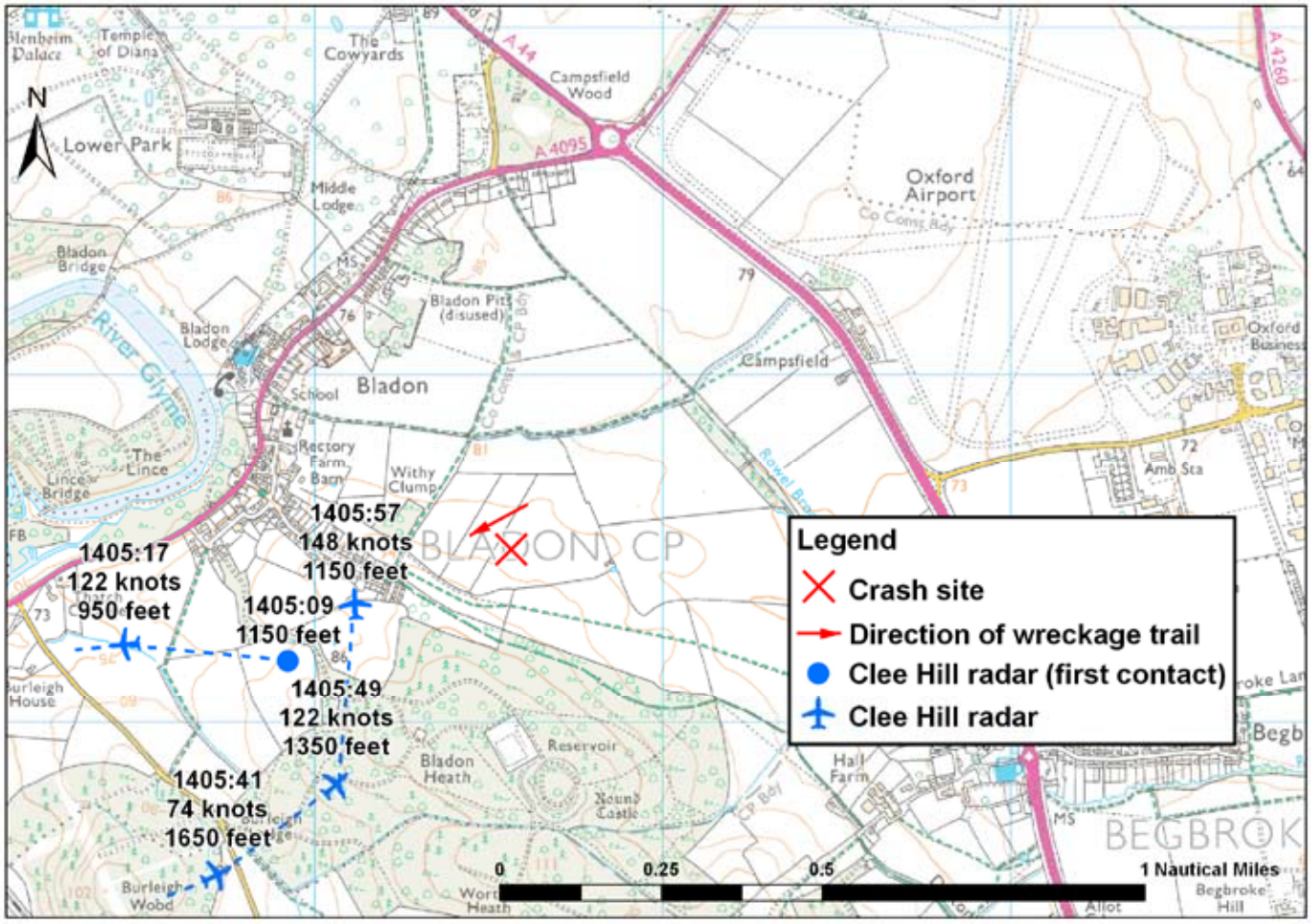

Figure 1

Radar track and accident site location

Radar coverage between the recorded track and the airfield to the northeast was at least to the level of the first and last contacts, which were both 1,148 feet amsl. Therefore, it is likely that the aircraft was between the ground and this altitude from takeoff to the first contact, and from the last contact to the site of the accident.

Witness information

There were a number of witnesses who heard the aircraft during its flight, several of whom also saw the aircraft. Most commented that the aircraft was noisy, apparently running at high power. Several witnesses said that the engine noise varied and described the sound as unusual and, in some cases, as similar to an aircraft doing aerobatics. Some thought that they were hearing a single aircraft engine, others thought it was two engines.

Eyewitnesses caught a brief glimpse of the aircraft descending steeply nose down towards the ground. One of them described seeing the nose coming up just before impact. They reported that a very intense fire started a short while after the impact and that nobody was able to get close to the aircraft.

