
Ground collision between a Boeing 777-200, N781AN and an Airbus A340-300, TC-JDK, at London Heathrow Airport, November 6, 2005

Micro-summary: This A340's winglet made struck a Boeing 777's left elevator and left wing tip.

Event Date: 2005-11-06 at 1238 UTC

Investigative Body: Aircraft Accident Investigation Board (AAIB), United Kingdom

Investigative Body's Web Site: <http://www.aaib.dft.gov.uk/>

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ACCIDENT

Aircraft Type and Registration:	1) Boeing 777-200, N781AN 2) Airbus A340-300, TC-JDK
No & Type of Engines:	1) 2 Rolls Royce Trent 892 turbofan engines 2) 4 CFM56-5C2 turbofan engines
Year of Manufacture:	1) 2000 2) 1993
Date & Time (UTC):	6 November 2005 at 1238 hrs
Location:	Holding Area Runway 27L, London Heathrow Airport
Type of Flight:	1) Public Transport (Passenger) 2) Public Transport (Passenger)
Persons on Board:	1) Crew - 12 Passengers - 267 2) Crew - 13 Passengers - 270
Injuries:	1) Crew - None Passengers - None 2) Crew - None Passengers - None
Nature of Damage:	1) Left elevator and left wing tip damaged 2) Right winglet damaged
Commander's Licence:	1) Airline Transport Pilot's Licence 2) Airline Transport Pilot's Licence
Commander's Age:	1) Not known 2) 59 years
Commander's Flying Experience:	1) Not known 2) 23,000 hours (of which 7,407 were on type) Last 90 days - 216 hours Last 28 days - 56 hours
Information Source:	AAIB Field Investigation

Synopsis

Aircraft entering the Holding Area prior to departure from Runway 27L at London Heathrow Airport, initially follow a single yellow taxiway centreline, which splits into two parallel lines within the holding area. This is wide enough for two 'heavy/widebody' aircraft to position side by side when lined up on the parallel lines. Prior to departure, a Boeing 777 (B777) was holding, in turn, at N2W behind a Boeing 737-800 (B737), in the Holding Area. Whilst in this position, an Airbus A340

(A340) was instructed to taxi to N2E. As it passed behind the B777, the A340's right winglet made contact with the B777's left elevator and its left wing tip. The A340 had not reached the section of the line parallel to the parked B777. This accident happened at the same location as a collision between similar aircraft types reported in AAIB Bulletin 9/2005, reference EW/C2004/07/03.

Two recommendations are made addressing the issues of the design and operation of the Holding Area for Runway 27L at London Heathrow Airport.

History of the flight

At the time of the accident it was daylight, the visibility was in excess of 10 km and it was raining. The B777 was cleared to taxi from Stand 320 at Terminal Three, via taxiways Echo and Alpha, to Holding Point LOKKI for departure from Runway 27L. Four minutes later the A340 was cleared to taxi from Stand 335, also at Terminal Three, via the same routing to holding point LOKKI, Figure 1.

As the B777 approached LOKKI it was instructed to monitor the Heathrow ATC Tower frequency. On contact with Heathrow Tower, the Air Departures Controller (ADC) instructed the B777 to hold at N2W. This is to

the western side of the Holding Area for Runway 27L. Due to the presence of a B737 that was also holding at N2W, the B777 had to line up behind it and wait in turn. (The ADC was an experienced Air Traffic Control Officer (ATCO) who was new to controlling at London Heathrow Airport. He was being supervised at the time by an ‘On-the-Job’ Trainer (OTJT).)

As the A340 approached Holding Point LOKKI, it too was instructed to monitor the Heathrow ATC Tower frequency. On making contact, the ADC instructed the A340 “When you can, taxi forward to hold N2E.” The crew replied “OK, taxi N2E”. N2E is the hold on the eastern side of the Holding Area for Runway 27L. As the aircraft joined taxiway UNIFORM, the ADC transmitted “Just caution, the B777 will be moving up shortly”; this transmission was not acknowledged.

