

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 747-436, G-BNLA
No & Type of Engines:	4 Rolls-Royce RB211-524G2-19 turbofan engines
Year of Manufacture:	1989
Date & Time (UTC):	29 July 2009 at 0359 hrs
Location:	Heathrow Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 19 Passengers - 237
Injuries:	Crew - None Passengers - None
Nature of Damage:	Minor damage to No 1 engine cowling.
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	57
Commander's Flying Experience:	19,569 hours (of which 6,831 hours were on type) Last 90 days - 58 hours Last 28 days - 58 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was proceeding onto Stand 409 at London Heathrow Airport with the Aircraft Parking Information System (APIS) providing correct lateral guidance. The distance indication to the stopping point did not function and the aircraft passed 11 metres beyond its correct stopping point. A baggage container was incorrectly parked and was protruding into the stand area. The outboard cowling of the left outer engine contacted the container which caused superficial damage.

The APIS had not been activated but due to a wiring defect, the lateral guidance was illuminated which it should not have been.

History of the flight

The crew were scheduled to carry out a flight from London Heathrow to Singapore departing 25 July 2009 and returning to Heathrow, arriving 29 July. The flight crew consisted of four pilots divided into two crews, each crew comprising a captain and a co-pilot. The crew for the outbound flight were supported by the second crew to relieve them during their in-flight rest period. The relief crew is referred to as the 'heavy crew'. On the return flight, the outbound heavy crew became the operating crew for the sector.

Following the required 48-hour rest period in Singapore the aircraft departed after a short air traffic delay. After departure the heavy crew took their rest period for about four hours before relieving the operating crew

who took their rest for approximately six hours before returning to the flight deck. The heavy crew took a further two hours rest before rejoining the handling crew in the descent.

Shortly before the top of descent, the aircraft's Aircraft Communications and Automatic Reporting System (ACARS) was used to notify the company of the ETA at Heathrow and receive the parking stand allocation which was Stand 409. It was 18 months since the commander had parked at Terminal 4 and he consulted the Aerodrome Booklet, a document by the operator, to remind him of its use. Although information was available for stands at Terminal 5, there was no information included for stands at Terminal 4. As the commander was used to using different types of system, he was not overly concerned and decided to see what type of Stand Entry Guidance (SEG) was installed on arrival.

There was no air traffic delay on arrival at Heathrow and the aircraft landed on Runway 27R with the co-pilot as the handling pilot. He taxied the aircraft to Taxiway 'T' as instructed by ATC and handed control to the commander for the turn onto stand. The SEG system was the Aircraft Parking Information System (APIS) which provides lateral and distance-to-stop parking information displayed on illuminated boards when activated by the Turn Round Manager (TRM).

In accordance with the operator's procedures, the aircraft may only be turned onto the stand when the APIS is activated. At the distance at which the aircraft was turned onto the stand, this was most easily established by the illuminated lateral guidance board, which was clearly visible in the half light.

The TRM arrived on Stand 409 five minutes before the aircraft and inspected the area for obstructions. He

noted that a number of metal baggage containers of the type loaded into aircraft holds were incorrectly parked and were protruding from the safe area. He attempted to contact Heathrow Airport Limited (HAL) Marshalling to get the equipment moved and also to provide a marshaller as he was not prepared to activate the APIS with the containers in position. He departed the stand to enter the terminal building to accomplish these tasks.

The commander, having taken control of the aircraft, made a visual check of the stand which appeared to be clear. He did not see the baggage container protruding onto the stand as it was probably hidden behind other vehicles and containers as he turned onto the stand. He noted that the APIS lateral guidance was illuminated and interpreted this as the system having been activated. He commenced the left turn onto the stand monitoring the lateral guidance which was functioning correctly.

The TRM, who was about to enter the terminal building and establish more details regarding the arriving aircraft, heard it taxiing onto the stand. He moved back onto the stand and approached the front left side of the aircraft and attempted to signal the commander to stop using his hands to form a cross above his head. There was no radio communication between the TRM and the flight deck. His signal was not seen by the commander and with the aircraft not stopping, the TRM ran around the front of the stand and activated the STOP button.

