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**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Boeing 777-232, N864DA	
<b>No &amp; Type of Engines:</b>	2 Rolls-Royce Trent 892-1-7 turbofan engines	
<b>Year of Manufacture:</b>	1999	
<b>Date &amp; Time (UTC):</b>	20 May 2005 at 0635 hrs	
<b>Location:</b>	Stand 50, London (Gatwick) Airport	
<b>Type of Flight:</b>	Public Transport (Passenger)	
<b>Persons on Board:</b>	Crew - 13	Passengers - 296
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Damage to the leading edge of the left engine intake cowl; substantial damage to the passenger airbridge	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	57 years	
<b>Commander's Flying Experience:</b>	18,000 hours (of which 250 were on type) Last 90 days - 225 hours Last 28 days - 80 hours	
<b>Information Source:</b>	AAIB Field Investigation	

**Synopsis**

The aircraft was taxied onto the stand at an appropriate speed and aligned with the centreline; the airbridge was parked in the correct location. The stand guidance system had been calibrated correctly, and it was serviceable and operating at the time of the incident. The aircraft overran the stopping point and collided with the airbridge. The leading edge of the aircraft's left engine intake cowl was damaged, and there was substantial damage to the airbridge. Ten safety recommendations have been made.

**History of the flight**

The flight crew, consisting of the commander and two co-pilots, had reported for duty at Atlanta Airport,

Georgia, USA at 2120 hrs UTC (1720 hrs local) on 19 May 2005. One co-pilot acted as handling pilot during the takeoff and landing whilst the other acted as a relief pilot, taking control for part of the cruise phase.

The aircraft departed from Atlanta at 2322 hrs UTC (1922 hrs local) and landed at Gatwick Airport at 0620 hrs UTC (0720 hrs local) on 20 May 2005 after an uneventful flight. Once on the ground the commander took control from the handling co-pilot in order to taxi the aircraft. When clear of the runway ATC instructed the crew to taxi the aircraft to Stand 50; whilst taxiing to the stand the crew shut down the left engine, in accordance with the company standard operating procedures.

As the aircraft approached the allocated stand, both the commander and the operating co-pilot confirmed visually that the stand was clear of obstructions. The commander turned the aircraft onto the stand, using the Azimuth Guidance for Nose-In Stands (AGNIS) system to position it on the centreline, the AGNIS is located at the far end of the stand. He stated that he then alternated his gaze between the AGNIS and the Parallax Aircraft Parking Aid (PAPA) board, situated some distance to the left of the AGNIS; he identified the Boeing 777-200 stopping mark on the PAPA board. The commander stated that as the aircraft progressed onto the stand he saw that the AGNIS system indicated that the aircraft was no longer on the centreline and he was momentarily distracted whilst regaining the centreline. He stated that when he looked again at the PAPA board, it indicated that the aircraft was then approaching the stopping point for the Boeing 777-300 and, before he had a chance to stop the aircraft, he felt it judder. He applied the brakes and, on looking up, saw that the emergency STOP light, situated next to the AGNIS, was flashing. There were no abnormal indications on the flight deck and the crew waited for the ground engineer to speak to them via the aircraft intercom system. Once the ground engineer had connected his headset he informed the crew that the aircraft's left engine had struck the passenger airbridge. The crew then shut down the right engine and the passengers were later disembarked using stairs on the right side of the aircraft.

#### **The arrival on the stand from the ground staff's perspective**

The ground crew handling the flight's arrival consisted of a team leader and five other ground handlers. They arrived at Stand 50 in good time and after checking that the stand was clear of obstructions, and that the airbridge was parked in the correct position, the team

leader switched on the stand's parking guidance system (AGNIS and PAPA). The ground crew member with the aircraft chocks, then stood close to the position where, from previous experience, he knew that the aircraft's nose wheel should stop.

The aircraft was also being met by a dispatcher, who awaited its arrival in the control cabin at the end of the passenger airbridge. Waiting with him were an airline representative, two handling agents, two security agents, and two passenger wheelchair agents.

When the aircraft turned onto the stand the ground crew member with the chocks monitored its progress. When it continued past its expected stopping point he ran to the emergency STOP sign activation switch, positioned at ground level at the end of the stand, and turned it on. He estimated he activated the switch just as the aircraft's left engine contacted the airbridge.

As the aircraft approached it was also visible to the dispatcher standing in the control cabin at the end of the airbridge, although his view from that position was limited. As the aircraft was moving past the end of the airbridge the dispatcher felt the airbridge suddenly move. Initially he thought it was the airbridge malfunctioning, but then realised that it had been struck by the aircraft. The airbridge continued to move, and he and those with him ran back along the airbridge towards the terminal.

There were no injuries to any of the waiting ground staff, although some of the agents waiting on the airbridge suffered slight shock.

#### **Examination of the aircraft and stand**

The damage to the aircraft was restricted to a tear and two large dents in the leading edge of the left engine intake cowl.

The aircraft had stopped with its nose wheels on the centreline of the stand and with the fuselage at a very slight angle to it. The nosewheels had stopped 7.3 m forward of the correct parking position for a Boeing 777-200 and 1.74 m forward of that for a Boeing 777-300. The airbridge had been parked in the correct location for the arrival of the aircraft, with its wheel carriage inside the circle painted on the ground.

