

AAIB Bulletin S1/2013

SPECIAL

ACCIDENT

Aircraft Type and Registration:	Agusta A109E G-CRST
No & Type of Engines:	2 x Pratt & Whitney Canada PW206C
Year of Manufacture:	1998
Location	St George Wharf, Vauxhall, London
Date & Time (UTC):	16 January 2013 at 0759 hrs
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew -1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Helicopter destroyed
Commander's Licence:	Air Transport Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	To be confirmed
Information Source:	AAIB Field Investigation

This Special Bulletin contains facts which have been determined up to the time of issue. It is published to inform the aviation industry and the public of the general circumstances of accidents and serious incidents and should be regarded as tentative and subject to alteration or correction if additional evidence becomes available.

AAIB investigations are conducted in accordance with Annex 13 to the ICAO Convention on International Civil Aviation, EU Regulation No 996/2010 and The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996.

The sole objective of the investigation of an accident or incident under these Regulations is the prevention of future accidents and incidents. It is not the purpose of such an investigation to apportion blame or liability.

Accordingly, it is inappropriate that AAIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

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Notification

At 0820 hrs on 16 January 2013 the Air Accidents Investigation Branch (AAIB) was notified that a helicopter, flying over central London, had collided with a crane and crashed into the street near Vauxhall Bridge. A team of AAIB inspectors and support staff were deployed immediately and arrived on the scene at 1130 hrs.

Synopsis

The helicopter was flying to the east of Battersea Heliport when it struck the jib of a crane, attached to a building development at St George Wharf, at a height of approximately 700 ft in conditions of reduced meteorological visibility. The pilot, who was the sole occupant of the helicopter, and a pedestrian were fatally injured when the damaged helicopter impacted a building and adjacent roadway. This Special Bulletin presents facts determined up to the time of issue and offers no analysis.

History of the flight

The pilot of G-CRST arrived at Redhill Aerodrome at approximately 0630 hrs in preparation for a flight to Elstree Aerodrome. He intended to collect a client to take him and another passenger to the north of England.

The helicopter, callsign Rocket 2, lifted at 0735 hrs and departed to the north climbing to 1,300 ft amsl¹ (see Figures 1 - 3). The pilot called Thames Radar on frequency 125.625 MHz and stated that he was en route from Redhill Aerodrome to Elstree Aerodrome and wished to route overhead London Heliport (near Battersea) with a Special VFR (SVFR) clearance. He was cleared to transit the London Control Zone (CTR)

Footnote

¹ Helicopter altitudes above mean sea level (amsl) were derived from the Mode S downlink of transponder Mode C altitude, and have an accuracy of approximately ± 50 ft.

via Battersea, under SVFR, not above 1,000 ft. The helicopter descended to 1,000 ft before entering the London CTR.

At 0742 hrs, G-CRST was abeam London Heliport at 1,100 ft heading approximately north. It crossed the River Thames 15 seconds later and altered track left towards Holland Park, towards a point immediately east of Brent Reservoir. At 0745 hrs, when 2 nm southeast of the reservoir, ATC amended the helicopter's clearance to "NOT ABOVE 2,000 FT".

G-CRST climbed to 1,500 ft on track to Elstree and cleared the northern boundary of the London CTR at 0746 hrs, when it began a descent. It passed Elstree Aerodrome at 0748 hrs in a descent through 1,200 ft before reaching a minimum altitude of 1,000 ft. At 0749 hrs, G-CRST was 2 nm north-west of Elstree Aerodrome when it climbed and turned right onto a south-easterly track towards central London.

At 0751 hrs, Thames Radar broadcast London City Airport ATIS² information 'J' which reported a visibility of 700 m, a Runway Visual Range (RVR) of 900 m, freezing fog and broken cloud with a base 100 ft above the airport. Thirty seconds later, the pilot of G-CRST asked to route back to Redhill Aerodrome via the London Eye and received the reply:

"ROCKET 2 APPROVED VIA THE LONDON EYE NOT ABOVE ALTITUDE 1,500 FEET VFR IF YOU CAN OR SPECIAL VFR, QNH 1012".

The pilot replied:

"YEAH, WE CAN, 1012 AND NOT ABOVE 1500, VFR OR SPECIAL VFR ROCKET 2".

