

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	i) Airbus A340-311, 4R-ADC ii) Boeing 747-436, G-BNLL
<b>No &amp; Type of Engines:</b>	i) 4 CFM 56-5C2F Turbofan engines ii) 4 Rolls-Royce RB211-524G2-19 turbofan engines
<b>Year of Manufacture:</b>	i) 1995 ii) 1990
<b>Date &amp; Time (UTC):</b>	15 October 2007 at 2113 hrs
<b>Location:</b>	London Heathrow Airport
<b>Type of Flight:</b>	i) Commercial Air Transport (Passenger) ii) Commercial Air Transport (Passenger)
<b>Persons on Board:</b>	i) Crew - 15                      Passengers - 286 ii) Crew - 19                     Passengers - 328
<b>Injuries:</b>	i) Crew - None                  Passengers - None ii) Crew - None                  Passengers - None
<b>Nature of Damage:</b>	i) Right navigation light damaged ii) Left winglet detached
<b>Commander's Licence:</b>	i) Airline Transport Pilot's Licence ii) Airline Transport Pilot's Licence
<b>Commander's Age:</b>	i) 56 years ii) 47 years
<b>Commander's Flying Experience:</b>	i) 15,000 hours (of which 7,000 were on type) Last 90 days - 200 hours Last 28 days - 70 hours  ii) 16,740 hours (of which 9,411 were on type) Last 90 days - 138 hours Last 28 days - 32 hours
<b>Information Source:</b>	AAIB Field Investigation

**Synopsis**

A ground collision occurred when an Airbus A340 attempted to pass a Boeing 747 that was stationary on an adjoining taxiway, at night. Various factors contributed to the incident including the challenge faced by the crews of these large aircraft in assessing wingtip clearances, their interpretation of ATC instructions and the taxiway design.

One Safety Recommendation is made.

**History of the flight**

The crew of the Airbus A340-300, registration 4R-ADC, reported for duty at 1930 hrs, after a rest period of about 36 hours. The flight deck was manned by the commander in the left seat, an operating co-pilot

in the right seat and a relief co-pilot on a jump seat. The aircraft was prepared for departure, during which the crew listened to the Heathrow ATIS broadcast, and was pushed back off its stand at Terminal 4 at 2044 hrs, by which time it was dark. There was no significant weather, 8 km visibility and a south-westerly wind of about 10 kt.

On completion of the pushback and engine start, ATC cleared the A340 to taxi and to hold short of Runway 27L. The co-pilot was the handling pilot for the flight but, in accordance with company procedures, the commander taxied the aircraft. ATC then cleared the aircraft to cross Runway 27L and issued a further clearance for it to taxi to Holding Point A1, which is adjacent to the threshold of Runway 27R. Another aircraft, a Boeing 747-400, registration G-BNLL, which was ahead of the A340, had also been cleared to taxi to Holding Point A1. The B747 had stopped temporarily on Link 23 behind a Boeing 777, as indicated in Figure 1, leaving sufficient space to protect it from the latter's possible jet blast. Its position also avoided stopping in the turn ahead, preventing stress on the landing gear and avoiding excessive thrust when taxiing was resumed.

Prior to reaching Link 22, the A340 was transferred to the departure frequency and was re-cleared by ATC to taxi to Holding Point A2, with the following transmission:

ATC: "XXXX FOLLOW GREEN LIGHTS TO HOLDING POINT ALPHA TWO"

A340: "FOLLOW GREEN LIGHT HOLDING POINT ALPHA TWO XXXX"

On issuing this clearance, ATC illuminated the green centreline lights along Link 22; these lights had been extinguished while the B747 was taxiing along