The airbridge had suffered substantial damage. Inspection confirmed that the left engine had struck the end of the airbridge at the point which houses the rotating mechanism for positioning the control cabin at the end of the airbridge parallel to a parked aircraft. The rotating cabin had been pushed off its left support roller, causing it to move upwards and tilt approximately 10°. The cabin rotation drive motor securing bolts had sheared, the drive chain had broken and the sidewalls of the cabin were damaged.

The AGNIS and PAPA board indicator lights and the emergency STOP light were serviceable and correctly calibrated. It was noted that there was no cover in place behind the slot cut in the PAPA board, through which the light is viewed. This allowed the terminal building, which was of glass construction with vertical window pane supports, of a similar appearance to the light tube, to be seen through the slot.

### **Commander's rest and duty time**

The commander had taken a rest period of 24 hours preceding the flight and had reported for the flight to Gatwick at 2120 hrs UTC, in Atlanta; his flight duty time commenced at this point. In order to report on time the commander left his home, in Texas, at 1230 hrs UTC (0730 hrs local) to take a flight from Dallas to Atlanta, where he arrived at about 1700 hrs UTC.

The flight to Gatwick departed from Atlanta at 2322 hrs UTC, landing at 0620 hrs UTC; a flight duration of nearly seven hours. The commander stated that during the flight he had rested for two and a quarter hours on a bunk in the aircraft's crew rest area.

The arrival time at Gatwick equated to a local time of 0120 hrs at the commander's home in Texas.

### **Flight Recorders**

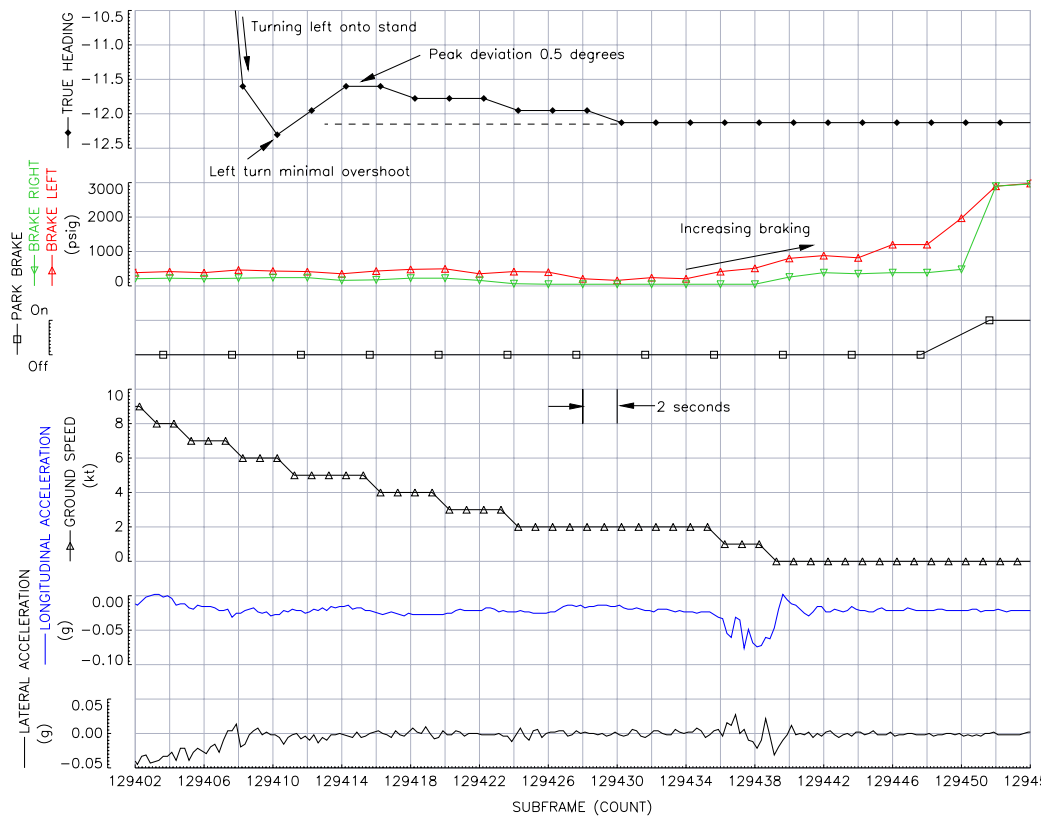
The aircraft Flight Data Recorder (FDR) and the Cockpit Voice Recorder (CVR) were removed and successfully replayed.

### **Flight Data Recorder**

Ground speed data was verified by using recorded ground speed and heading data to derive the low speed taxi path of the aircraft, this was then compared to the GPS positional information, which was recorded at a much lower sampling rate. The comparison showed a high degree of correlation, hence validating the recorded ground speeds.

The pertinent data from the FDR is shown in Figure 1, commencing at the point when the aircraft had started to turn off the taxiway onto the stand, and ending shortly after the application of the park brake.