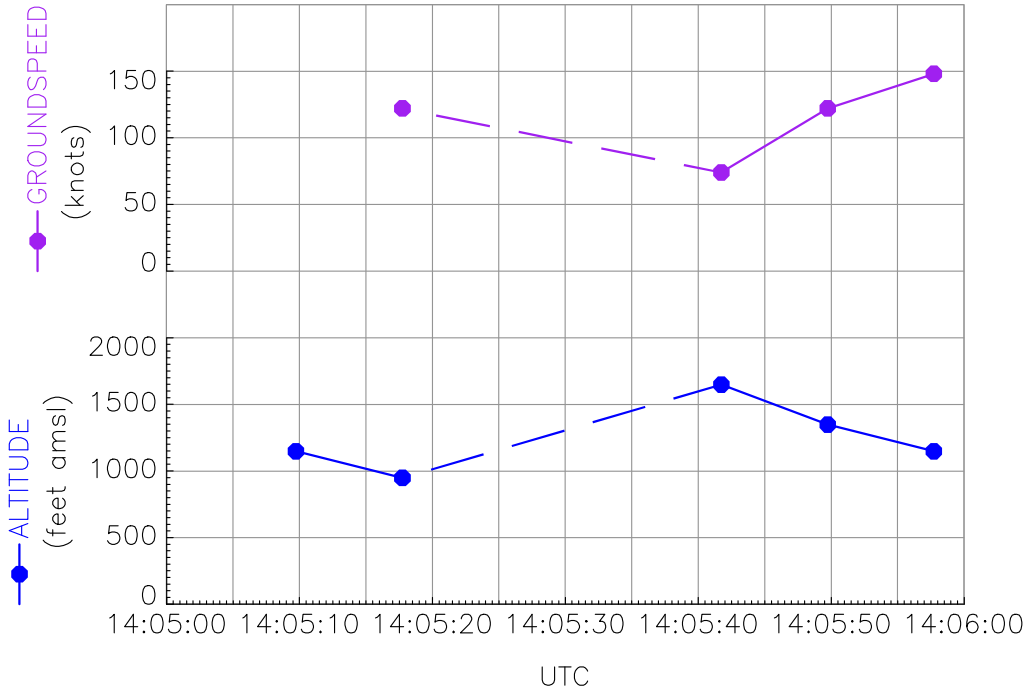

Figure 2

Aircraft groundspeed and altitude

Analysis

Technical

The post-crash fire precluded a full technical examination of the aircraft systems, but those examinations which could be performed revealed no indication of any technical problem with the aircraft before its impact with the ground.

Operational

The weather conditions at takeoff were not suitable for visual flight but were within the capability of the pilot, who was experienced in flight in IMC. An instrument approach would have been required to land back at Oxford.

The total flight was of between three and four minutes duration. By combining the recorded radar data with the witness information it was possible to reconstruct some of the flight path. The aircraft appears to have turned right after takeoff, in accordance with the departure instructions, and the pilot made contact with Brize Radar. The RTF calls were routine and there was no suggestion of any problem. The flight path of the aircraft then became erratic, over the next two minutes it flew an approximate figure-of-eight pattern, initially turning to the left and then turning right (see Figure 1). The height varied, the lowest recorded radar return was at 900 ft amsl, and during the final minute of flight there were no recorded radar returns, indicating that the aircraft was probably below this altitude. At the time of impact with the ground the aircraft was in a right-wing-low, nose-down attitude with both engines running. By the time that Oxford ATC attempted to contact the aircraft at 1407 hrs it had already crashed.

The fact that there was no radio call from the pilot when he deviated from his ATC clearance suggests either that he was not aware of it, or that he was unable to make

a call. Electrical failure is unlikely to have been the reason because the transponder continued to operate as the aircraft descended. A pressure instrument failure could have led to an erratic flight path but is unlikely to have led to a loss of control with no radio communication.

The medical evidence from the post-mortem showed that there was a strong possibility that the pilot had become incapacitated at some time before the final impact. The erratic flight path observed during the final part of the flight suggests pilot disorientation, which could either have been as a result of the pilot attempting to fly while incapacitated or an attempt by the passenger to fly in conditions that were beyond his training and experience. It seems likely that the pilot became incapacitated soon after his last radio transmission and that at some time after that the passenger took control and attempted to fly the aircraft. Although there were flight instruments in front of him he had not flown the aircraft before, was unprepared to take over, had very little experience of flight in IMC and was not accustomed to flying in the right seat. These factors, together with the difficulty of dealing with the pilot, whose condition at this time is not known, would have meant that the passenger was presented with a very difficult situation.

One witness suggested that there was an attempt to pull up the nose of the aircraft before it hit the ground but with the low cloudbase and snow-covered surface there would have been very little sight of the ground before impact. If the flight had taken place in VMC the passenger may have been able to take control of the aircraft and make a successful landing.

When the Brize Radar controller noticed the aircraft was deviating from its clearance there was no immediate attempt to call the pilot. Instead Oxford ATC was contacted by landline. It is not clear why this should have occurred, when it would be expected that the pilot would be called directly, but it is unlikely to have affected the outcome. Given the circumstances, it is likely that the passenger's attention was taken up with the condition of the pilot and the management of the aircraft, so that he was unlikely to have had any spare capacity to manage a radio call.

The pilot held a current Class One medical certificate. However, there is evidence that such medical examinations are not necessarily successful at detecting coronary heart disease.