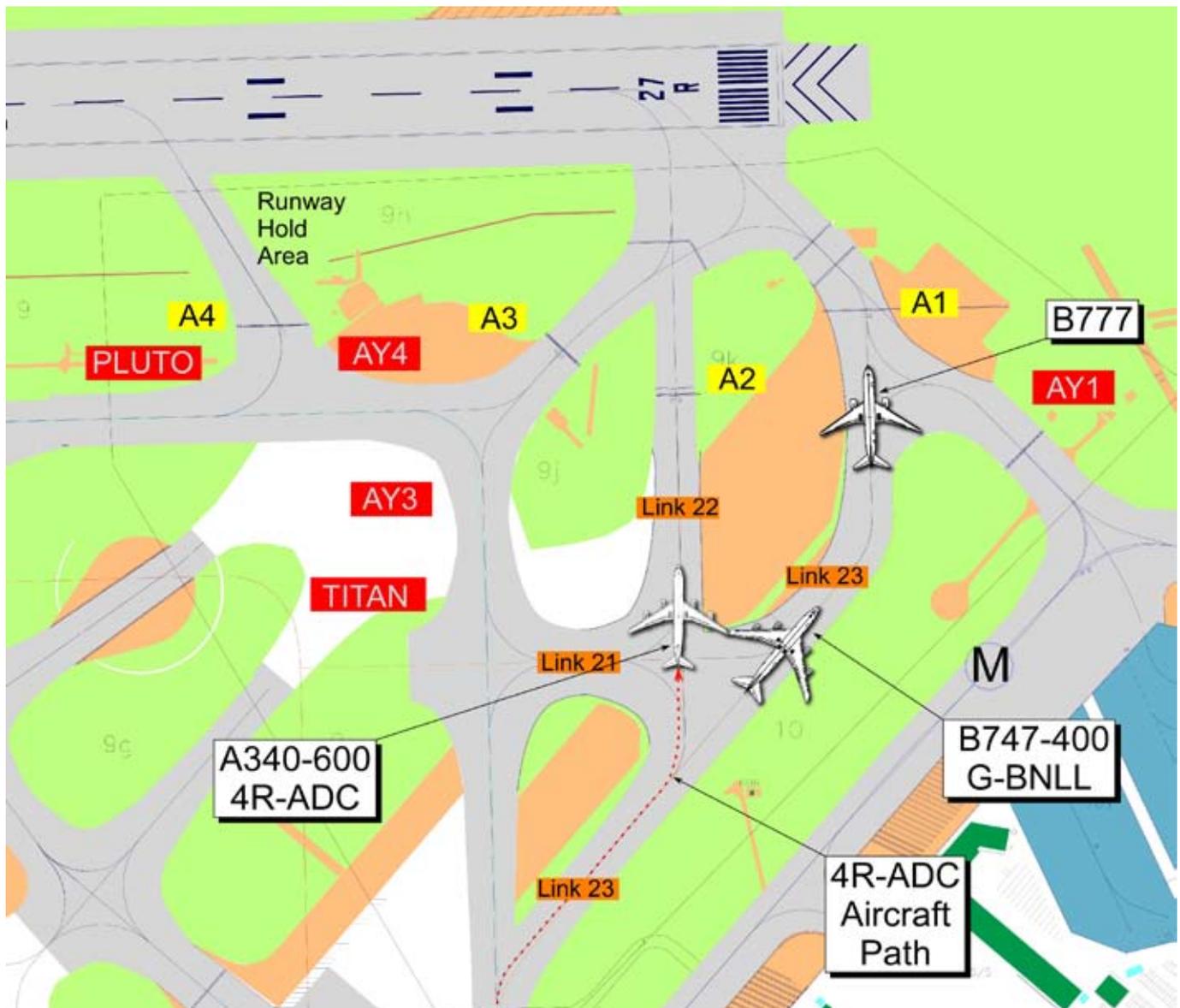
Link 23. The crew of the A340 understood that the ATC instruction meant that there was nothing to impede their progress towards Holding Point A2 but, as the A340 approached the, now stationary, B747, they briefly discussed the separation between the two aircraft. The crew's comments suggest that, although concerned, they believed the separation was adequate; however, the commander, under the guidance of the co-pilot, took the precaution of taxiing the A340 to the left of the taxiway centreline. As they continued, the right wingtip of the A340 struck the winglet of the B747 and the co-pilot called for the commander to stop the aircraft.

The crew of the A340 then informed ATC that their aircraft may have collided with the B747. The flight crew on board the B747 had felt a jolt but thought it was possibly due to jet blast from the B777 ahead. They were, however, able to see the close proximity of the A340 and received a report from a member of their cabin crew who had witnessed the B747's left winglet being struck. They, too, then advised ATC that a collision may have taken place.

ATC dispatched the Airport Fire Service (AFS) to attend the incident, while both aircraft remained in position with their engines running. The AFS confirmed that both aircraft had sustained damage but that there was no evidence of any fuel leak. Both aircraft were shut down and the passengers deplaned normally, before being transferred to an airport terminal by coach. There were no injuries.

### Measurements

Following the collision, the B747 was positioned on taxiway Link 23, facing toward Holding Point A1. The aircraft was aligned with the taxiway and the nosewheel was on the centre line, 193 metres short of Holding Point A1.



**Figure 1**

Point of collision at holding points for Runway 27R

The A340 was positioned on taxiway Link 22 facing toward Holding Point A2. The aircraft had come to rest a short distance beyond the point of contact with the wingtip of the B747. The nosewheel was 1.8 metres to the left of the taxiway centreline and the body gear was also to the left of the centreline by 2.3 metres.

The point of contact had occurred at the intersection between taxiways Link 22 and Link 23. The overlap between the left wingtip of the stationary B747 and

the right wingtip of the A340 was about 2 metres. See Figure 1.