The left engine had been stopped prior to the aircraft being turned onto stand and the right engine power lever remained at idle throughout the parking procedure. On turning onto the stand, the aircraft heading passed fractionally through the final heading by 0.2°T followed by a correction to the right by 0.5°T before recovering back onto the final heading. At this time the aircraft had a recorded ground speed of between 4 and 5 kts and was slowing. The aircraft heading had stabilised 17 secs after the peak deviation and the ground speed



**Figure 1**

Time history of the key FDR parameters during the taxi onto stand.  
Incident to N864DA on 20 May 2005 at Gatwick airport

reduced to approximately 2 kt. About 4 to 5 secs after stabilising at this speed, the data showed disturbances in the lateral and longitudinal acceleration parameters and a drop in ground speed to zero; this is consistent with the aircraft colliding with the stand. The direction of the longitudinal acceleration is consistent with the aircraft decelerating and it peaked at approximately 0.05g from the reading at rest. The direction of the lateral acceleration was consistent with a force pushing to the right, this was followed by a motion back to the left after a further jolt or oscillation. The peak lateral acceleration was less than 0.03g. The time from the first indications of the impact to the time the aircraft had settled was 4 to 5 secs; the park brake was applied 7 to 11 secs later.

**Cockpit Voice Recorder**

The CVR was a two-hour, solid state unit, with four audio inputs. These were recorded separately for the last 30 minutes and as a mixed audio stream for the whole two hours. The power to the CVR was isolated one hour and ten minutes after the incident had occurred and as a result, only the mixed audio recordings were available for analysing the conversations at the time of the event. The lower quality of the recording produced from the mixed audio streams made it more difficult to decipher some conversations that might have been clearer had the separately recorded, individual audio tracks been available.

From the recording, in the seconds after the impact, the commander can be heard to say *“I never saw, I never saw it change. I missed it.”*. The subsequent conversation between the three pilots makes it apparent that they were initially unaware of the seriousness of the impact, indeed before the commander had been told what had happened he had requested that they be pushed back to the appropriate stopping point by a tug. Cockpit discussions also confirmed that the aircraft had stopped beyond the Boeing 777-300 mark on the PAPA board.

### **Stand 50 and its visual docking guidance system**

At the time of the incident there were 110 aircraft parking stands at Gatwick Airport. These used a variety of centreline and stopping guidance to allow aircraft to park without the aid of a marshaller. Stand 50 had guidance and markings for three different parking positions and could accommodate either a single wide-bodied aircraft or two narrow-bodied aircraft; the latter two aircraft parking positions were designated Stand 50L and Stand 50R.

Centreline guidance onto all three parking positions was by AGNIS. This system comprises two closely spaced light bars, at cockpit level, positioned side-by-side in a box at the end of the stand and thus directly ahead of the pilot. The light bars appear to the pilot as either red or green depending on the aircraft's lateral position relative to the stand's centreline. If the aircraft is on the centreline both light bars are green. If the aircraft is to the left of the centreline, the left light bar is red whilst the right one remains green, and if it is to the right of the centreline, the right light bar is red whilst the left one remains green. The system is aligned to be used by the pilot in the left seat only.

Stopping guidance for Stand 50 was provided by a PAPA board. This is a large reference board positioned

at cockpit level at the end of the stand, some distance to one side of the AGNIS unit; on Stand 50 it was to the left. There is a horizontal slot in the reference board behind which is positioned a vertical fluorescent light tube. Several vertical reference marks are painted on the board, each identified as relating to a particular type, or group of types, of aircraft intended to use the stand. As an aircraft moves along the stand centreline, the vertical light tube appears to move across the slot as a result of the parallax effect. When the light aligns with the mark for the particular type of aircraft using the guidance, the aircraft is at the correct stopping point. The stopping guidance, as with the AGNIS, is aligned for use from the left seat only. The PAPA board for Stand 50 has two markings for use by Boeing 777 aircraft. The B 777 mark is intended for use by Boeing 777-200 series aircraft whilst the B777-3 mark is intended for the longer Boeing 777-300 series aircraft.

In this incident the commander's view of the PAPA board was obstructed by a window pillar, requiring him to move his whole body either forwards or backwards in order to see the board behind the pillar. It was also raining when the aircraft arrived at the stand, further reducing the commander's ability to see the PAPA board clearly. As the system is only correctly aligned when viewed from the left seat, the pilot sitting in the right seat is unable to provide any form of assistance during the stopping manoeuvre.

There was an emergency STOP sign positioned immediately adjacent to the AGNIS guidance lights which, when activated, illuminates with the word STOP in red. Should the ground crew wish to stop an aircraft at any time during the parking manoeuvre, they can activate the emergency STOP sign by using either of two buttons, one located at the airbridge operator's station and the other on a panel at ground level at the end of the

stand. On Stand 50 the ground level button was mounted on the side of one of the PAPA board support pillars. It was positioned at ninety degrees to the stand centreline and its identification board was masked by that for the fuel hydrant emergency shut-off, which was on the same pillar and facing into the stand. As such the ground level button was not immediately visible from the main area of the stand.

The aircraft operator provided instructions for its pilots on the use of the parking aids at Gatwick Airport. These were in the airfield charts issued to each pilot flying to the airport. The briefing note supplier had used the airport operator's instructions as its reference material.

