

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Boeing 737-600, 7T-VJT
<b>No &amp; Type of Engines:</b>	2 CFM 56-7B20 turbofan engines
<b>Year of Manufacture:</b>	2002
<b>Date &amp; Time (UTC):</b>	31 May 2006 at 1200 hrs
<b>Location:</b>	London Gatwick Airport
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)
<b>Persons on Board:</b>	Crew - 6                      Passengers - 18
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	Damage to engine and engine outer casing
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence
<b>Commander's Age:</b>	54 years
<b>Commander's Flying Experience:</b>	10,868 hours (of which 700 were on type) Last 90 days - 195 hours Last 28 days - 45 hours
<b>Information Source:</b>	AAIB Field Investigation

## Synopsis

The aircraft taxied onto the stand centreline but failed to stop before its left engine cowling came into contact with the airbridge. The commander misunderstood the information provided by the parking aids and overran the correct stopping point whilst looking for a positive indication to stop. The emergency stop signal was not activated by either of the two ground staff present because confusion existed about when and how to operate it. Four safety recommendations are made.

## History of the flight

The aircraft landed on Runway 08R at London Gatwick Airport after an uneventful flight from Algiers. It was the only flight conducted by the crew that day. After vacating the runway the aircraft was instructed to taxi to

Stand 43, at the western end of the North Terminal. As the aircraft taxied towards this stand it was given revised instructions to taxi to Stand 19, located on the north side of South Terminal Pier 2. The aircraft taxied towards the newly allocated stand without difficulty.

As the aircraft approached the stand the commander could see that the AGNIS<sup>1</sup> docking guidance system was illuminated and entered the stand area. As he did so, he remarked to the co-pilot that he could not see any stopping guidance, but noted the presence of a ground crew member on the right side of the stand centreline.

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### Footnote

<sup>1</sup> Azimuth Guidance for Nose-In Stands, see later text for a full explanation.

He believed that this was a marshaller. He also noted a sign to the right of the AGNIS which he thought might be a stopping guidance signal, but this was in fact an extinguished emergency STOP sign. He elected to proceed. When he realised that no stopping guidance would be provided, either automatically or by the ground crew member, he stopped the aircraft and, together with the co-pilot, completed the shutdown checks.

When cabin crew opened the main entrance door, activity around the entrance alerted the commander to the fact that the left engine cowling had come into contact with part of the airbridge. The gentle impact had not resulted in injuries, either to ground staff or aircraft occupants, and the passengers disembarked without further incident.

Examination showed that part of the stand mechanism had contacted the cowling, resulting in a three inch diameter hole in the intake lip. The stand mechanism had been slightly deformed. The aircraft had overrun its correct stopping point by 10.3 m.

### **Arrival of the aircraft on stand from the ground staff's perspective**

An employee of the handling agent known as a GPU crewmember (GPUC)<sup>2</sup>, (whose duties included placing chocks around the nosewheel and connecting a ground power unit (GPU) to of the arriving aircraft), was informed of the change of stand shortly before the aircraft arrived. He was able to reach the stand before the aircraft and positioned himself ahead and to the right of where he believed the aircraft would stop.

Another employee of the handling agent known as a Traffic Officer was also advised of the change of stand and reached the manoeuvrable airbridge before the

aircraft arrived. In accordance with her normal duties, she lowered the airbridge from its parked height to a level corresponding approximately to the forward entrance door of the approaching aircraft, using controls located on a panel to the left of the airbridge head. As she did so she saw the aircraft continue beyond its normal stopping position. Although the airbridge remained in its parked position she realised that a collision might occur. She attempted to illuminate the emergency STOP signal but was unable to do so because she could not find the activation button.

The GPUC had seen the aircraft approaching and stated that he was aware that it had "gone a bit far" but thought that "he [the commander] knew what he was doing". The GPUC stated that he made no attempt to signal to the pilots that the aircraft was proceeding too far into the stand because he did not consider this to be one of his responsibilities. When the aircraft stopped he placed chocks in front of and behind the nosewheels but, noticing that the engine cowling had come into contact with part of the airbridge, did not connect the GPU to the aircraft.