Footnote

² Automatic Terminal Information Service.

G-CRST climbed to 1,500 ft for the transit. At 0753 hrs, the controller asked:

“ROCKET 2 DO YOU HAVE VMC OR WOULD YOU LIKE AN IFR TRANSIT?”

The pilot replied:

“I HAVE GOOD VMC ON TOP HERE, THAT’S FINE, ROCKET 2”.

At 0755 hrs, G-CRST was put under radar control as it entered the London CTR. One minute later, the pilot asked:

“ROCKET 2, IS BATTERSEA OPEN DO YOU KNOW?”

After being told that London Heliport was open, the pilot said:

“IF I COULD HEAD TO BATTERSEA THAT WOULD BE VERY USEFUL”.

The controller replied:

“I’LL JUST HAVE A CHAT WITH THEM, SEE WHAT THEIR CLOUD IS LOOKING LIKE”

At 0757 hrs, G-CRST was abeam the London Eye at 1,500 ft and the pilot said:

“ROCKET 2, I CAN ACTUALLY SEE VAUXHALL, IF I COULD MAYBE HEAD DOWN TO H3... H4³ SORRY”

The ATC controller replied:

“ROCKET 2, YOU CAN HOLD ON THE RIVER FOR THE MINUTE BETWEEN VAUXHALL AND WESTMINSTER BRIDGES AND I’LL CALL YOU BACK”.

G-CRST was flying south parallel to the River Thames and, as it passed Westminster Bridge, began to descend. At 0758 hrs, G-CRST was approaching the north side of the river, 0.5 nm west of Vauxhall Bridge. The controller said:

“ROCKET 2 BATTERSEA ARE JUST TRYING TO FIND OUT IF THEY CAN ACCEPT THE DIVERSION”

The pilot acknowledged, after which the controller continued:

“AND YOU CAN MAKE IT QUITE A WIDE HOLD, YOU CAN GO AS FAR AS LONDON BRIDGE”

The helicopter crossed the north bank of the Thames at 1,000 ft heading south-west and began a right turn through north onto a south-easterly heading which took it back over the middle of the river. It was by now level at approximately 800 ft and altered course to follow the line of the river east towards Vauxhall Bridge.

At 0759:10 hrs, the ATC controller said:

“ROCKET 2 YEAH BATTERSEA DIVERSION APPROVED YOU’RE CLEARED TO BATTERSEA”.

The pilot replied:

“LOVELY THANKS ROCKET 2”.

The ATC controller continued:

“ROCKET 2 CONTACT BATTERSEA ONE TWO TWO DECIMAL NINER”.

The pilot replied:

“TWO TWO NINE, THANKS A LOT”.

This exchange ended at 0759:18 hrs when G-CRST was approximately 150 m south-west of Vauxhall Bridge.

Footnote

³ H4 is a helicopter route that runs along the River Thames.

Immediately afterwards the helicopter began to turn right. At 0759:25 hrs it struck a crane on the south side of the river 275 m from the south-west end of Vauxhall Bridge.

Telephone calls and text messages

Another pilot (Witness A) was aware of the flights planned by the pilot of G-CRST. He reported that the pilot phoned him at 0706 hrs to tell him that the weather at Redhill was clear and that he was going to collect a passenger from Elstree. The pilot said there was fog at Elstree but he was going to fly overhead to see for himself.

At 0718 hrs, the client called the pilot to discuss the weather. The pilot said he thought the weather might

clear earlier than forecast. The client said he would drive to Elstree and call the pilot to keep him advised.

At 0731 hrs, having noticed how poor the weather was during his journey, the client called the pilot to suggest that he did not take off until he (the client) had reached Elstree and observed the weather. The pilot replied that he was already starting the engines. The client stated that he repeated his suggestion that the pilot should not take off.

At approximately 0750 hrs the client phoned London Heliport and was told that it was open.

Table 1 shows text messages that were sent during the morning.