### Operation of the airbridge

Stand 50 was served by a single passenger airbridge. It was manoeuvred into position using controls situated in the rotating cabin, at the end which abuts the aircraft. The airbridge was moved by a set of powered, steerable wheels on the end of the legs which support the control cabin end. When the airbridge was parked, awaiting the arrival of an aircraft, the wheels should have been positioned in a circle painted on the ground. In this position the cleared distance between the airbridge and a correctly parked Boeing 777-200 was 6.8 m. The airbridge controls included an emergency stop button which stopped the airbridge moving and another similar button which activated the emergency stop sign by the AGNIS. The purpose of neither button was clearly marked. A limited view of aircraft manoeuvring onto the stand was available through transparent panels in the doors and structure of the airbridge control cabin.

Airbridges were only allowed to be operated by suitably qualified personnel. At Gatwick, information relating to

their use was provided by the airport operator through Managing Director's Instructions (MDI). MDI A17/02 related to aircraft stand guidance and stopping guidance and cross-referred to the '*Airside Safety and Operations Safety and Training Standards for Airbridge Operations*'. This document set out the standards required by the airport operator for the training, licensing, operational safety and audit procedures of those using airbridges. It included the statement:

*'The presence of any persons on the airbridge except the operator while moving the airbridge is forbidden, unless they are:*

- *In the process of being trained*
- *Audited by BAA*
- *Assisting BAA Engineering'*

The dispatcher had 20 years experience and was correctly licensed; however, he was unaware of the requirement to have only one person on the airbridge whilst it was being operated.

### Recommended international standards - (ICAO Annex 14)

Annex 14 to the Convention on International Civil Aviation sets out the international standards and recommended practices for aerodromes. Chapter 5, Section 5.3.24 of this Annex concerns visual docking guidance systems and sets out the basic characteristics of such systems which are regarded as essential, and makes recommendations regarding others considered desirable. Of particular relevance to this incident is the standard for the location of the stopping position indicator, described at 5.3.24.14, which states that the centreline guidance and stopping point indicators should be, effectively, co-located.

The commander had previously used a variety of stand

guidance systems and the system he was most familiar with, and found easiest to use, was that installed at his home base of Atlanta, USA. Lateral guidance on these stands was provided by a system of lights similar to the AGNIS system at Gatwick. Stopping guidance was provided by a series of three lights: red, amber and green. These were situated at the end of the stand, with the AGNIS, and were controlled by a ground handler who manually selected each light in turn. A green light indicated that the aircraft should continue forwards, amber that it was approaching the stopping point and red that it should stop. The commander had also used airports where guidance was provided by combined laser and radar guidance systems such as the Aircraft Positioning and Information System (APIS) and 'Safe Dock'. These systems provide the pilot with both lateral guidance and correct stopping point indication by means of a series of lights contained within a single unit positioned at the end of the stand, on the centreline and at cockpit level. These visual docking guidance systems, where the centreline guidance and stopping point indicators are co-located, meet the recommended international standards.

### Recent investigations into collisions on stand

In 2004 the AAIB investigated two incidents at Heathrow Airport involving aircraft colliding with stands: one to a B737-700, YR-BGF<sup>1</sup>, and another to a B747-400, G-BNLG<sup>2</sup>. Heathrow and Gatwick are operated by the same parent company. Several safety recommendations were made as a result of these investigations, some of which are relevant to this incident.

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#### Footnote

<sup>1</sup> Report reference EW/C2004/03/02 published in AAIB Bulletin 5/2005.

<sup>2</sup> Report reference EW/C2004/04/02 published in AAIB Bulletin 5/2005.

### Investigation into the incident involving YR-BGF

It was established that there was only a single emergency STOP light on each stand at Heathrow, positioned at the end of the stand close to the AGNIS unit. It was considered that the commander had been concentrating on the stopping point mirror which was at a considerable angular separation from the AGNIS unit. It was concluded that, as a result of this separation, the pilot of YR-BGF had not noticed the illumination of the emergency stop indication, which the ground crew had activated after the aircraft had progressed beyond the correct stopping point. The following recommendation was therefore made:

#### ***Safety Recommendation 2005-011***

*It is recommended that, in addition to the stop light at the end of each stand, Heathrow Airport Limited should also install an emergency STOP light adjacent to any aid used by the pilot for alignment, or stopping, in such a position that, irrespective of which aid is being used, the light falls within the handling pilot's field of view.*

### Investigation into the incident involving G-BNLG

a) Buttons to activate the emergency STOP sign were not present on all airbridges at Heathrow. Where the buttons did exist there was inadequate marking to indicate their purpose and to differentiate them from the co-located, and equally poorly marked, emergency buttons intended to stop the airbridge from moving. When asked, a number of airbridge operators were unable to differentiate between the buttons. The following recommendation was therefore made:

**Safety Recommendation 2005-014**

*“It is recommended that Heathrow Airport Limited should expedite the program to install duplicate emergency stop buttons at all of its airbridge control stations and ensure that all such buttons are clearly and unambiguously marked.”*

Buttons to activate the emergency STOP light were present on all airbridges at Gatwick at the time of the incident to N864DA. However, the marking of emergency buttons positioned on airbridges was poor, leading to confusion by the operators in identifying their purpose.