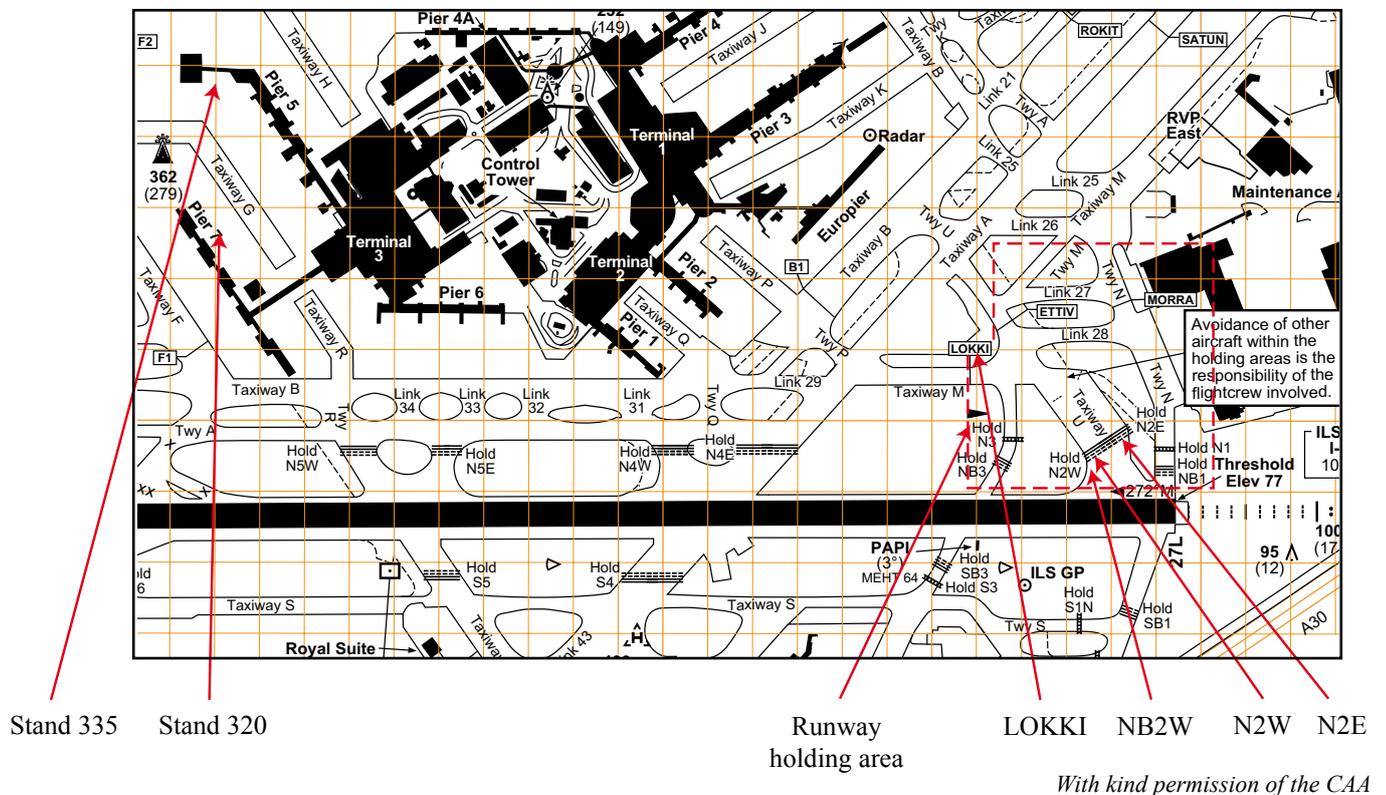


Figure 1

After the A340 had passed behind the B777, and was nearly in line abreast with it, the pilot of the B777 advised the ADC that he would have to return to stand. He added that the A340 on his left had just collided with him and he could see some damage to the wing tip of the A340¹. Airport Rescue and Fire Fighting Service (RFFS) and ground operations personnel were dispatched to the scene. They reported damage to the right winglet of the

A340 and the left elevator and left wing tip of the B777. Both aircraft were advised to taxi back onto a stand to enable engineers to inspect the damage.

Aircraft examination

Damage to the B777's left elevator and left wing tip appeared to have been inflicted by the upper part of the winglet of the A340. Damage to the A340 was temporarily repaired and the aircraft was dispatched. The B777 had been equipped with a replacement wing-tip fairing and was still awaiting delivery of a replacement elevator when examined by the AAIB.

Footnote

¹ The ATIS broadcast at the time contained information to the effect that pilots were responsible for the wing tip clearance of their aircraft in the Runway Holding Area. Similar information was contained in the notes section on the airfield 'plates'.