Time	From	To	Text
0630	Pilot	Client	Weather ok up north but freezing fog at Elstree and Luton not clearing between 8 - 10am I've got same at Redhill keep you posted
0640	Pilot	Operator	Freezing fog all london airports ok up north have text [client] clearing between 8 - 10
0705	Witness A	Pilot	Give me a call as I have checked weather and freezing fog around at the moment
0729	Pilot	Client	I'm coming anyway will land in a field if I have to
0743	Pilot	Witness A	Can't see batts
0744	Witness A	Pilot	Ok
0747	Pilot	Witness A	VFR on top at 1500 feet
0748	Witness A	Pilot	But can you land?
0751	Pilot	Witness A	No hole hdg back to red
0753	Witness A	Pilot	Ok
0753	Pilot	Client	Over Elstree no holes I'm afraid hdg back to Redhill least we tried chat in 10
0755	Client	Pilot	Battersea is open
0755	Pilot	Operator	Can't get in Elstree hdg back assume clear still
0755	Operator	Pilot	Yes it's fine still here. <i>NB. This text was not read</i>

Table 1
Text messages

Witness and CCTV information

Witness and CCTV evidence collected to date indicate that the top of the crane and the top of the building to which it was attached were obscured by cloud at the time of impact.

Meteorological information

Redhill Aerodrome Common Automatic Weather Station ATIS

The information below was taken from the Redhill Aerodrome Common Automatic Weather Station ATIS on 16 January, 2013.

At 0720 hrs, the wind was variable in direction at 1 kt, visibility was 3,100 m, the temperature was -5° C, the dew point was -5° C and QNH was 1010 hPa.

At 0738 hrs, the wind was variable in direction at 1 kt, visibility was 1,300 m, the temperature was -6° C, the dew point was -6° C and QNH was 1010 hPa.

At 0804 hrs, the wind was variable in direction at 1 kt, visibility was 5,000 m, the temperature was -5° C, the dew point was -5° C and QNH was 1011 hPa.

Throughout this period, the system was reporting “NO CLOUD DETECTED” (NCD).

Met Office Report

The Met Office produced a general report of the meteorological conditions prior to and at the time of the accident.

A large ridge of high pressure, centred over Finland, extended a slack, mainly east to south-easterly flow across southern England which had stagnated overnight. The air mass was particularly cold, with air temperatures well below freezing across the area. Much of the area

was prone to widespread low cloud, poor visibility and patches of freezing fog. Cloud bases were in the range of 100 ft to 400 ft agl at 0800 hrs. Visibility was generally below 4,000 m, with several areas of London, including London City Airport, reporting freezing fog with visibility of approximately 700 m.

Visibility at nearby airports (London Heathrow, London City and Royal Air Force Northolt) was generally less than 4,000 m at 0800 hrs, and as low as 700 m at London City Airport. Freezing fog was forecast for Redhill and Elstree Aerodromes, and at London Heliport until 1000 hrs.

Crane description

The crane was in place to facilitate the construction of a new high-rise building at One St George Wharf. The main tower of the crane was positioned next to the building and was braced to its structure at regular points. The height of the crane tower was increased by introducing new sections as the building increased in height. At the time of the accident the building had reached its full height; the crane tower had reached a height of 572 ft agl. On top of the crane tower was a cab unit, a counterjib ‘A’ frame and counter weight platform attached to the crane tower by a bearing ring, which allowed the jib to rotate (slew) in the horizontal plane. The crane had a ‘luffing’ jib, which meant the full length of the jib pivoted in the vertical plane from a point a further 11.5 ft above the height of the tower section.

During out-of-service periods, such as overnight, the jib was parked in the ‘minimum jib’ position, at a 65° angle above the horizontal. At the time of the accident this gave a total height from the ground to the tip of the jib of 719 ft.

The crane was lit at night with red lights, both on its tower and jib. The tower lighting consisted of mains powered steady red lights at approximately 50 m intervals. The jib lighting was provided by solar powered lights. The *Air Navigation Order* requires the lighting to be of medium intensity (2,000 candela) and that the obstacle be lit at night only.

Notice to Airmen (NOTAM)

The following NOTAM relating to the crane was valid at the time of the accident:

- Q) EGTT/QOBCE/IV/M/
AE/000/008/5129N00007W001
- B) FROM: 13/01/07 17:00C) TO: 13/03/15 23:59
- E) HIGH RISE JIB CRANE (LIT AT NIGHT)
OPR WI 1NM 5129N 00007W, HGT
770FT AMSL (VAUXHALL, CENTRAL
LONDON), OPS CTC 020 7820 3151
12-10-0429/AS 2.