b) Heathrow Airport used a series of Operational Safety Instructions to disseminate information on procedures and equipment in use at the airport. There was inadequate indexing or cross referencing provided to readily identify the existence and location of relevant documents and information had become dispersed. The following recommendation was therefore made:

**Safety Recommendation 2005-016**

*It is recommended that Heathrow Airport Limited should review the system by which Operational Safety Instructions are published to ensure that they are either incorporated into a relevant document, such as the Aerodrome Manual or Aeronautical Information Publication, or are provided with an effective index such that the information they provide is readily identifiable.”*

Gatwick Airport Ltd (GAL) used a similar system for disseminating information, although they were referred to as Managing Director’s Instructions. The information in these instructions was inadequately indexed and the cross referencing was poor. At Gatwick Airport,

information on the operation of airbridges was not contained in either the Aerodrome Manual or Managing Director’s Instructions, as might be expected, but in a Safety and Training Standards Document. Whilst this document contained all the relevant material it was intended for use by those with a training or managerial role and, as a result, this information was not readily available to the operators.

The dispatcher was unaware of the requirement to have only one person on the airbridge when it was being operated. During the course of this investigation, information obtained suggested that the practice of having more than one person on the airbridge, whilst it was being operating, was common at the airport. Having been made aware of the problem, the ground handling company involved took immediate steps to stop the practice.

c) The investigation revealed the presence of unofficial and redundant ground markings on stands at Heathrow. The following recommendation was therefore made:

**Safety Recommendation 2005-018**

*“It is recommended that Heathrow Airport Limited should review all ground markings related to aircraft parking stands, to ensure that their meanings are unambiguous, that markings are clearly displayed and that clear diagrams of such markings are prominently displayed on any aircraft stand.”*

Similar ground markings were in evidence at Gatwick. Other stopping marks were intended to be used only temporarily whilst, for instance, work was undertaken on the stand and aircraft were required to stop short. These marks had remained after their initial requirement had passed.



d) The investigation into the incident involving G-BNLG revealed that despite the presence of ground crew on the apron, the STOP button at ground level on the stand was not activated. It was considered logical to have a ground crew member actually manning the STOP button for it to be effective in preventing a collision once an overrun had been identified by the ground crew. The following recommendation was therefore made:

***Safety Recommendation 2005-020***

*“It is recommended that British Airways should require that a member of their ground crew assumes the responsibility of being adjacent to the ground level emergency STOP light button and of monitoring the arrival of the aircraft onto the stand, whenever ground crews are present on a stand whilst an aircraft is manoeuvring to park.”*

In the incident involving N864DA at Gatwick, once the ground crew realised the aircraft had overrun its correct stopping position, a ground crew member had run to the emergency STOP button and activated the emergency STOP sign. He was however unable reach the STOP button in time to prevent the aircraft striking the airbridge. Subsequent to the incident the ground agents concerned took immediate steps to ensure that where possible a member of the ground crew was positioned next to the STOP button on the stand during parking operations. However, this procedure was abandoned after a few weeks because the agent at the STOP button could not determine adequately the point at which the aircraft should stop.

**Analysis**

Evidence from the FDR indicates that the aircraft had been correctly aligned with the centreline of the stand

and had taxied along it, at an appropriate speed, for some distance prior to the impact.

The PAPA guidance system at Gatwick Airport requires the pilot in the left seat to alternate his gaze between the AGNIS unit, directly ahead of him, and the PAPA board, situated either to his left or right. By placing the board to one side of the aircraft there are times when it may only be visible through a side window rather than through the main front screen. Not only does this result in reduced visibility during periods of rain, since such windows are not usually equipped with wipers, but the view of the PAPA board may also be obstructed by the pillars between the various flight deck windscreens. The problem is exacerbated when the PAPA board is placed to the right of the aircraft and can only be seen by looking across the cockpit through the windows on the other side of the flight deck. Moreover, when considering this incident, if the pilot had been concentrating on the PAPA board during the final stages of the parking manoeuvre, it is unlikely that he would have seen the emergency STOP light illuminate, because of the wide angular separation between the AGNIS indicator and the PAPA board.

With the exception of the PAPA board, all other forms of guidance used by the commander provided an active indication that the aircraft has reached the correct stopping point, whether by a marshaller crossing his arms, a light changing colour or the word ‘STOP’ illuminating. The PAPA board system, whilst indicating the aircraft’s approach to, and arrival at, the correct stopping point, does not physically change to highlight that the aircraft has reached this point. A comparison of the guidance systems encountered by the commander revealed that, with the exception of the PAPA board, all the other systems have the required elements effectively co-located directly ahead of the

aircraft, in accordance with the standard described in ICAO Annex 14. The CAA is encouraging UK airport operators to replace such systems with ICAO Annex 14 compliant, advanced docking visual guidance systems as soon as is practicable.

Whilst no comments on the CVR specifically indicated where the commander's vision was concentrated at the time of the impact, his subsequent comments suggest that whether he was looking at the PAPA board or AGNIS, he was expecting some active indication that he should stop. It is possible that he was concentrating solely on the AGNIS lights. The aircraft was correctly on the centreline and the consistent heading, as recorded on the FDR, meant that the commander would have seen the two green lights ahead of him throughout the final stages of parking. It seems possible that the comment "*I never saw, I never saw it change. I missed it.*", combined with his familiarity with the Atlanta stopping system, on which the lights change from green to amber to red, might indicate that the commander was concentrating on the AGNIS and was expecting the light to change colour at the appropriate stopping point. It is also feasible that the emergency STOP light sign could have been misinterpreted to be part of the normal parking system. The ground handler who activated the emergency STOP light stated that this illuminated at about the same time as the aircraft came to a halt, immediately after the impact.