### **Personnel information**

#### *GPU crewmember*

The GPUC had been employed by the same handling agent since March 1999 and, according to his employer, had received training appropriate to his duties. He had been trained to marshal aircraft by a previous employer and occasionally was required to do so by his present employer.

#### *Traffic officer*

The Traffic Officer had been employed by the same handling agent since November 1997 and, according to her employer, had received training appropriate to her duties.

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#### **Footnote**

<sup>2</sup> This acronym is used for brevity in this report but is not used officially by any of the organisations involved.

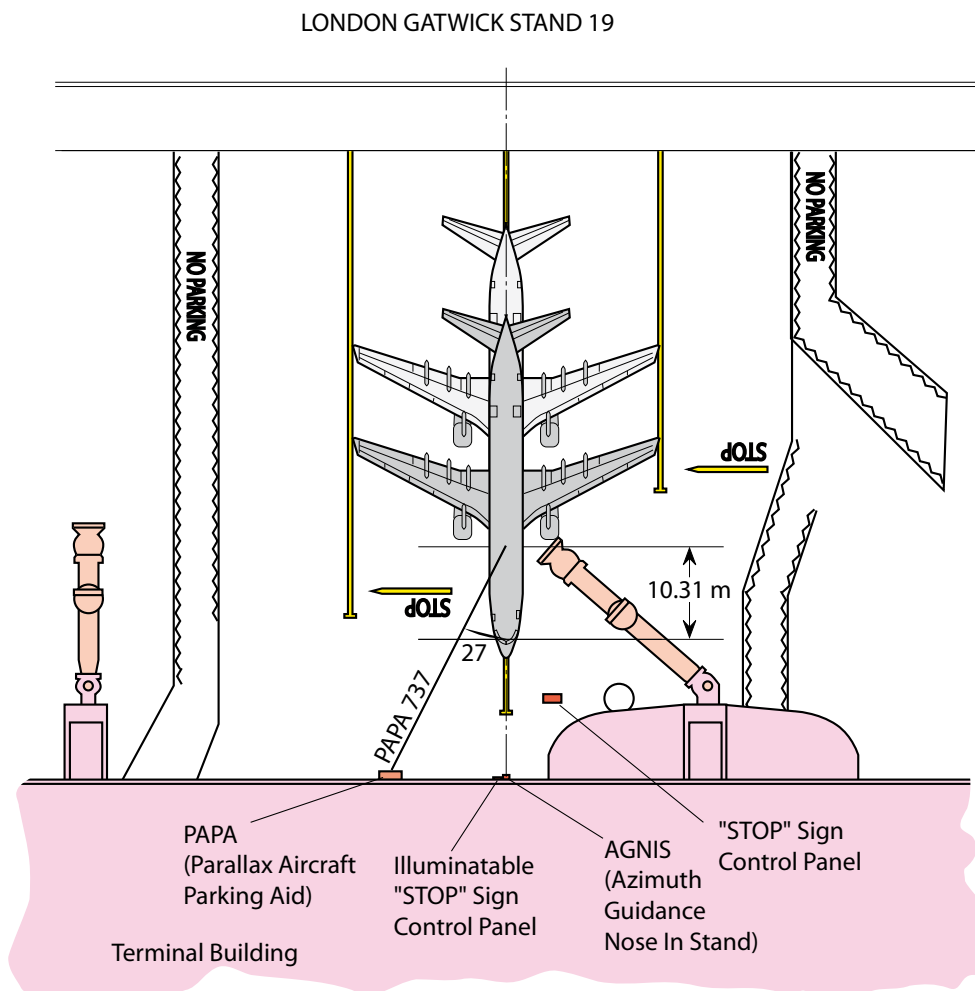
### Meteorological information

The runway and taxiway surfaces were dry and visibility was reported to be in excess of 10 km.

### Stand layout and guidance

Throughout the incident the airbridge remained in its assigned 'guard' position<sup>3</sup>, where it would not interfere with an aircraft manoeuvring onto and parking correctly on Stand 19 centreline.