#### **Aircraft damage**

The Boeing 747-400's left winglet had been severed approximately 1.7 metres from its tip. The winglet was subsequently replaced prior to the aircraft returning to service.

The Airbus A340-300 had a fractured right wing

navigation light assembly and some damage to the leading edge of the right winglet. The damaged winglet was removed, as permitted in the Minimum Equipment List (MEL), and the navigation light assembly was replaced before the aircraft returned to service the following evening.

## Procedures

*The UK Aeronautical Information Publication (AIP)*

The entry for London Heathrow Airport in the UK AIP, under *LOCAL TRAFFIC REGULATIONS, Ground Movement* stated:

### *'a General*

- i Ground Movement Control (GMC) is in continuous operation and all surface movement of aircraft, vehicles and personnel on the Manoeuvring Area is subject to ATC authority.*
- ii Directions issued by ATC should be followed specifically. RTF transmissions must be brief, concise and kept to the minimum number.*
- iii Within the Movement Area, pilots will be cleared to and from the aircraft stands under general direction from GMC. Pilots are reminded of the extreme importance of maintaining a careful lookout at all times.*
- iv Runway Holding Areas for aircraft departing on Runways 27L/09R and 27R/09L. The areas are illustrated on pages AD 2-EGLL-2-5/8. Within these areas, revised Air Traffic Control procedures are as follows:*

*1 At all times in good visibility an ATIS message will remind pilots that they remain responsible for wing tip clearance. In the hours of darkness, selectable reds and greens are used.*

*2 In promulgated holding areas, flight crew will be expected to follow conditional line-up clearances to maximise runway utilisation, which may entail overtaking and passing other aircraft in the holding areas. It is stressed that during these manoeuvres, avoidance of other aircraft is the responsibility of the flight crew involved. If doubt exists as to whether other aircraft can be overtaken then ATC must be informed that the conditional clearance that has been received cannot be complied with.*

*v ATC will clear aircraft to the holding point of the departure runway in use. Until a line-up clearance or sequence instruction is issued, commanders are to position their aircraft in such a way that the entrances to the runways are not obstructed.'*

The Heathrow Manual of Air Traffic Services (MATS) Part 2, Section 1, Paragraph 7.7.4 stated the following:

### *'Runway Holding Areas - Caution to Pilots*

*The following message is to be broadcast with the Departure ATIS at all times, except when Low Visibility Procedures are in force:*

*"Pilots are to exercise caution when manoeuvring in the Runway Holding Areas as wing tip clearance is not assured."*

The introduction of this message in the Departure ATIS was the result of an accident at the airport in November 1995 (AAIB Bulletin 07/96 Report Reference EW/C95/11/4) in which the wingtip of a taxiing A340 struck the tail of a B757 that was stationary at a holding point.

The crew of 4R-ADC confirmed that they had heard this message broadcast on the ATIS prior to taxiing. They had misinterpreted the meaning of the message as a disclaimer by the airport authorities against any damage caused to aircraft whilst taxiing. A senior pilot with the same operator, when asked, considered that the message referred to a potential lack of clearance between taxiing aircraft and airfield obstructions. The AAIB was also contacted, as a result of this incident, by a management pilot from another overseas operator. He raised concerns about the Heathrow ATIS message, pointing out that it was not possible to judge wingtip clearance from the flight deck when manoeuvring large aircraft.

### **Heathrow Airport Eastern Apron Development – Runway 27R Holding Area**

The area of apron on which the incident occurred had recently been re-developed by the airport operator. The re-development project had various aims which included:

- Re-aligning existing dual taxiways to provide maximum space for other infrastructure developments
- Provide Code F<sup>1</sup> routes to the Runway 27R holds

- Provide sufficient holding areas to maintain capacity
- Reconstruct life-expired pavement areas
- Provide one Airbus A380 and two Boeing 747 remote stands

The plans were complicated by the need to fulfil these requirements, whilst using as much of the existing infrastructure as possible. Initial plans were rejected as they were unable to fulfil the requirements for Code F operations. A subsequent plan utilised the disused Runway 05/23 and, whilst it met the requirements of Code F operations, it reduced the operational flexibility of the runway holding area. Evaluation by ATC of this new design indicated that, should one particular junction become unavailable, access to the Runway 27R hold would become extremely difficult. This would have led to a rapid loss of runway capacity, resulted in outbound delays and, as such, was deemed unacceptable. The design was, therefore, modified further and resulted in the design that was finally adopted, as depicted in Figure 1.

The airport operator had designed the taxiway development to comply with the guidance laid down in Civil Aviation Publication (CAP) 168 – *Licensing of Aerodromes*. The final design was based on a separation requirement that only one aircraft should occupy any length of taxiway between any two adjacent stopbars at any one time. These taxiway ‘blocks’ also included junctions and as a result meant that two or more different taxiways might be included within such a block. The airport operator believed that, should the taxiway system be operated to this requirement, it could guarantee aircraft separation at all times.