As the aircraft progressed along the centreline of the stand, the commander monitored the distance bar waiting for it to activate. He had not read the horizontal aircraft type bar and was surprised that although well onto the stand there was no indication of distance to go. He began to feel uneasy at the proximity to the terminal building and stopped the aircraft. This was coincident with the word STOP illuminating on the horizontal bar.

After the aircraft was shut down it was established that the forward left side of the No 1 engine cowling had contacted the baggage container which was protruding onto the stand. The resulting damage was a minor dent with an associated abrasion of the paintwork.

Aircraft Parking Information System (APIS)

When activated, the APIS SEG provides both lateral and distance guidance for parking on a stand. Figure 1 shows Stand 409 APIS with the information windows indicated.

System operation is as follows:

When the system is not activated:

- The upper alphanumeric display will show 'STND' which is an abbreviation for Stand and the lower alphanumeric display will show the stand number, in this case, 409.
- The distance thermometer and azimuth guidance display will not be illuminated providing no indications.

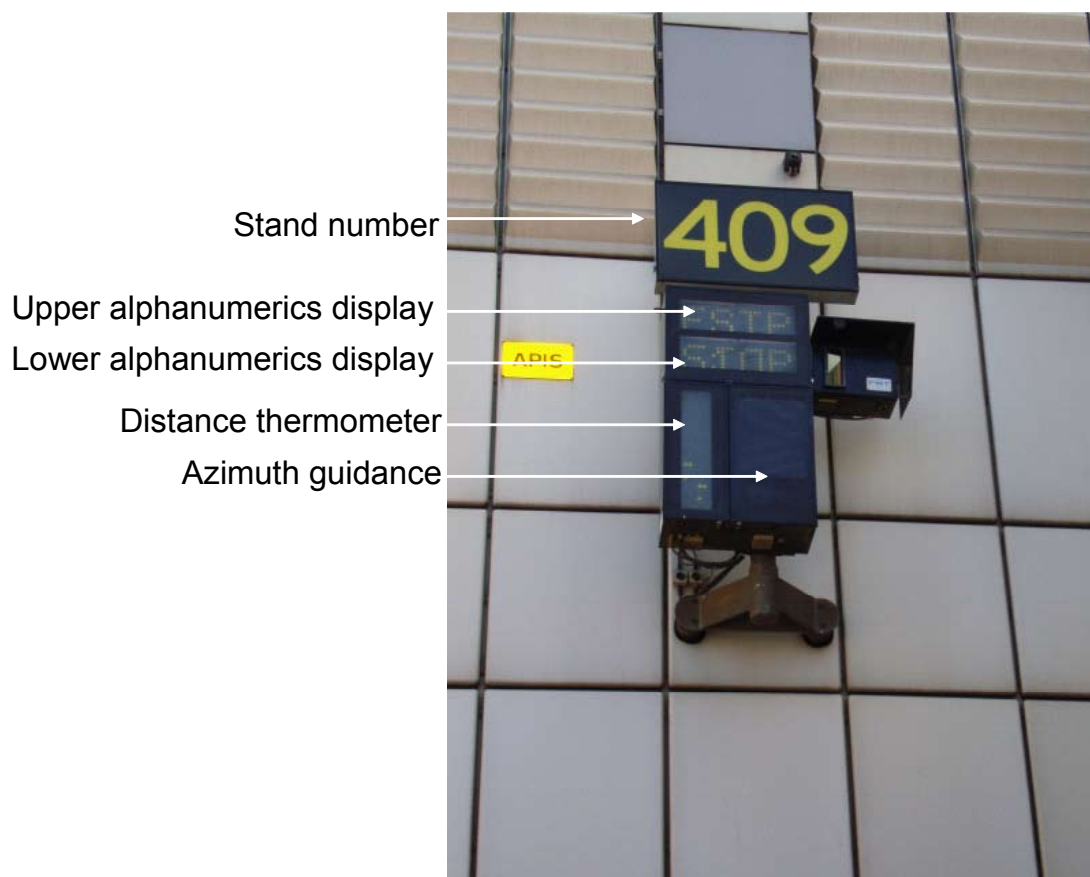


Figure 1

Stand 409 Aircraft Parking Information System (APIS)