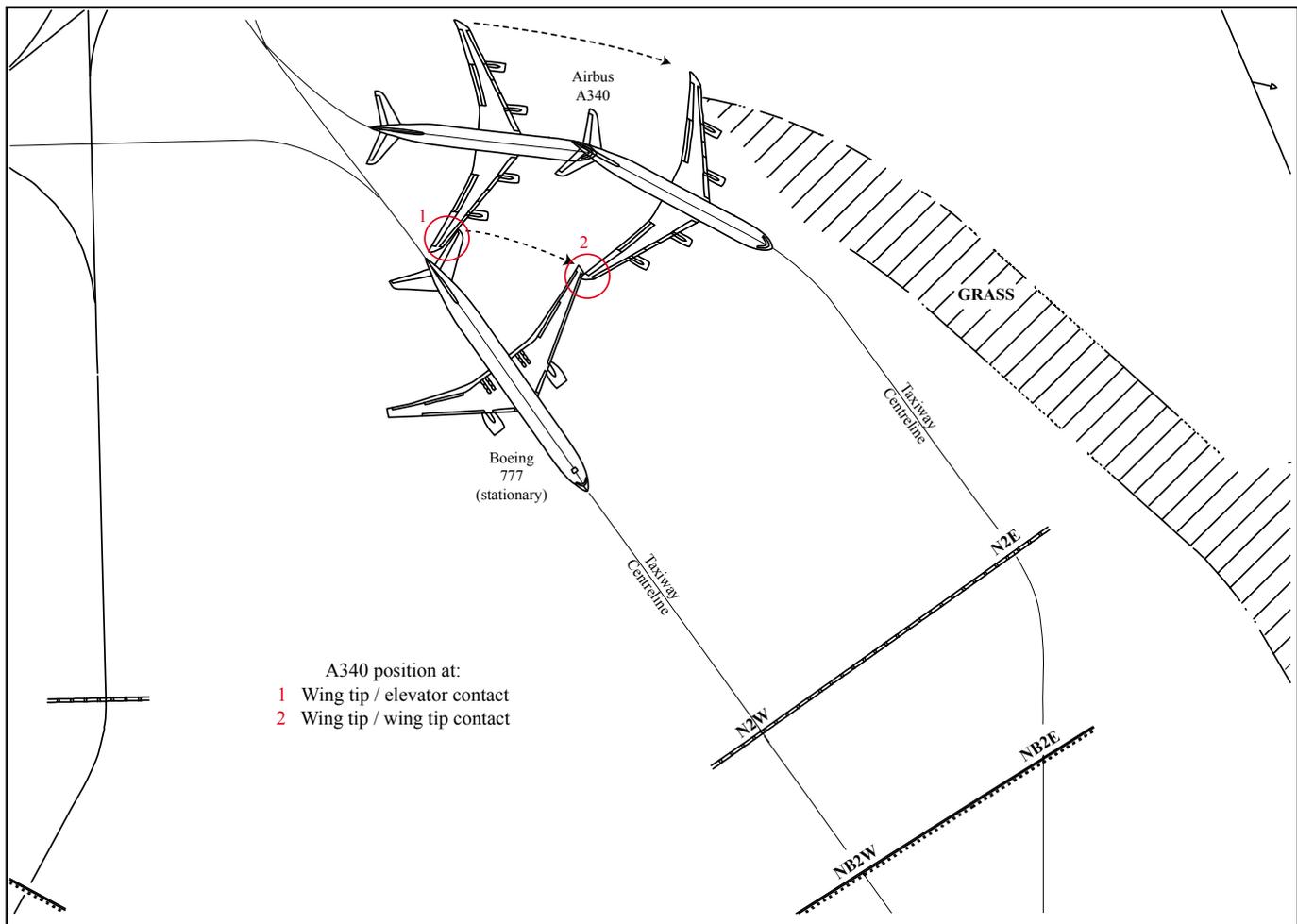


Figure 2

Relative aircraft positions at points of contact

Recorded data sources

ATC radio transmissions and the ground radar display are recorded at LHR and information covering this event was used during the investigation. The ground movement radar showed all ground movements of the aircraft, with a radar signature overlaid with a marker derived from the 'multilateration' system. This system triangulates the location of the aircraft from the ATC transponder transmissions. The flight data recorder from the A340 was downloaded by the airline, on request of the AAIB. It showed that the ground speed at impact was 6 kt and that the collision occurred at approximately 1238 hrs.