As a result of allowing space between it and the B777

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#### **Footnote**

<sup>1</sup> This refers to routes capable of being used by aircraft with wingspans up to 80m, a requirement for Airbus A380 operations.

in front, the rear of the stationary B747 extended over a stopbar beneath the aircraft. Thus, at the point where the collision occurred both aircraft were occupying the same taxiway block. ATC were not aware of this fact as they had no means of accurately determining the position of the aircraft.

The taxiway lighting system also operated on a block system, so that only one route guiding taxiing aircraft was illuminated in a block at any one time. Thus, as the green taxiway centreline lighting along Link 22 to Holding Point A2 was switched on, the green taxiway centreline lights along Link 23, to the rear of the stopbar under the tail of the B747, were extinguished.

#### Published instructions to pilots

CAP 637, the *Visual Aids Handbook*, Chapter 2, Section 2.3.1 b) states:

*'Taxi holding positions are normally located so as to ensure clearance between an aircraft holding and any aircraft passing in **front** of the holding aircraft, provided that the holding aircraft is properly positioned **behind** the holding position. **Clearance to the rear of any holding aircraft cannot be guaranteed.** When following a taxiway route, pilots and persons towing an aircraft are expected to keep a good lookout and are responsible for taking all possible measures to avoid collisions with other aircraft and vehicles.'*

*NOTE 1: Upon reaching a Taxi Holding Position identifying a taxi clearance limit, the pilot should stop the aircraft as close as possible to the Taxi-Hold Position Marking, whilst ensuring that no part of the aircraft protrudes beyond the marking.'*

#### Previous incidents

A review of AAIB reports identified nine previous ground collisions between taxiing aircraft at Heathrow Airport since 1975. In all cases the collisions were the result of a wide body aircraft attempting to pass a stationary aircraft waiting at a holding position. These reports identified various factors, including the difficulty in assessing wingtip clearance from the flight deck of large aircraft and the belief of some of the pilots involved that, by maintaining the taxiway centreline, separation between their aircraft others would be assured. It was also apparent that some of the crews involved did not realise that their aircraft had been involved in a collision. The reports commented on the potential influence of taxiway design and operational procedures in use.

#### Analysis

The crew of the A340 incorrectly believed that ATC had issued the instruction to follow the green centreline lights to Holding Point A2 on the basis that there was nothing to impede their progress. The illumination of the green taxiway centreline lights along the taxiway in front of them reinforced this assumption. The crew were aware of the B747 on the adjacent taxiway but had assessed that they had sufficient room to pass, although the decision to move to the left of the centreline, away from the B747, indicated a lack of confidence as to the true extent of the separation between the two aircraft.

The commander of the A340 was seated in a position that placed him furthest away from the B747 and was unable to make an accurate assessment of the clearance between the two aircraft as they drew level. He, therefore, relied on guidance from the two co-pilots, neither of whom had direct experience of taxiing large aircraft. As with most large aircraft, it is difficult to see the wingtips on the Airbus A340 from the flight deck. It was also dark,

adding to that difficulty. This was further compounded by the acute angles between the two aircraft, which may have given the impression of more distance between their wingtips than existed.

When taxiing, the inability of crews to judge wingtip positions accurately, particularly on large aircraft, can make it difficult to decide whether sufficient clearance exists. The design of an airport layout, in particular its taxiways, and clear operational procedures can help to minimise the risk of collisions between such aircraft. This is of particular importance at large busy airports, where limited available space and high capacity demands impose additional pressures.

This and previous investigations revealed a lack of understanding amongst some pilots of the protection afforded by airfield markings to taxiing aircraft. In particular, there was a certain amount of misunderstanding that taxiing along the centreline of a taxiway provided separation from all other aircraft. As CAP 637 explains, clearance is only guaranteed to aircraft taxiing in front of a holding position from those

aircraft holding behind it. When taxiing, responsibility for the avoidance of other aircraft lies with the flight crew of an aircraft.

This lack of understanding was a factor in this and other accidents. The extent of the problem is unclear but it highlights the need for greater awareness amongst flight crews in the area of ground operations. There is a possibility that a ground collision could occur which is not identified in time to prevent one or both aircraft attempting to become airborne, having sustained damage that may affect their airworthiness. The airport operator's attempts to raise awareness, through the message on the Departure ATIS, may have led to further misunderstanding. Therefore, the following Safety Recommendation is made:

**Safety Recommendation 2010-010**

It is recommended that Heathrow Airport Limited improve the effectiveness of the warnings issued to pilots of manoeuvring aircraft, to clarify that clearance from other aircraft is not assured in all circumstances, regardless of the ATC taxi clearance.