

# AAIB Bulletin 3/2015

## *SPECIAL*

### ACCIDENT

<b>Aircraft Type and Registration:</b>	Hawker Hunter T7, G-BXFI	
<b>No &amp; Type of Engines:</b>	1 x Rolls-Royce Avon Mk 122 turbojet engine	
<b>Year of Manufacture:</b>	1959 (Serial no: 41H-670815)	
<b>Location</b>	Near Shoreham Airport, West Sussex	
<b>Date &amp; Time (UTC):</b>	22 August 2015 at 1222 hrs	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - 1 (Serious)	Passengers - N/A Other - 11 (Fatal)
<b>Nature of Damage:</b>	Aircraft destroyed	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	51 years	
<b>Flying experience:</b>	14,249 hours (of which 40 hours were on type) Last 90 days - 115 hours Last 28 days - 53 hours	
<b>Information Source:</b>	AAIB Field Investigation All times in this bulletin are UTC	

### The investigation

The AAIB was notified of the accident at 1235 hrs on Saturday 22 August 2015 and immediately initiated a Field Investigation. This Special Bulletin is published to provide preliminary information gathered from ground inspection, radar data, recorded images and other sources.

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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.

## Synopsis

The aircraft was taking part in an air display at Shoreham Airport during which it conducted a manoeuvre with both a vertical and rolling component, at the apex of which it was inverted. Following the subsequent descent, the aircraft did not achieve level flight before it struck the westbound carriageway of the A27.

## History of the flight

The Hawker Hunter aircraft was scheduled to carry out a display of aerobatic manoeuvres at the Royal Air Forces Association (RAFA) airshow at Shoreham Airport in West Sussex. The pilot had flown his light aircraft to North Weald Airfield in Essex where the Hunter was based. The Daily Inspection, valid for 24 hours, had been carried out the previous afternoon by an engineer and on the day of the flight the pilot carried out a pre-flight inspection and signed the aircraft Technical Log. There were no reported defects. He requested the aircraft to be refuelled to full and this was carried out by the two ground crew. The pilot was described as being in good spirits and looking forward to the flight.

The weather was good and, at the time of departure from North Weald, the nearest recorded actual weather was at Stansted Airport with a surface wind 150° at 14 kt, no cloud below 5,000 ft, visibility more than 10 km, temperature 28°C, dewpoint 16°C and the QNH 1014 hPa.

When all preparations were complete, the pilot occupied the left seat and secured his harness before putting on his helmet. The engine start was normal and the aircraft took off from Runway 02, which had a downslope, with a tail wind of approximately 8 kt. The takeoff run was longer than usual, probably due to the ambient conditions and, once airborne, the aircraft flew to Shoreham.

The flight towards Shoreham was uneventful and, having descended to 1,000 ft above mean sea level (amsl) the aircraft carried out a left orbit offshore at Brighton between 2,300 ft and 2,500 ft amsl. The pilot was cleared to commence his display and, remaining offshore, flew along the coast towards the airfield. At 1220 hrs Shoreham Airport reported that the wind was from 120° at 12 kt, with no significant cloud and visibility of more than 10 km. The surface temperature was 24° C, dewpoint 17°C and QNH<sup>1</sup> 1013 hPa.

The pilot flew parallel to the coast in a gradual descent during part of which he flew inverted. This may have been to check that there were no loose articles in the cockpit before his display.

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## Footnote

<sup>1</sup> Barometric pressure adjusted to sea level.