The central parking position of Stand 19 was equipped with an AGNIS system to provide centreline guidance and a Parallax Aircraft Parking Aid (PAPA) to provide stopping guidance. Stopping guidance was provided in the Left and Right parking positions by a STOP arrow painted on the apron surface to the left of the relevant centreline and visible from the cockpit. Aircraft stop in the correct position on the centreline of Stand 19 Left or Right by taxiing towards the terminal building until the head of the STOP arrow is in line with the commander's shoulders.



Layout of Stand 19, illustrating normal stopping position and stopped position of 7T-VJT

### Footnote

<sup>3</sup> When the airbridge is correctly parked in the guard position its wheels rest within a circle painted on the apron surface for this purpose.

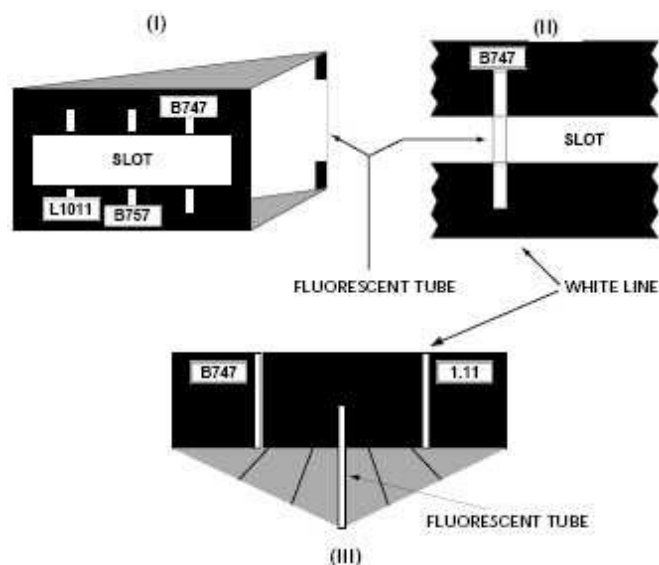
CAP 637 – *Visual Aids Handbook*, published by the CAA, describes the various Visual Docking Guidance Systems (VDGS) currently in use in the UK. Relevant extracts are reproduced below.

*'AGNIS provides Stand centreline alignment guidance and is normally used in conjunction with either PAPA, SMB or SML which provide stopping guidance separately. The system is designed for use from the left pilot position and the unit displays two closely spaced vertical light bars mounted in a box at about flight deck height ahead of the pilot. The light bars display one of the following signals:*

- (a) one red bar and one green bar, indicating that the pilot should steer away from the red towards the green bar, or*
- (b) two green bars, indicating correct alignment*

#### *PAPA*

*This aid is positioned to the left side of the Stand centreline and provides stopping guidance by employing a black board marked with white vertical lines bearing aeroplane type identification labels and in which a horizontal slot has been cut, as illustrated at Fig (2) (i). A short distance behind the slot is a vertically-mounted white fluorescent light tube which, when aligned with the required aeroplane type line, indicates the stop-point, as shown at Fig (2) (ii). An alternative layout is illustrated at Fig (2) (iii) where the board is provided without a slot and the tube is mounted in front of it; the method of use is identical.*



**Figure 2**

PAPA (typical)

On Stand 19, the PAPA, Figure 2, was installed approximately 13 m to the right of the stand centreline but designed for use from the left pilot position. Consequently, it was necessary for the commander to look across the cockpit in order to view it as shown in Figure 3.



**Figure 3**

Stand 19 PAPA viewed from commander's seat<sup>4</sup>

#### Footnote

<sup>4</sup> The photograph was taken immediately after the incident. In order to include the whole PAPA board it was necessary to lower the camera viewpoint slightly below the commander's eye line.

The system is calibrated to provide correct stopping guidance to the pilot occupying the left seat of an aircraft tracking the stand centreline. Being a parallax system, it cannot provide meaningful stopping guidance to anyone in another location, such as the pilot occupying the right seat or staff on the ground.

The PAPA for Stand 19 was serviceable and would have provided correct stopping guidance to the commander of the aircraft whilst tracking the stand centreline. The commander reported after the incident that, because of its location, it was not apparent that this PAPA referred to Stand 19.