The investigation considered whether the commander had confused the B777-3 mark for the B777 mark appropriate for his aircraft type; however, this is inconsistent with the fact that the aircraft over-ran this mark too. Indeed had the aircraft stopped at the mark intended for the Boeing 777-300 series aircraft it would still have stopped 1.3m short of the airbridge. Whilst it does not appear to have been a factor in the incident

GAL accepted that, for clarity, the B777 mark should more appropriately have been labelled 'B777-2'.

The investigation considered whether the absence of a back-plate, behind the slot in the PAPA board, might have lead the pilot to mistake a window support in the terminal building for the light tube. After examination this possibility was discounted, although the absence of the back-plate on a considerable number of the other PAPA boards at the airport might possibly lead to pilot confusion. This absence seems to have been an oversight and, although it would not have rendered the PAPAs unusable, it may have reduced the clarity of the indications.

The investigation also considered whether crew fatigue was a possible contributory factor in the incident. The commander's allocated rest period prior to the flight was reduced by the time taken for him to travel to Atlanta. He left his home approximately 18 hours prior to the landing at Gatwick, although he had taken the opportunity during the flight to rest for two and a quarter hours in a bunk, in accordance with the company procedures. The operator requires all of its crews to sign a statement when reporting for duty that they are fit to conduct the flight. Whilst the commander no doubt felt sufficiently rested when reporting for duty it is possible that he would not have felt so on arrival at Gatwick. It is of note that of the three pilots on this flight, two lived in Texas (where the operator had recently closed one of its bases), and one in Florida, all some distance from their base at Atlanta. Whilst the responsibility for being fit to conduct a flight remains with an individual crew member, an operator should not ignore a situation where it must be known that, due to their home locations, their crew members are travelling considerable distances prior to operating flights.

Comparison of this incident with those recently investigated at Heathrow Airport reveal a number of similarities. In light of the recommendations made as a result of these previous investigations it is clear that the information contained in the recommendations was not shared across those airports operated by the same parent company.

Both airports had poorly marked airbridge mounted emergency buttons, where these were fitted. Gatwick however, unlike Heathrow, did have additional emergency STOP light buttons fitted in all its airbridges. Furthermore, the emergency stop button at ground level on Stand 50 at Gatwick, whilst well marked, was poorly positioned so that its location was not obvious to ground crew monitoring an aircraft's arrival on the stand.

Both airports shared a similar system for disseminating information although they were referred to by different names. The systems were similar in that they both led to information becoming fragmented and difficult to locate.

The dispatcher involved in the N864DA incident had 20 years experience of operating airbridges and was correctly licensed. He was unaware of the requirement to have only one person on the airbridge when it was being operated, but the importance of this instruction was borne out by both the close escape had by those on the airbridge on this occasion, and that of the dispatcher in the incident referred to in the G-BNLG investigation report. The practice of having more than one person on the airbridge, whilst it was being operated, was reported to be common at the airport. The lack of a readily accessible set of instructions for the operation of airbridges is believed to be significant in allowing this bad practice to become widespread. Having been made aware of the problem, the ground handling company involved took immediate

steps to stop the practice. However, the existence of an easily accessible reference document would have increased the probability of the ground crews adhering to the requirements in the first place.

Both airports had unofficial and redundant ground markings. The effective removal of redundant ground markings is problematic but where they are allowed to remain it potentially leads to confusion by both ground crew and flight crew. This was a contributory factor in the incident involving G-BNLG at Heathrow, where the airbridge was parked in the wrong position by a member of ground crew because the markings of the parking position for the airbridge has been changed whilst the old markings remaining visible. This is also potentially confusing for pilots trying to identify whether the airbridge is correctly parked prior to the aircraft entering the stand.

As at Heathrow, there were also numerous hand-painted and unofficial ground marks in existence on stands at Gatwick. These are used by ground crew when marshalling or towing aircraft onto stand when the normal aircraft parking aids are of little use. They are generally made using paint sprayed from hand-held aerosol cans and there is generally no means available to determine who made the mark, why it was made or whether it has been made in the right place. Where a range of stopping positions is required for different aircraft types, this can lead to there being a series of marks which in turn can lead to mis-identification, especially as the identification marks attached to each line are of varying clarity. In all cases, the use of ground marks to indicate to ground staff the correct stopping point for an aircraft gives rise to difficulties. A solution to the problem is known to exist at least one UK airport where the stands are designed so that a common stopping position is used by all aircraft and the airbridge is capable of being manoeuvred into

position on all types authorised to use the stand. This allows one common stopping mark to be applied on the ground for use by ground staff. This effective solution is however reliant on the initial design of the stand and choice of airbridge and it is accepted that this may not be appropriate for all existing airport infrastructures. Where a common stopping point is not possible, an alternative mechanism should be identified by airport operators that does not rely on ground crew using marks of unknown origin, authority and accuracy for the parking of aircraft.