The following is a plain language translation:

'In the London Flight Information Region an obstacle has been erected affecting both instrument and visual traffic. Aerodrome and en route traffic is affected. The obstacle is from the surface to 800 ft amsl and is positioned within a 1 nm radius of 51°29'N 000° 07'W. The obstacle will be in place from 1700 hrs on 7 Jan 2013 to 2359 hrs on 15 March 2013. It is a high rise jib crane (lit at night).'

Recorded information

The helicopter's radar position and Mode S altitude were provided to the AAIB by NATS⁴. The position of the helicopter was captured by several radar heads and was first recorded at 07:35:48 hrs just north of Redhill Aerodrome at 400 ft amsl. The helicopter then climbed and tracked north towards Elstree arriving 1,100 ft overhead at 07:48:19 hrs, before turning back towards central London.

The helicopter arrived over the River Thames adjacent to Battersea Power Station at 07:58:35 hrs at a recorded altitude of 900 ft before performing a right turn to track along the river towards Vauxhall Bridge. The final two recorded positions show a turn to the right abeam St George Wharf at 800 ft, with the final position recorded at 07:59:24 hrs.

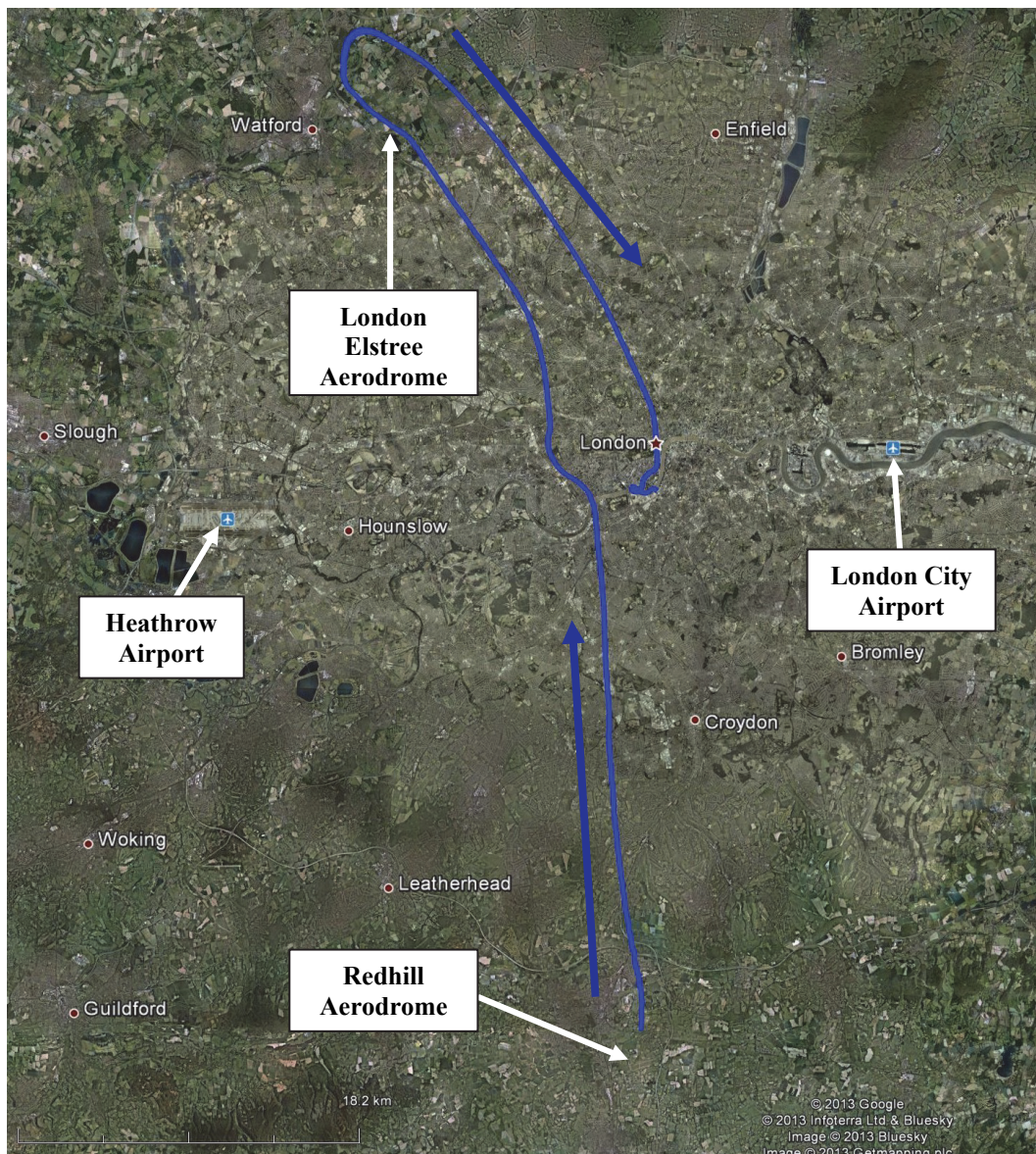
Injuries to persons

The pilot and a pedestrian on Wandsworth Road suffered fatal injuries in the accident. Several people on the ground suffered serious injuries⁵, but the exact numbers have yet to be confirmed.

Footnote

⁴ The national air traffic control services provider.

⁵ As defined by ICAO Annex 13 and the Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996, which are accessible from the AAIB website.

**Figure 1**

G-CRST radar track

Aircraft description

The Augusta A109E is a high performance, multi-purpose helicopter. The cockpit seats up to two pilots and the rear cabin can accommodate six passengers. It is powered by two Pratt and Whitney PW206C turboshaft engines and has a fully articulated main rotor head with four main rotor blades. To the rear of the passenger cabin are the fuel tanks, baggage compartment and electrical

equipment bay. Above the cabin located on the engine deck are the two engines and the main gearbox. This gearbox drives the main rotor head and blades and the tail rotor drive shaft. The tail boom of the helicopter is bolted to the main fuselage and locates the twin-bladed tail rotor and gearbox, the vertical fin and the horizontal stabilizer. The helicopter has a retractable, tricycle landing gear.