**Figure 4**

Stand guidance control box (ground)

### Emergency stopping guidance

Emergency stopping guidance was provided by a single red STOP sign located beside the AGNIS indicator.

#### *Ground operation*

The emergency STOP sign could be activated by pressing a button on the stand guidance control box, located at the head of the stand (nearest the terminal building) to the left of the stand centreline, Figure 4. It could also be operated by a button on an identical control box mounted above the steering controls in the cab of the airbridge, on the left side of the airbridge head (nearest the aircraft), Figure 5. The Traffic Officer was not aware of this, believing that it was located beside the door to the airbridge steps, on the other side of the airbridge head and, consequently, out of reach.



**Figure 5**

Stand guidance control box (airbridge)

### Standards for Visual Display Guidance Systems (VDGS)

International standards for VDGS are contained in Volume 1 of Annex 14 to the Convention on International Civil Aviation. Chapter 5, section 5.3.24.14 of this document states:

*'The stopping position indicator shall be located in conjunction with, or sufficiently close to, the azimuth guidance unit so that a pilot can observe both azimuth and stop signals without turning the head.'*

Section 5.3.24.16 contains the following recommendation:

*'The stopping position indicator should be usable by the pilots occupying both the left and right seats.'*

The Aerodrome Standards department of the CAA Safety Regulation Group publishes an information leaflet entitled *Reference Point*. The August 2005 issue contained the following comment:

*'Visual Docking Guidance Systems (VDGS) deployed in the UK have normally comprised AGNIS (Azimuth Guidance Nose in Stand) and PAPA (Parallax Aircraft Parking Aid) boards or mirrors. However, these systems only cater for left-hand seat operation and require the pilot to turn his/her head to ascertain the stopping position; therefore, they do not comply with ICAO requirements published in Annex 14, Chapter 5, section 5.3.24.*

*The ICAO Aerodromes Panel is developing criteria for the use of advanced docking visual guidance systems (ADVGS) that provide more accurate guidance information to both pilots.*

*These systems are becoming more customary at larger aerodromes and pilots that regularly operate to and from international hubs are becoming more familiar with them.*

*Accordingly, the CAA encourages aerodromes to consider the replacement of existing VDGS with ICAO compliant VDGS or ADVGS as soon as practicable'.*

The airport operator reported that it was under the impression that recommended compliance with Annex 14 Chapter 5, section 5.3.24 was not required before 2018. No documentary evidence of this recommendation was forthcoming. Nevertheless, the airport operator stated that it plans to replace all PAPA/AGNIS equipment with ICAO compliant VDGS by the end of 2009 and that funding has been secured for this purpose<sup>5</sup>. It planned to have installed a total of 43 such systems by the end of 2006. The order of replacement is based on a risk assessment of each stand carried out by the airport operator.

The current edition of the UK Aeronautical Information Publication (AIP) shows that the following airports are equipped with AGNIS/PAPA type VDGS:

Birmingham, Edinburgh, Gatwick, Glasgow, London Heathrow, Manchester, Prestwick and Stansted.

### **Previous investigation**

In October 2006 the AAIB published a report<sup>6</sup> of the investigation of an incident in which a B777, N864DA, collided with the airbridge on Stand 50 at Gatwick Airport. The report concluded that the design of the stand guidance system did not comply with ICAO Annex 14 and that contributory factors to the incident were the

### **Footnote**

<sup>5</sup> The replacement system has a STOP sign on the stand centreline in front of the aircraft. This sign illuminates automatically when the aircraft reaches the correct stopping position.

<sup>6</sup> Report reference EW/C2005/05/04 published in AAIB bulletin 10/2006.

commander's lack of familiarity with the parking system and possible fatigue.

Ten safety recommendations were made relating to stand guidance, ground procedures, information exchange and crew fatigue, nine of which were accepted and one of which was partially accepted.