When the system is activated:

- The upper alphanumeric display shows the aircraft type, in this case, B747.
- The closing rate thermometer panel will be fully illuminated.
- The azimuth guidance display shows the pilot black arrow heads indicating which direction to steer for the centreline. When the aircraft is properly aligned in azimuth, a black vertical bar will be displayed.
- At approximately 20 m, the system detects the aircraft and at about 17 m from the stop position, the closing rate thermometer lights will start to progressively extinguish from the bottom upwards, indicating the aircraft's movement towards the stop position. When this position is reached, the thermometer will be totally black and both the upper and lower alphanumeric displays will change to read 'STOP'.

Should the ground crew believe that the aircraft is in danger of overrunning its nosewheel stop position, they are to push a button which will immediately show the words 'ESTP' (emergency stop) on the upper and 'STOP' on the lower alphanumeric displays.

The APIS is one of four different stand entry guidance systems installed at London Heathrow Airport. The basic APIS fitted at Stand 409 was installed 15 years ago and is in the process of being replaced by a more up-to-date system.

The stand entry guidance systems are checked for correct operation every six months. This procedure did not include a visual check of the display to ensure that no elements were incorrectly illuminated. If a system is found to be unserviceable, the stand remains available but the system is not used and aircraft would be marshalled onto the stand.

A fault history of the APIS is recorded by the logic computer and this was downloaded for the investigation. It provided no record of when the fault which caused the lateral guidance board to remain illuminated when the system was de-activated. Further inspection of the faulty APIS showed that a wire in the lateral guidance module was defective and this caused the board to remain illuminated. It could not be established when the fault had occurred but there were no recorded reports of the problem.

Duties of the Turn Round Manager (TRM)

When the TRM arrives on the stand to meet an aircraft, he first checks that the stand is clear of obstructions. If the stand is clear he then activates the APIS by entering a code followed by the aircraft type. He visually checks the APIS in order to ensure that the correct aircraft type is displayed and that the lateral guidance is illuminated. He remains on the stand adjacent to the emergency stop button and monitors the progress of the aircraft onto the stand. Once the aircraft is safely parked and chocked, he moves onto the airbridge and positions it to the aircraft door. It was not part of the TRM's pre-activation check to see if any of the display panels were illuminated.

Aircraft parking Standard Operating Procedures (SOPs)

The operator provided comprehensive procedures in Part A of the Operations Manual for the entry onto a

stand and the parking of an aircraft. The procedures are set out below:

'Ground Procedures

Parking on Stand; Azimuth and Stopping Guidance

When approaching the assigned parking stand, Flight Crew must ensure that the stand is clear of all equipment so that the aeroplane may be parked safely.

Different Stand Entry Guidance (SEG) systems may be encountered and are detailed in the applicable Aerodrome Booklet. The illumination or activation of any guidance system does not mean that the stand is clear for the aeroplane to be safely parked.

If an aircraft cannot enter a stand, the aircraft should be brought to a halt. ATC (GMC) must be informed immediately of your position, ATC (GMC) acknowledgement received and marshalling assistance requested.

*Whenever a "dynamic" (e.g. APIS – Aircraft Position Is Detected) guidance system is employed on a stand, Flight Crew should ensure that the system is operating and indicating the correct aircraft type **before** final alignment onto the stand centreline.*

If the aircraft is already aligned and proceeding onto stand, before the system is correctly set, or if the guidance system fails after turning onto stand, stop and await marshalling assistance.

Turning on and stopping short of the final stopping position, awaiting system activation, can lead to incorrect indications once the system operates,

even if the correct aircraft type is subsequently displayed. After a failure it is possible for the system to provide false guidance information even if electronic guidance is restored.

Whenever a STOP SHORT sign is displayed, the aeroplane should be taxied to a position just short of the airbridge and adjacent to the sign.

If the tail of the aeroplane is likely to infringe the taxiway or airside road behind the aeroplane, ATC must be informed.