Comments by B777 crew

The B777 crew reported that, initially, they thought that the jolt caused by the first collision was the result of an engine surge. After checking the engine instruments they quickly discounted this and realised that they had been hit by another aircraft. Soon after the first collision they felt the second jolt and were now able to see the A340 on their left with what appeared to be a piece of their aircraft's wingtip embedded in its winglet. They added that the first collision was firmer than the second.

Comments by A340 crew

The crew of the A340 had a slot time of 1250 hrs for their departure. Although the ATIS broadcast contained a warning reminding pilots that they are responsible for wing tip clearance in the Runway Holding Area, the crew did not remember hearing this information. However, they had read the notes on their airfield plates that contained the same warning.

The push back, start up and taxi out to LOKKI was uneventful. On transferring to the Tower frequency they recall their first instruction from the ADC as "Taxi

november two echo." They did not register the preceding part of the instruction of "when you can" and felt that, given their understanding of English, they would not have realised that there might have been a 'hidden meaning' in this phrase. The commander believed that ATC wanted him to comply with the instruction completely so he did not question ATC to clarify the meaning. The crew also reported that they did not hear the additional call of "Just caution, the B777 will be moving up shortly" made by the ADC.

However, the commander and co-pilot discussed the relative position of the B777. They felt that it was an excessive distance behind the B737 and, as a result, they decided to taxi slightly left of the yellow taxi line in order to give themselves more room. As they passed behind the B777 the commander asked the co-pilot if they were clear. He replied "It seems safe for now" but later added that while he could see the right wing tip, it was difficult to make an accurate assessment due to the obtuse angle. Furthermore, his view was distorted by rain on the window.

The crew were now concerned about the proximity of the grass on the left of the aircraft. Consequently, both the commander and the co-pilot were looking to the left in order to assess their position on the taxiway. Once clear of the rear of the B777, the aircraft turned parallel to it and, again, the co-pilot looked out at the right wingtip. Although, once more, it appeared to be clear of the B777, he then felt a jolt, which was in fact the second collision.

A340 manufacturer's advice

Clearance from fixed obstructions at airports is usually assured by following the yellow taxiway lines, but clearance from movable obstructions, such as other aircraft, is at the discretion of the flight crew. There is,

however, no advice from the manufacturer as to reference points to use on the aircraft or the ground to ensure wing tip clearance. The wing tips on most large transport aircraft are not easily visible from the flight deck and the judgement of distance along a wing, for example, is difficult even in clear conditions.

Comments by the Air Departures Controller (ADC) and the On-the-Job Trainer (OTJT)

The ADC and the OTJT both commented that they considered that the B777 was not excessively far behind the B737 at Holding Point N2W. When the ADC issued the instruction to the A340 to taxi to N2E, he added the phrase “when you can” to emphasise that the decision about when it was safe to proceed rested with the operating crew. In this situation, it was possible that, to the crew of the A340 who did not speak English as their mother tongue, the implied meaning of this phrase was too subtle to be understood by them. The ADC added that he was not unduly worried by the incomplete read back of this instruction, as he would expect a flight crew to stop and query an instruction if they thought there was not enough room, rather than continue forward and risk taxiing into another aircraft.

The ADC transmitted the caution message as a result of him noticing that the A340 was taxiing very slowly behind the B777, as if it was quite tight and the crew were proceeding with caution. He wanted to inform them that the B777 would be moving forward shortly so that they were aware that there was no urgent need to squeeze past. The ADC didn't expect a reply to this message as it was for information purposes and is not a mandatory read back item. He did not make a conscious effort to look at the Ground Movement Radar to assess the movement of the A340 and the space available.

The “when you can” and “caution the B777 will be moving up shortly” messages are both non-standard R/T phrases, but the ADC and the OTJT both stated that it is not uncommon for them to be used.

ATC procedures

The CAA's Civil Aeronautical Publication (CAP)493, the *Manual of Air Traffic Services Part 1* states the following:

3 Air Traffic Control Service

3.1 An air traffic control service is provided for the purpose of:

- a) preventing collisions between aircraft in the air;*
- b) assisting in preventing collisions between aircraft moving on the apron and the manoeuvring area;*
- c) assisting in preventing collisions between aircraft and obstructions on the manoeuvring area;*
- d) expediting and maintaining an orderly flow of air traffic.'*

In addition, the UK AIP AD 2-EGLL-1-11 iv 1 states:

'At all times in good visibility an ATIS message will remind pilots that they remain responsible for wingtip clearance'.