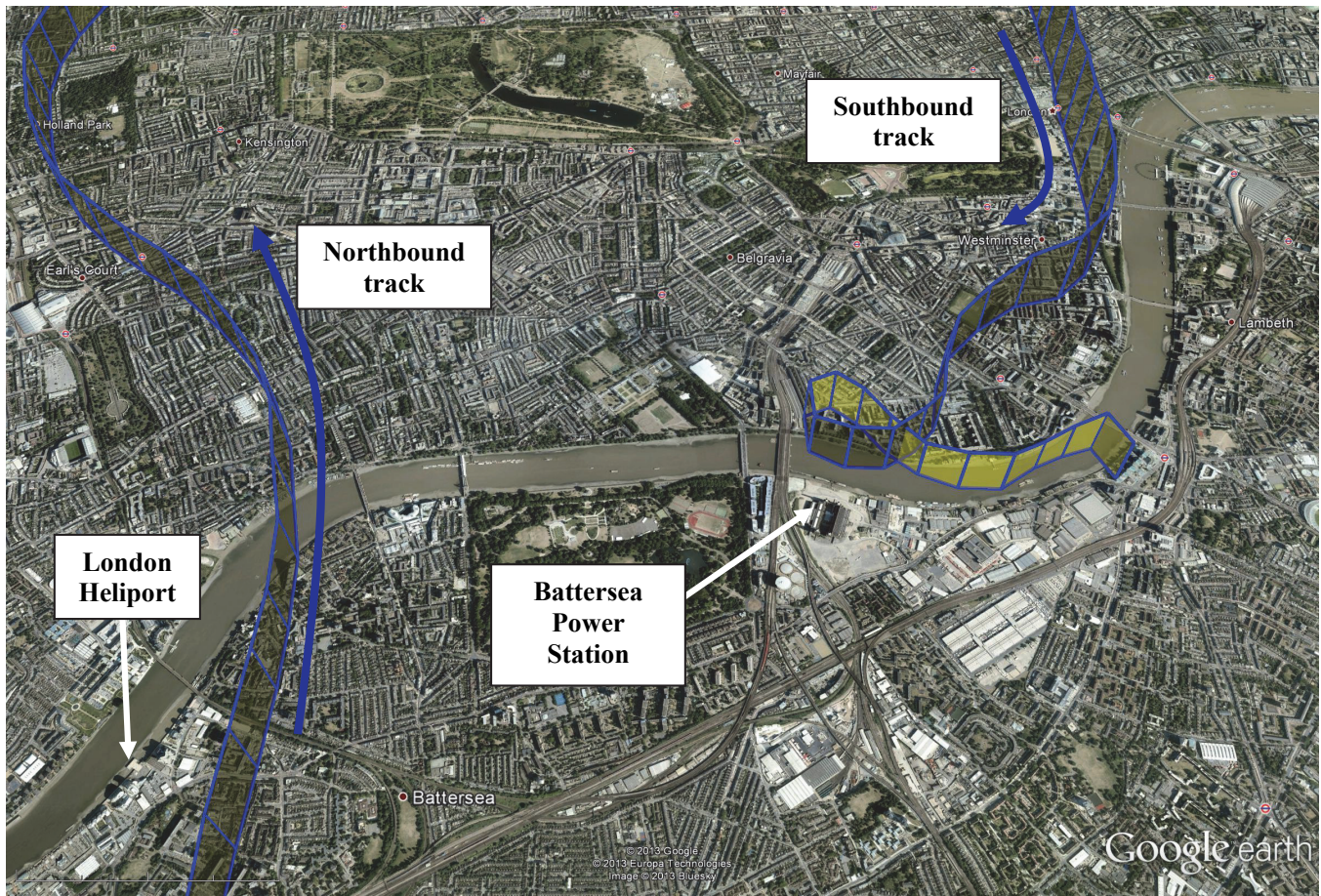


Figure 2

G-CRST radar track showing London Heliport

Damage to the helicopter

The collision with the crane’s jib resulted in separation of the main rotor blades from the rotor head, and the rotor head and main gearbox from the fuselage of the helicopter. The cockpit airframe structure was also damaged. The main rotor head and gearbox landed separately from the fuselage and were further damaged by the impact with the ground. The tail section of the helicopter detached from the tail boom as the helicopter made contact with a building, before the fuselage struck the ground. The ground impact caused further extensive damage and the majority of the fuselage wreckage was consumed by a post-impact fire.

Other damage

The helicopter’s collision with the crane resulted in detachment of the outboard section of jib structure from near the point of impact to the tip of the jib. The released section landed in the road on Nine Elms Lane, adjacent to the base of the crane, causing extensive damage to the road surface. The inboard section of the jib remained attached to the crane at its pivot point, but hanging vertically. A residential building below the crane suffered minor structural damage, including broken glass panels, from impact by released sections of the helicopter’s main rotor blades.