The report noted that:

*'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.'*

### Training

Both the GPUC and the Traffic Officer received training in the use of equipment at their respective stations, including stand guidance controls. Training materials produced by the handling agent showed clearly the location and appearance of the emergency stop button. The syllabus of operator training, produced by a third party, included the following:

#### 'Emergency Procedures'

3. Emergency stops, location, resetting, establishing cause and hazard before resetting
4. Airport specific emergency accessories and procedures, stop short, stand emergency stop, PAPA AGNIS signs, crossing of arms above head'

It did not contain guidance on when, if ever, a particular crewmember was expected to operate this equipment.

The accompanying 'Boarding Bridge Operator Test' multiple choice test did not include any questions relating to use of emergency stop signs.

Before being signed off to operate airbridges, each Traffic Officer was required to undergo a final check in accordance with an 'Airbridge Operation Safety Audit – Control Form' supplied by the airport operator. There was no item on this form referring to operation of emergency stop signs. The 'Airbridge Training Record' maintained by the handling agent made no reference to operation of emergency stop signs.

The investigation into the incident to N864DA examined the issue of ground crew operating emergency stop buttons and highlighted the difficulty ground crew have in determining whether a particular aircraft type has overrun its stopping position. The use of unofficial, potentially ambiguous, ground markings to assist with this determination was shown to create additional problems. Consequently Safety Recommendation 2006-084 was made:

*'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.'*

The following response was received:

*'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.'*

This response did not address the second part of the recommendation, namely:

*'An effective means of monitoring whether the aircraft has overrun its correct parking position should also be devised.'*

The airport operator produces 'Managing Director's Instructions' (MDIs) and 'Airfield Advice Notices' in order to advise organisations and their staff of changes to operational procedures and equipment. At the time of the incident to 7T-VJT, these instructions and notices could neither be accessed centrally nor was an index provided. This issue was addressed in Safety Recommendation 2006-082 arising from the investigation into the incident to N864DA:

*'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 that they provide is readily identifiable.'*

However, neither the training or guidance material, nor copies of the MDIs were held by the handling agent in a form, such as in a bound and indexed folder, which would promote easy access and self study by its staff.

### Flight Recorders

The aircraft was fitted with a Solid State Memory Flight Data Recorder (FDR) and a Cockpit Voice Recorder (CVR). Both recorders were downloaded at the AAIB

and data and audio recordings were recovered for the accident.<sup>7</sup>

The ground track of 7T-VJT as it taxied towards the stand was calculated using ground speed and heading data taken from the FDR. Figure 6 shows the track of the aircraft as it manoeuvred onto the stand, with ground speed in knots and distances in metres. The points are one second apart.

When lined up with the stand, ground speed was between 2.5 and 3.0 kt. The aircraft then decelerated to a stop within two seconds.

### Additional information

The operator of N864DA issued the following guidance to its crews:

#### *'Aircraft Parking Threats*

*Reading summaries from the crews who have experienced a parking incident, their comments are similar. One or more of the following extenuating circumstances appear in most all the reports:*