Finally, an issue arose at both Heathrow and Gatwick over the manning of emergency stop buttons positioned at ground level on the airport stands. Only one of the three handling agencies involved in the incidents investigated specifically required the button to be manned whilst aircraft were in the process of parking on the stand. Of the three incidents it was only their ground crew that had managed to activate the emergency stop sign in sufficient time for it to have potentially prevented the incident occurring. That it failed to do so was because neither of the pilots was looking at it when it was activated. Whilst the location of the signs has already been discussed, if they are not activated in a timely manner then, irrespective of their position, they can never serve their intended purpose. It therefore seems logical to have the button manned whenever possible during parking operations, since this then allows for a rapid reaction when the threat of an imminent collision becomes evident.

### **Subsequent Actions**

The aircraft operator, GAL and the ground handling agency involved have carried out internal investigations leading to initial preventative action being taken by all parties. In particular, the aircraft operator has taken the following actions:

- a The operator has produced a computerised training package for its crews regarding aircraft parking aids.
- b On 6 July 2006, their Director (Flight Operations) issued an internal memorandum to all of their pilots regarding the parking hazards associated with the PAPA/AGNIS system.
- c On 12 July 2006, the operator's General Manager (Flight Safety Programmes), together with their Airport Customer Service Regional Director responsible for the UK, met with the Station Manager for London (Gatwick) to discuss the issues relating to PAPA/AGNIS. On 18 July 2006 the following employee notification was disseminated to all of the agent's ramp employees and posted in all break rooms, both at Gatwick and other relevant destinations.

*A designated ramp employee of either Team Leader Grade or above must be available in the vicinity of the emergency stop button for all arriving [the operator] aircraft. This individual must take the appropriate action if those actually working around the aircraft indicate that it is necessary to stop the aircraft in the event of any emergency situation.*

This procedure will also be forwarded for implementation to the other international stations used by the operator, where PAPA/AGNIS is installed. The only exception is Manchester, where a manual stop light system is used to indicate to parking aircraft that they should stop.

## CVR Handling

Given that the incident happened on stand it is unfortunate that over one hour elapsed before power to the CVR was isolated. Deactivation of the CVR after an accident or incident is part of the published crew procedures. However, the practicalities of isolating the power from the CVR fitted to the B777 are not straightforward since the CVR circuit breaker is located in the electronics bay of the aircraft instead of on the flight deck. Access to the electronics bay from within the aircraft is via a hatch in the cabin floor adjacent to the front left door of the aircraft, alternatively access can be gained from beneath the aircraft via a hatch. A survey of the other types of aircraft used by the operator revealed that the B777 was the only aircraft with the circuit breaker not on the flight deck.

As a backup to the crew procedures, the operator Technical Operations Policies And Procedures required that:

*“2. On Ground - In the event of an accident or incident on the ground, a responsible Delta employee at the scene ensures that the voice recorder circuit breaker is opened.”*

Discussions with the operator revealed that it is not made clear in the operator procedures how the responsible employee is identified in a timely manner.

The operator is actively reviewing their procedures and policies in this area. However, as with previous investigations, there is a need for the certifying authority to ensure that the oversight of operations include ensuring appropriate procedures and training and in place to handle CVRs after accidents and incidents.

## Conclusion

At the time of the incident the aircraft was serviceable. It was taxied onto the stand, along the centre line, at an appropriate speed. The airbridge was parked in the correct location and the stand guidance was correctly calibrated, serviceable and operating. The aircraft passed the correct stopping point and the aircraft collided with the airbridge.

The design of the stand guidance system did not comply with the standards described in ICAO Annex 14. The CAA is encouraging UK airport operators to replace such systems with ICAO Annex 14 compliant advanced docking visual guidance systems as soon as is practicable. Contributory factors to the incident were the commander’s lack of familiarity with the parking system and possible fatigue.

## Safety Recommendations

As a consequence of this incident the following recommendations are made:

### Safety Recommendation 2006-076

It is recommended that BAA should ensure an effective transfer of airside safety related information between all of their airports.

#### *Response to Safety Recommendation 2006-076*

*BAA has accepted this recommendation. Information exchange within BAA is now achieved through meetings involving the Operations Directors of the various airports in the group; these meetings are held every 4 months. The Duty Managers of the different airports make contact more frequently in order to share immediate safety related information.*

**Safety Recommendation 2006-077**

It is recommended that Gatwick Airport Limited should ensure that all PAPA boards are fitted with backing plates and that aircraft type markings on the boards are unambiguous.

*Response to Safety Recommendation 2006-077*

*Gatwick Airport Limited has accepted this recommendation. An audit has been carried out to identify those PAPA units at Gatwick Airport without a backing plate. It was found that backing plates were not fitted to those older units which had been manufactured without provision for such plates to be fitted. New backing plates have been designed and will be fitted where required. Newly manufactured PAPA units have enclosed systems where no such backing plate is required. Aircraft type markings on the PAPA boards have been revised to remove ambiguity.*

**Safety Recommendation 2006-078**

It is recommended that BAA should review all current and future visual guidance docking systems at their airports with a view to complying with ICAO Annex 14, Chapter 5, Section 5.3.24.