Additionally, within the UK (from UKAIP)

Pilots must not enter the marked aircraft stand area unless the Stand Entry Guidance is illuminated or a marshaller has signalled clearance to proceed. An aircraft stand is normally delineated from the taxiway by a double white line'

NB: Text in **bold** was included by the operator.

Information for the pilot interpretation of the APIS was contained in the aircraft library. It was not included in the Aerodrome Booklet but in the Aerodrome and Legend Specification booklet which is a separate document. The information is set out in Figure 2.

Airport Operations

Heathrow Airport Limited (HAL) is the airport operator and has programmes to identify and deal with safety issues. The problem of vehicles and equipment not being parked within designated areas is recognised. and handling agents have internal programmes for reminding staff of the importance of correct parking. If a handling agent fails to address parking violations, ultimately their licence to operate at Heathrow may be withdrawn.

Aircraft Parking and Information System (APIS)

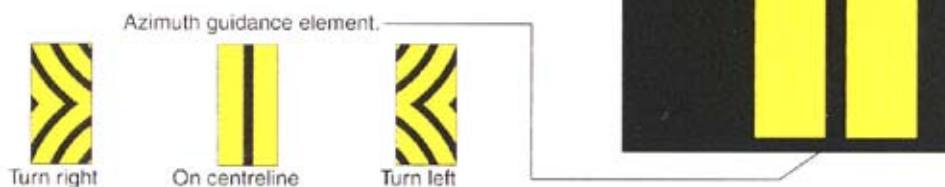
APIS is designed for use from the left pilot position and combines both alignment and stopping signals in one visual display, mounted at flight deck height ahead of the pilots.

Alphanumeric dot matrix:

- Aircraft type/series
- OK STOP - aircraft correctly parked
- TFAR - aircraft has overrun the stopping position
- STSH - aircraft have stopped short of stopping position
- ESTP - emergency stop

Abort docking if display shows STOP or wrong aircraft type/series.

A dot progress matrix that will decrease in length by one row at a time. When aircraft is in the correct stop position the progress strip will be extinguished. One row is approx. 0.6m.



Safety actions

Following the incident on Stand 409 involving G-BNLA, permission was given by AAIB for the operator to move the aircraft to a remote stand to inspect the damage. At this stage the problem with Stand 409 APIS had not been identified. The stand was used to park another aircraft, which was completed safely as the APIS was working normally. The fault was not identified until an inspection was made after that aircraft had departed the stand and the APIS was subsequently de-activated.

HAL then withdrew use of the APIS and following an internal investigation, changed the unit. It also undertook to inspect the remaining systems to ensure no others were defective. This would include a visual check of the display windows before the SEGS was activated to ensure they were indicating correctly.

HAL has also undertaken to re-emphasise the need for vehicles and equipment to be correctly parked.

The aircraft operator carried out a review of Part A of their Flight Operations Manual and have updated the information relating to SEGS operation.

Analysis

The crew were properly licensed and qualified to conduct the flight and had received the required rest periods prior to and during the flight. Fatigue was not considered to be a contributory factor.

When Stand 409 was allocated to the aircraft for parking, the Commander wanted to establish what type of SEG system was installed. He believed this was included in the Aerodrome Booklet as stated in Part A of the Operations Manual and was surprised

that it only included those installed at Terminal 5. He was unaware that the information was in the Aerodrome and Legend Specification booklet and was therefore unable to remind himself of the operation of the APIS.

In accordance with SOPs, he checked the stand was clear before turning onto it but did not see the baggage container protruding onto the stand area. The commander considered that he was subject to confirmation bias in continuing to taxi because the lateral guidance element of the APIS was illuminated and indicating in the correct sense. Although he was

aware of the text in the alpha numeric displays, he did not read either display. This is critical to this type of guidance system because the correct aircraft type displayed confirms that the stand has been activated. If no aircraft type is displayed, the stand has not been activated and any illuminated guidance indicates a defective APIS.

If the baggage container had been correctly parked within the designated area, the contact with the engine cowling would not have occurred even though the aircraft overran its stop position.