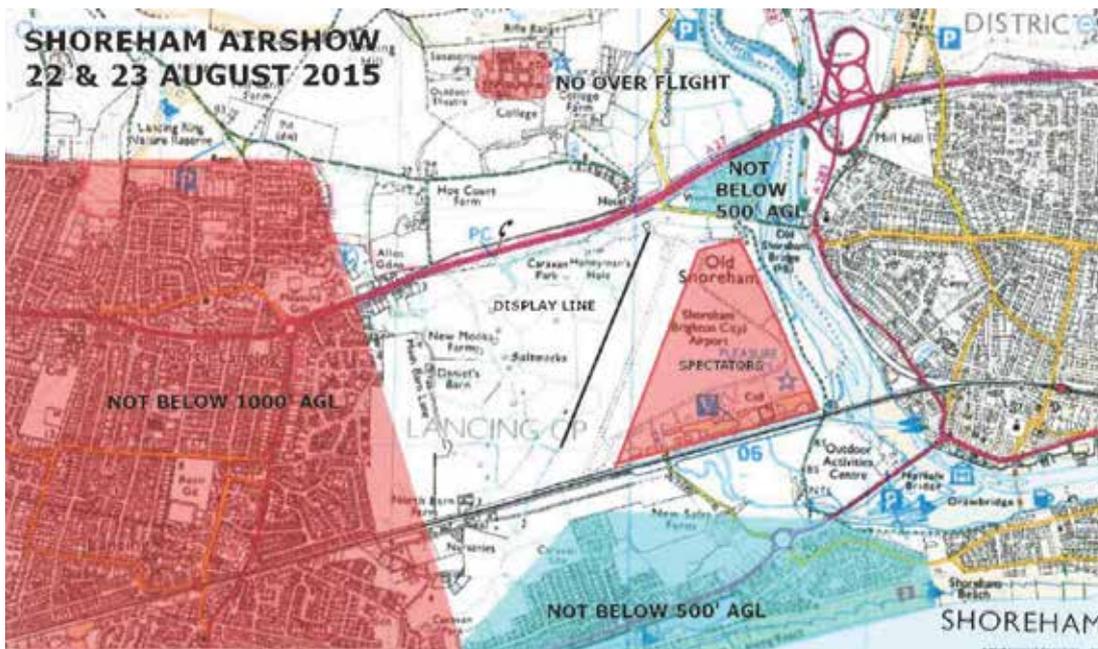
**Figure 1**

Approximate flight path derived from Pease Pottage radar data

Having rolled upright and wings level, the descent was continued to 800 ft amsl and a right turn made to line up with the display line to the west of Runway 02/20 at Shoreham (see Figure 1). The aircraft remained in a gentle right turn with the angle of bank decreasing as it descended to 100 ft amsl and flew along the display line. It commenced a gentle climbing right turn to 1,600 ft amsl, executing a Derry turn<sup>2</sup> to the left and then commenced a descending left turn to 200 ft amsl, approaching the display line at an angle of about 45°. The aircraft then pitched up into a manoeuvre with both a vertical component and roll to the left, becoming almost fully inverted at the apex of the manoeuvre at a height of approximately 2,600 ft amsl. During the descent the aircraft accelerated and the nose was raised but the aircraft did not achieve level flight before it struck the westbound carriageway of the A27 at its junction with Old Shoreham Road.

#### Footnote

<sup>2</sup> A 'Derry turn' is executed by rolling the aircraft 270° about its longitudinal axis in the direction opposite to that of the desired turn. When the roll angle reaches 270°, the roll is stopped and nose up elevator is applied to pull the aircraft into the turn.



**Figure 2**

The Shoreham Airport display map

### **Aerodrome information**

Shoreham Airport is located 1 nm west of Shoreham-by-Sea. The aerodrome has three runways: an asphalt surfaced main runway orientated 02/20, 1,036 metres long with a width of 18 metres; and two grass runways, 07/25 and 13/31. The aerodrome is 7 ft above mean sea level.

A large organised air display was being undertaken with the required minimum separation from the crowd determined according to aircraft speed and the type of display being flown. The relevant display axis for G-BXFI was 230 m from the crowd line, parallel with, and on the other side of, the main runway. The extended centreline of the display axis therefore passed through the junction of the A27 and Old Shoreham Road.

Local restrictions were in place directing pilots not to overfly Lancing College buildings, residential areas at Lancing below 1,000 ft, or Shoreham Beach below 500 ft.

A copy of the of the Shoreham Airport display map is shown at Figure 2 above.

### **Pilot's qualification and experience**

The pilot had received flying training in the Royal Air Force and had served as an instructor and fast jet pilot before entering commercial aviation. He held a European Union Airline Transport Pilot's Licence (ATPL) which was valid for the lifetime of the pilot. An Aircraft Type Rating Exemption (Full) was issued by the United Kingdom Civil Aviation Authority (UK CAA) on 27 August 2014 enabling him to fly the Hawker Hunter, Jet Provost Mk 1-5 and Strikemaster aeroplanes, valid until 27 August 2015. He held a European Union

Class 1 Medical Certificate with no limitations, issued on 20 January 2015 and valid until 31 January 2016. He held a valid Display Authorisation (DA), issued by the UK CAA, to display the Hawker Hunter to a minimum height of 100 ft during flypasts and 500 ft during Standard<sup>3</sup> category aerobatic manoeuvres. He had also met the requirement stipulated in Schedule 2 of his DA to have flown:

*‘three full display sequences, one of which was on the aircraft to be displayed, not more than 90 days prior to the flight in question.’*

From the pilot’s electronic logbook, it was established that the pilot had flown a total of 40.25 hours in the Hunter since 26 May 2011, of which 9.7 hours had been flown in the last 90 days and 2.1 hours in the last 28 days. He had also flown air displays in other types of aircraft, and the investigation will study his other logbooks for further information.