*Insufficient review of special pages (preparation)*

*Fatigue (late arrival, poor crew rest)*

*Distractions (vehicles, personnel, airport and ramp construction)*

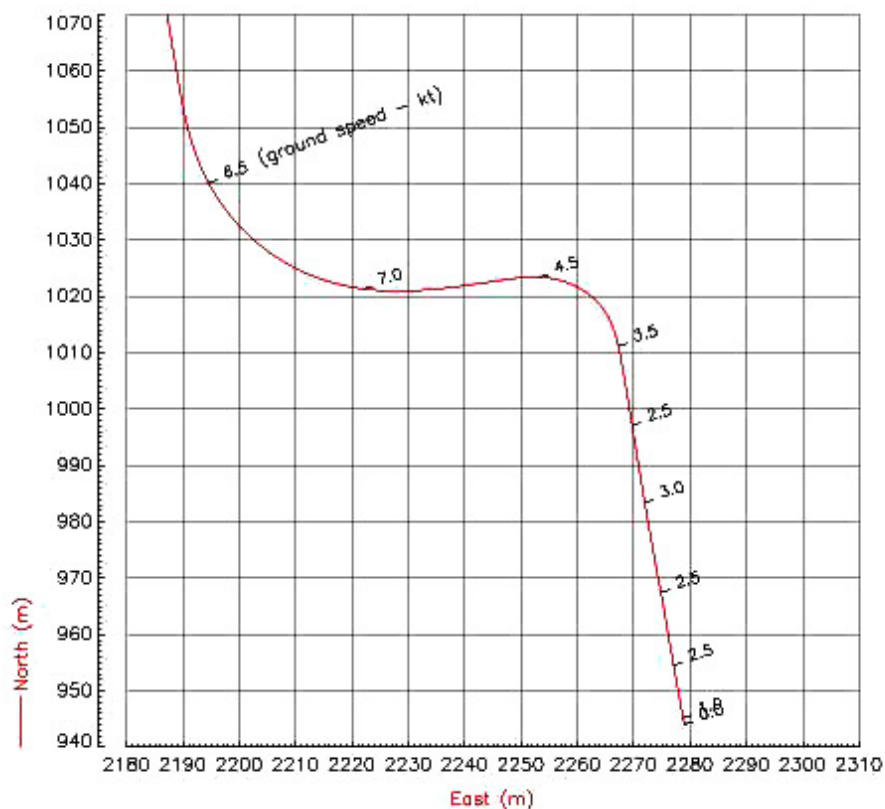
*Misinterpretation of a unique parking system (inconsistent location of PAPA board)*

*Fixation on one part of the guidance system – focusing on left/right alignment at the expense of fore/aft position.'*

### Footnote

<sup>7</sup> During the taxi to stand, the crew were communicating with each other without using their microphone/headset equipment; therefore, crew speech was recorded via the Cockpit Area Microphone (CAM). However, as they were also listening to the 'ground radio' via the cockpit's speaker at a high volume level and that ground-radio channel was particularly busy, the majority of the recorded crew speech was drowned out and unintelligible.





**Figure 6**

Ground track of 7T-VJT onto stand

The operator suggested the following strategy for mitigating these factors:

*'Thoroughly review the (operator's own guidance material) and Jeppesen "Special Pages." Consider using both engines to taxi into unfamiliar gates. Before entering the ramp area, ensure that it is clear. Most parking systems are only valid from the Captain's seat but the entire crew must stay vigilant. With the PAPA/AGNIS and other unique systems, one crew member should be assigned to watch the emergency stop indication that is located near the AGNIS board in front of the cockpit because with most systems no emergency stop light is installed on the left or right side PAPA boards. Realize that some parking systems have an open area on the PAPA board and this may*

*lead to confusion. Many parking systems have inconsistent labeling and inconsistent locations. Do not proceed into the gate area until all the parking boards are located. Depending on the location of the PAPA board, a cockpit window frame can block the view. Centerline accuracy is critical to proper guidance. Bring the aircraft to a stop if you're unsure of the guidance you're getting from the parking system.'*

### Analysis

Evidence from the FDR indicated that the aircraft was correctly aligned with the centreline of the stand and had taxied along it at an appropriate speed prior to impact. The PAPA element of the stand guidance system was serviceable, calibrated and compliant with local and national standards for that system. The airbridge was

parked in the appropriate 'guard' position while the aircraft manoeuvred onto the stand. Consequently, if the aircraft had been stopped in accordance with the normal guidance available to the commander, it would not have hit the airbridge.

The Traffic Officer stated that she had been willing to operate the emergency stop signal but could not find the button to do so, whereas the GPUC stated that in the circumstances of this incident he did not consider operation of the emergency stop signal to be one of his responsibilities. It was not clear, from the training materials and records provided by the handling agent, what was expected of each crewmember in this regard. Nor was it clear what sources of information were available to ground crew following their initial training. Furthermore, although updated operational information was produced from time to time by the airport operator and handling agent, it was not clear how such information was promulgated to ground crew. Finally, ground crew had no effective means of determining whether an aircraft had overrun its correct parking position.