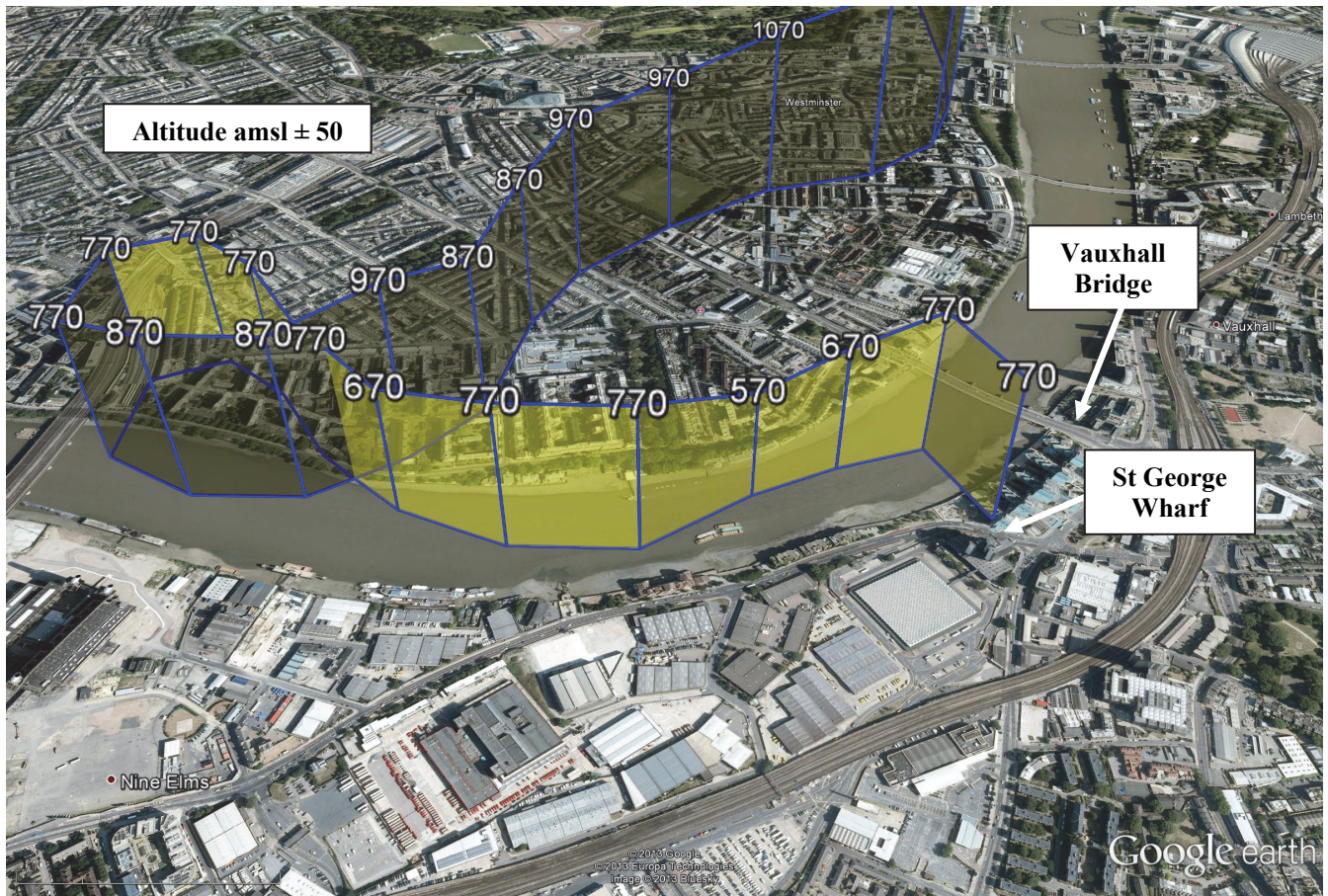


Figure 3

G-CRST radar track final positions showing altitude amsl

The detached rotor head and gearbox from the helicopter landed in the loading bay of the nearby flower market, striking and damaging a delivery van. The tail of the helicopter struck a low-rise building immediately prior to its impact with the ground, resulting in structural damage to the building. The subsequent impact of the forward fuselage with the pavement adjacent to the building created a shallow crater and ruptured the water main below. The final impact sequence disrupted the helicopter's fuel tanks allowing a significant amount of fuel to be released and ignited. The fuselage continued to travel forward onto the road, resulting in an area of fire damage which encompassed the two adjacent building fronts and the road surface from the initial ground impact

to the final resting position of the fuselage. The surface of the road there suffered considerable heat damage as the stationary fuselage was consumed by fire.

A number of vehicles on Wandsworth Road, close to the impact of the fuselage, suffered heat damage or were damaged by liberated wreckage debris. Two cars suffered severe fire damage, with the one closest to the final location of the fuselage wreckage being completely consumed. A third vehicle was damaged by a piece of wreckage falling through the panoramic sunroof.

Wreckage and impact information

Initial assessment of the location and condition of the various sections of wreckage from the helicopter indicated that the first points of contact with the jib of the crane were the helicopter's main rotors followed by the main rotor head and top section of the fuselage at the level of the main rotor gearbox. These sections were released from the rest of the fuselage and fell separately from the main wreckage. Loose items from the cockpit and sections of airframe structure from the roof of the cockpit were found in the wreckage trail close to the tower to which the crane was attached. This indicated that the top of the forward fuselage above the pilot had also been damaged during the initial impact.