*Response to Safety Recommendation 2006-078*

*BAA has accepted this recommendation. A program has commenced across BAA airports to replace older generation guidance systems with those complying with ICAO Annex 14, Chapter 5, Section 5.3.24. A risk assessment has been conducted for each stand and guidance systems are being replaced on a priority basis related to this assessment. Thirty 'Safe Dock' docking systems have now been installed at Gatwick Airport.*

**Safety Recommendation 2006-079**

It is recommended that Gatwick Airport Limited should install an emergency STOP light adjacent to any aid used by the pilot for alignment or stopping, in such a position that, irrespective of which aid is being used, the emergency STOP light is within the handling pilot's field of view.

*Response to Safety Recommendation 2006-079*

*Gatwick Airport Limited has partially accepted this recommendation. They pointed out that when the STOP button is activated all lights within the guidance system extinguish, at which point a pilot should bring the aircraft to a halt immediately. They also considered that such STOP lights, which are visible in some light conditions even when not illuminated, could confuse some pilots who might expect them to illuminate to provide active stopping guidance when the aircraft was at the correct stopping point. Gatwick Airport Limited has agreed to carry out a risk assessment for each stand, taking these factors into account, before deciding if additional lights were required.*

**Safety Recommendation 2006-080**

It is recommended that Gatwick Airport Limited should ensure that the location of emergency STOP buttons, at ground level on stands, is clearly identifiable to ground crews operating on the stand.

*Response to Safety Recommendation 2006-080*

*Gatwick Airport Limited has accepted this recommendation. The location and signage of the emergency STOP buttons, at ground level on stands, has now been standardised and is clearly identifiable to the ground crews operating on the stands.*

**Safety Recommendation 2006-081**

It is recommended that Gatwick Airport Limited should ensure that all emergency STOP buttons positioned in airbridges are clearly and unambiguously marked.

*Response to Safety Recommendation 2006-081*

*Gatwick Airport Limited has accepted this recommendation. An audit of the airbridges at Gatwick Airport has been completed and all emergency STOP buttons positioned in the airbridges are now clearly and unambiguously marked.*

**Safety Recommendation 2006-082**

It is recommended that Gatwick Airport Limited should review the system by which Managing Directors Instructions are published to ensure the information they provide is readily identifiable.

*Response to Safety Recommendation 2006-082*

*Gatwick Airport Limited has accepted this recommendation. A suitable index will be added to the Managing Directors Instructions to ensure that the information they provide is readily identifiable.*

**Safety Recommendation 2006-083**

It is recommended that Gatwick Airport Limited should review all ground markings related to aircraft parking stands to ensure that they are clearly marked and that their meanings are unambiguous.

*Response to Safety Recommendation 2006-083*

*Gatwick Airport Limited has accepted this recommendation. Unofficial ground markings have been removed. All future marks will have to be authorised by the Duty Operations Manager and will only be made using a suitable stencil.*

**Safety Recommendation 2006-084**

It is recommended that Gatwick Airport Limited should examine the practicability of requiring a member of the ground crew to assume the responsibility of being adjacent to the ground level emergency STOP light button, and of monitoring the arrival of the aircraft onto the stand, whenever ground crews are present on a stand whilst an aircraft is manoeuvring to park. An effective means of monitoring whether the aircraft has overrun its correct parking position should also be devised.

*Response to Safety Recommendation 2006-084*

*Gatwick Airport Limited has accepted this recommendation. Gatwick Airport Limited will consult ground operation organisations working at the airport to determine whether it is feasible to have the ground level emergency stop button manned during parking manoeuvres.*

**Safety Recommendation 2006-085**

It is recommended that Delta Airlines review the effectiveness of their measures to control crew fatigue, taking into account the time for crews to travel from their residences to the bases at which they are required to report for flight.

*Response to Safety Recommendation 2006-085*

*Delta Airlines has accepted this recommendation. Their Director (Flight Safety) will conduct a review of Delta's crew fatigue countermeasures together with the Director (Flight Operations) and the Director (Crew Resources and Scheduling).*

## Previous Safety Recommendations

Following an incident at London (Heathrow) airport, involving a Boeing 777 aircraft<sup>3</sup> operated by another American operator, the following safety recommendations were made. Both recommendations are relevant to this incident.

### ***Safety Recommendation 2005-52***

*It is recommended that the Federal Aviation Administration and the Joint Aviation Authorities review their processes of oversight of Operator's procedures and training support to ensure the timely preservation of Cockpit Voice Recorder recordings in accordance with ICAO Annex 6 Part I, 11.6, following a serious incident or accident. The operator procedures and training should provide the necessary skills and information to identify accidents and serious incidents and implement the necessary tasks to preserve these recordings in a timely manner.*

### ***Safety Recommendation 2005-53***

*It is recommended that the Federal Aviation Administration require United Airlines, and any other airline regulated by the Federal Aviation Administration with similar procedures, to ensure that their procedures allow for the prompt identification of accidents and serious incidents and the timely preservation of Cockpit Voice Recorder recordings.*

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## Footnote

<sup>3</sup> Report reference EW/C2004/07/03 published in AAIB Bulletin 9/2005.