### Safety Recommendations

In view of the above, the following safety recommendations are made:

#### Safety Recommendation 2007-008

It is recommended that the CAA should use all measures that it can to encourage airport operators to expedite their compliance with international standards for visual docking guidance systems as specified in ICAO Annex 14, Chapter 5, section 5.3.24

In response to this recommendation, the CAA has stated that it will take action as described below:

#### *'Background*

*To permit the use of AGNIS and PAPA type VDGS, the UK currently has filed a difference with ICAO for the three relevant Standards and Recommended Practices (SARPs) contained in Annex 14, Chapter 5, Section 5.3.24. However, CAP168, Licensing of Aerodromes, at Chapter 6, paragraph 7.2.4, specifies that:*

*VDGS should meet the requirements specified in ICAO Annex 14. Aerodromes should replace existing VDGS with ICAO compliant systems as soon as practicable, and when refurbishment or development of stands is undertaken.*

#### *Action*

- 1. The CAA will give notice to airports that the filed difference will be withdrawn at a future specified date.*
- 2. To strengthen the statement in CAP 168, all applicable licensed aerodromes will be requested to provide an appropriate compliance action plan as an aerodrome audit theme item for 2007-08.'*

#### Safety Recommendation 2007-009

It is recommended that Aviance UK should include in its syllabus of training for airport ground staff information on when it is appropriate to activate stand emergency stop signals during aircraft parking manoeuvres, and ensure that a specific assessment of their ability to do so correctly is tested during their initial approved and recurrent training.

**Safety Recommendation 2007-010**

It is recommended that Aviance UK should review the system by which operational information is provided to airport ground crews to ensure that it is readily identifiable and accessible to all members of staff who require it in the performance of their duties.

In response to these recommendations, Aviance UK has stated the following:

*'...all of the staff receive Ramp safety training, which covers the operation and emergency use of the Stand Entry Guidance Systems. The operator in question, received his training on 3 March 2005; at the same time he was also trained in aircraft marshalling. Refresher training is provided every 24 months.'*

*'In addition to the training, we have a Safety Bulletin concerning the arrival of aircraft on-Stand - Aviance generic bulletin number 024 - which staff are required to read and sign for, every 12 months. This advises them of the emergency procedure to be used.....'. '.....we will be updating the bulletin to place more specific requirements on the operative allocated to chock the aircraft, so that the aircraft progress is monitored and the emergency stop activated if required.'*

The contents of the original and updated (draft) Bulletin 024 are shown below.

**SAFETY BULLETIN NO: GEN-024****ARRIVAL OF AIRCRAFT ON STAND**

Before the arrival of aircraft on Stand, certain checks must be carried out to allow safe entry and working of aircraft:

- Stand must be cleared of FOD prior to arrival of aircraft and placed in FOD bin at head of Stand. If item is too large, call Airfield Ops
- All equipment must be withdrawn off the stand and parked beyond the Stand boundary
- Once it is deemed safe, the stand guidance entry system can be activated (only trained personnel to operate system)
- In an emergency the RED STOP BUTTON must be activated
- Personnel must not approach the aircraft until the anti collision lights have been turned off and engines have spooled down
- Chocks are to be put in place as per procedures BEFORE ANY EQUIPMENT approaches aircraft
- Ground power should be connected to aircraft as per procedures

The draft updated Bulletin replaces the fourth bullet point above with the following:

- The ground personnel allocated to chock the aircraft should monitor the aircraft's progress. If at any time they feel that the aircraft safety has been compromised, the emergency stop button located on each stand should be immediately

activated. In the event they are unable to access the Stop button, then the emergency stop hand signal of both arms above the head, wrists crossed and fists clenched, should be given. It is also incumbent upon any member of staff during the course of the arrival to activate these procedures, should there be any danger (in their opinion) to the aircraft or the ground personnel.

**Safety Recommendation 2007-011**

It is recommended that Gatwick Airport Limited should provide ground crew with an effective means of determining whether an aircraft has overrun its correct parking position.

**Conclusions**

At the time of the accident the aircraft was serviceable and taxied onto the stand aligned with the centreline. The airbridge was parked in the correct location and the stand guidance system was serviceable. The commander misunderstood the information provided by the parking aids and overran the correct stopping point whilst looking for a positive indication to stop. The aircraft subsequently collided with the airbridge. The design of the parking system and uncertainty concerning operation of the emergency stop signal contributed to the incident.