Actions following previous accidents

On 23 November 1995, a similar accident, that occurred between an Airbus A340 and a Boeing 757-236 in the holding area for Runway 27R at LHR, was investigated by the AAIB. As a result, the following safety recommendation was made to the CAA:

Safety Recommendation 96-43

'The CAA should, in liaison with the appropriate ICAO committees, consider what action may be taken in the longer term to ensure that flight crews of large public transport aircraft are better able to achieve a positive clearance between their aircraft and others while manoeuvring on the ground'.

In response to this recommendation, the CAA raised the issue with the UK ICAO Navigation Commission in Montreal, which tasked their Airport Design Study Group to develop appropriate guidance. However, little specific information relating directly to this topic is currently contained in the ICAO Annex 14 or its associated Aerodrome Design Manual. In 1997, the CAA issued CAP 637 titled '*Visual Aids Handbook*', which reiterates guidance to pilots on the interpretation of aerodrome visual aids, including taxiway markings. This document is currently being reviewed with the intention to re-issue it in 2007.

Following another similar accident at the LHR Runway 27L Holding Area in 1997 (AAIB Bulletin 9/97), Heathrow Airport Limited (HAL), the airport authority, undertook to set up a working party to:

- examine the current daylight (non Low Visibility Procedure) procedures for runway holding areas
- examine whether or not pilots should be given additional guidance within runway holding areas
- review the British Airports Authority (BAA) design standards for runway holding areas.

It has not been possible to find a record of the working party or its conclusions.

Following a further similar accident, at the same place on the airport in July 2004 (AAIB Bulletin 9/2005), an internal memo was issued by HAL. It stated that the Airside Infrastructure Manager was in discussion with the Aerodrome Standards Department of the Safety Regulation Group at the CAA concerning the provision of additional ground markings to indicate the position of the stop bar at the northern end of the Holding Area for Runway 27L. These markings are meant to assist pilots in determining whether an aircraft is in a position that permits it to pass safely.

The Safety Regulation Group stated that they gave approval for these markings a few weeks after this accident. These additional ground markings had not been implemented at the time of this collision.

Analysis

Since 1995, the AAIB has investigated the circumstances surrounding three very similar accidents associated with the Holding Areas for Runways 27L and 27R at LHR. In this recent accident, it was evident that by taxiing slightly to the left of the yellow line, the crew were attempting to slowly 'squeeze' past the B777, with the co-pilot looking out to the right to assess the wing tip clearance, in compliance with the ATC instruction to "taxi forward to hold N2E". By doing so, they ran the risk of the left main landing gear wheels departing the paved surface. The wing tips are difficult to see from the cockpit of large swept wing transport aircraft, even in good daylight conditions. In addition, there is a difficulty in judging distance at a shallow angle along, and beyond the end of a large wing. Although the commander of an aircraft carries the responsibility to ensure that his aircraft remains clear of obstructions at all times, he is at an extreme disadvantage in discharging that responsibility, due to the reasons mentioned above.

The crew stated that they did not hear, or would not have understood, had they heard the implied meaning of the ATC caveat “when you can”. However, as they heard the ATC instruction to “taxi forward to hold N2E”, they must have been alerted to this by their call sign used by ATC at the beginning of this transmission. The caveat, being non-standard ATC phraseology, was probably missed due to the language issue; this is not an unusual situation with foreign flight crews whose mother tongue is not English.

In light of recent events, the message contained at the end of the ATIS broadcast, and published in the AIP, would appear to be insufficient to prevent collisions in the Holding Areas at London Heathrow Airport. An aircraft crew may not be aware that a collision has occurred, for example, by the jolt of such a collision being masked by movement induced by wind gusts and/or the event occurring at night. It is feasible, therefore, that a damaged aircraft could get airborne and potentially be put into a hazardous situation.

Safety Recommendations

In light of the previous accidents around the Holding Areas for Runway 27L and 27R, and the possibility that an aircraft could take off having had an unknown ground collision, the following recommendations are made:

Safety Recommendation 2006-058

It is recommended that Heathrow Airport Limited review the current layout/design of the Holding Areas for departing aircraft, to ensure that wingtip clearance is maintained between manoeuvring aircraft.

Safety Recommendation 2006-059

It is recommended that Heathrow Airport Limited, in co-operation with National Air Traffic Services, review the current Air Traffic Control procedures applicable to the Holding Areas for departing aircraft, and any future layout of these Holding Areas, to ensure that adequate wingtip clearance is maintained between manoeuvring aircraft.