Provisional calculations based on damage to the crane indicate the point of collision was at a height of around 682 ft agl. The helicopter's fuselage then travelled a horizontal distance of approximately 240 m to the south of the crane on an approximate track of 170°, rotating in yaw and descending, until the tail section struck the top of the external wall of a low rise building on Wandsworth Road. This resulted in the tail rotor, fin and horizontal stabiliser detaching, such that these items remained on the roof of the building. Paint transfer marks from the tail boom were visible on the wall of the building, indicating the track of the main fuselage as it reached the primary ground impact site. The remains of the main fuselage indicated that it had been upright at the time of the ground impact. The fuselage continued to slide approximately 20 m before coming to rest on the road.

Based on initial evidence the helicopter had approximately 500 kg of Jet A1 fuel onboard at the time of the accident. At the point of impact with the ground, disruption of the fuel tanks resulted in the fuel being released, allowing the fuel/air mix to ignite. This caused

extensive heat damage to the adjacent buildings and caused vehicles in the immediate vicinity to catch fire, but there was no evidence of significant blast damage. The main wreckage of the fuselage and a car adjacent to it were consumed by sustained fires, the remaining vehicles and buildings were extinguished by London Fire Brigade having suffered limited fire damage.

The main rotor head and gearbox, together with a section of one of the four rotor blades landed in a loading bay of the New Covent Garden Flower Market, to the northwest of the main impact site. Several items which would have been loose in the cockpit were also found in the vicinity of the market and on the roofs of adjoining buildings. Further small items of wreckage, mostly from the damaged rotor blades were found in the area around the base of the crane, the residential building adjacent to the crane and on the exposed bank of the river.

Civil Aviation Publication (CAP) 393, Air Navigation: The Order and the Regulations

Section 2 of the Air Navigation Order (ANO) details the Rules of the Air Regulations. Section 1, *Interpretation* states at paragraph 1 (k) that a Special VFR flight means a flight:

'in the course of which the aircraft ...remains clear of cloud and with the surface in sight.'

Section 3, *Low Flying Rule*, details in Rule 5 the low-flying prohibitions with which aircraft must comply unless exempted by Rule 6. The prohibitions include:

'Except with the written permission of the CAA, an aircraft shall not be flown closer than 500 feet to any person, vessel, vehicle or structure'; and:

'Except with the permission of the CAA, an aircraft flying over a congested area of a city town or settlement shall not fly below a height of 1,000 feet above the highest fixed obstacle within a horizontal radius of 600 meters of the aircraft.'

Exemptions in Rule 6 state that:

'Any aircraft shall be exempt from the 500 feet rule when landing and taking off in accordance with normal aviation practice'; and:

'Any aircraft shall be exempt from the 1,000 feet rule if it is flying on a special VFR flight.'

UK Air Information Publication (AIP)

The UK AIP entry for London Heathrow Airport contains in section AD 2.22 rules for non-IFR helicopter flights in the London CTR. It states that:

'Non-IFR helicopter flying in the London CTR is normally restricted to flight at or below specified altitudes along defined routes. These routes have been selected to provide maximum safety by avoiding built up areas as much as possible.'

For flights along the helicopter routes:

'Non-IFR flights in the London Control Zone are not to be operated unless helicopters can remain in a flight visibility of at least 1 km. Non-IFR helicopters must remain clear of cloud and in sight of the surface'; and:

'Non-IFR helicopters may be required to hold.... except on that portion of [route] H4 that lies between Vauxhall and Westminster Bridge.'

Multi-engined helicopters are not required to use the helicopter routes.

CAP 493 Manual of Air Traffic Services (MATS) Part 1

Chapter 2 of MATS Part 1 considers Flight Rules. Section 8.5 details the responsibilities of a pilot on a Special VFR flight and states:

'The pilot of an aircraft on a Special VFR flight is responsible for ensuring that his flight conditions enable him to remain clear of cloud, determine his flight path with reference to the surface and keep clear of obstructions.'

Further work

The AAIB will conduct a detailed inspection of recovered wreckage and helicopter maintenance documents, and an analysis of weather conditions. The investigation will also examine the conduct of this flight, regulation of flights over London, planning guidance and regulations relevant to development around aerodromes, and the lighting of obstacles.

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