## **Engineering investigation**

### *Recorded Data*

The aircraft was not fitted with a flight recorder and no flight path information was recovered from the aircraft GPS.

The accident flight was recorded by the NATS radar facility at Pease Pottage. The maximum altitude recorded during the final manoeuvre was 2,600 ft amsl (recorded by Heathrow radar), which may not reflect the peak altitude achieved because the radar data was not continuous.

The investigation is analysing audio recordings of air traffic control communications.

Two image recording cameras were mounted within the cockpit. One was located on the aft cockpit bulkhead between the two seats, giving a partial view of the pilot and instrument panel, and a view through the cockpit canopy and windscreen. To date no abnormal indications have been identified. Throughout the flight, the aircraft appeared to be responding to the pilot’s control inputs. The other video camera was mounted at the base of the windscreen, looking over the nose.

Cockpit imagery is being analysed to help understand the final manoeuvre in more detail and to provide system status information. Initial findings indicate that the minimum air speed of the aircraft was approximately 100 KIAS whilst inverted at the top of the manoeuvre. The associated audio recording is being analysed for information relating to the aircraft systems.

The AAIB has received a large amount of video footage and photographs of the aircraft, many of which were taken in high resolution, from a variety of locations on and around Shoreham Airport. An analysis of the information using photogrammetry techniques will be undertaken to establish the parameters of the aircraft manoeuvres, including flight path and speed.

### **Footnote**

<sup>3</sup> As defined in Chapter 6 of Civil Air Publication (CAP) 403 – ‘Flying displays and special events: A guide to safety and administrative Arrangements’ published by the UK CAA.

### *Aircraft description*

The Hawker Hunter T7 is a single-engine advanced military jet trainer capable of speeds close to the speed of sound. G-BXFI was built in 1955 as a single-seat aircraft, but subsequently it was modified to a two-seat trainer in 1959<sup>4</sup>. Both pilot positions were fitted with ejection seats. It remained in military service until 1997, when it was transferred to the civilian register. Figure 3 shows the aircraft during the 'fly past' at the commencement of the display.



**Figure 3**

Hawker Hunter G-BXFI during the initial 'fly past'.  
(Photo courtesy N Watkin)

### *Pre-flight technical activity*

The aircraft was operated on a CAA-issued Permit to Fly and its current Certificate of Validity was valid until 10 March 2016. There were no technical defects recorded in the aircraft Technical Log.

The aircraft and its two under-wing tanks were fully fuelled before the flight. Ground crew reported that the pre-flight checks and engine start were normal and that the safety pins for the pilot's ejection seat had been removed and placed in the stowage provided prior to departure to arm the seat and its associated systems.

### *Accident site and wreckage recovery*

The aircraft crashed on to the westbound carriageway of the A27 road near its junction with Old Shoreham Road and Coombes Road, which is close to the northern perimeter of Shoreham Airport. During the impact sequence, the aircraft struck vehicles and persons

### **Footnote**

<sup>4</sup> This information is based on research completed to date. The year of manufacture stated at the beginning of this Special Bulletin corresponds to the 'year built' as recorded by the UK CAA.

around the road junction. Traffic light stanchions, road signs and a crash barrier in the vicinity were also struck.

The ground marks and photographic evidence show that the aircraft struck the road in a nose-high attitude on a magnetic heading of approximately 230°. The first ground contact was made by the lower portion of the jetpipe fairing, approximately 50 m east of the road junction. During the impact sequence fuel and fuel vapour from the fuel tanks was released and then ignited. The aircraft broke into four main pieces which came to rest close together approximately 243 m from the initial ground contact, in a shallow overgrown depression to the south of the A27.

During the initial part of the impact sequence the jettisonable aircraft canopy was released, landing in a tree close to the main aircraft wreckage. During the latter part of the impact sequence, both the pilot and his seat were thrown clear from the cockpit. The pilot sustained serious injuries. The investigation continues to determine if the pilot attempted to initiate ejection or if the canopy and pilot's seat were liberated as a result of impact damage to the cockpit.

Most of the aircraft wreckage has been recovered and transported to the AAIB facilities at Farnborough where it will be subject to further detailed examination. Work continues to recover smaller wreckage from the accident site.

### **Further investigation**

Further investigation by the AAIB will examine the aircraft and its maintenance records to determine its condition before the accident. It will also explore the operation of the aircraft, the organisation of the event with regard to public safety, and associated regulatory issues.

The AAIB will report any significant developments as the investigation progresses.

*Published 4 September 2015*

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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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