No: 8/92 **Ref: EW/C92/4/4** **Category: 1a**

Aircraft Type and Registration:	Boeing 747SP-31, N601AA
No & Type of Engines:	4 Pratt and Whitney JT9D-7AH turbofan engines
Year of Manufacture:	1980
Date & Time (UTC):	9th April 1992 at 0621 hrs
Location:	Stand L29, Terminal 3, London Heathrow Airport
Type of Flight:	Public Transport
Persons on Board:	Crew - 18 Passengers - 134
Injuries:	Crew - None Passengers - None
Nature of Damage:	Puncture of inboard upper surface of left wing
Commander's Licence:	Airline Transport Pilot's Licence (USA)
Commander's Age:	58 years
Commander's Flying Experience:	Approximately 23,000 hrs (of which 350 were on type)
Information Source:	AAIB Field Investigation

History of the flight

This was the first flight undertaken by the two pilots after a seven day rest period in the USA. The flight engineer had previously operated on the 4th April. The aircraft landed at London Heathrow Airport at 0612 hrs UTC after an uneventful overnight, 5 hour 59 minute duration, transatlantic flight from New York JFK Airport. The aircraft was then taxied to the allocated parking stand, number L29, adjacent to Terminal 3, arriving on stand at 0621 hrs. The aircraft commenced to self manoeuvre onto the parking stand, and parked in the position normally used by the non-SP variants of the B747, which was too far forward to allow use of the outer (mobile) airbridge at the front left (L1) passenger door on this, the shorter B747 SP variant. Towards the end of the parking manoeuvre, part of the outer airbridge operating machinery had come into contact with the upper skin of the inboard section of the left wing of the aircraft. No impact had been felt on board the aircraft. The aircraft was then sufficiently far forward such that the inner (fixed) airbridge was aligned with the L1 door, and the passengers deplaned normally. The crew did not realise that any damage had been caused until after deplaning was complete.

Damage Assessment and Stand Details

An electrical motor projecting from the outboard side of the mobile airbridge had penetrated a wing top-surface fibreglass honeycomb sandwich panel about 2 metres out from the left wing root. The motor had penetrated the wing skin over a fore and aft distance of 0.4 metre but had not damaged any of the internal wing structure.

The required parking position for the bogie of the mobile airbridge was marked on the ground in yellow paint as a box slightly larger than the bogie itself. At the time of the collision, the bogie had not been entirely within the box; its position put the bridge 0.5 metre nearer the aircraft centreline and one metre further out towards the approaching aircraft than normal. A further erosion of the optimal clearances resulted from the aircraft not being absolutely aligned with the marked centreline; although the nosegear was on the centreline, at the point of contact the fuselage was offset towards the bridge by about 0.3 metre.

It was the responsibility of the airline handling dispatcher to position the airbridge correctly in the yellow box prior to the aircraft's arrival on stand, but in this case the mirror which enables the wheels of the airbridge to be seen from the dispatchers operating position was not present. The moving of the airbridge was thus an iterative process, the dispatcher having to go outside to check the position of the wheels relative to the yellow box, then moving to the operating position inside to drive the airbridge "blind", before checking its position again. Responsibility for the maintenance of the airbridges rests with the airport management. An Airside Safety and Operations Operational Instruction, number 8/86, was issued by the airport management in 1986, and advised operators to have a second staff member on the ramp to maintain a look-out for safety reasons. No such person was used in this case.

A drawing of the stand, showing general layout and the relative parking positions for the two Boeing 747 variants is shown in Figure 1.

Operation and Use of the Stand Entry Guidance System

The parking system in use on this particular stand was self manoeuvring (without the aid of a marshaller), facilitated by use of an AGNIS (Azimuth Guidance - Nose In Stands) for stand centreline guidance, coupled with a PAPA (Parallax Aircraft Parking Aid) for correct stopping location guidance This system is used on the majority of stands at Heathrow. A photograph of the units is given in Figure 2.

The AGNIS indicator is located at the head of the stand, and is set to give the pilot in the left hand seat a double green bar light indication when the aircraft nose is correctly on the stand centreline. This condition must be maintained for some distance after the aircraft has turned to approach the stand in order to ensure that the aircraft fuselage also aligns and straddles the centreline.

The PAPA indicator is (generally) located out to the right of the parking position. An advisory board is located by the AGNIS position, to inform the pilot that the PAPA system is in use. Once again, the PAPA board is set up so that the pilot in the left seat can manoeuvre the aircraft to the correct stopping position. This position is attained by moving the aircraft slowly forward until a vertical fluorescent tube light (mounted behind the board and viewed through a horizontal slot in the face of the board) is aligned with the vertical white line painted on the face of the board. Because many different types of aircraft occupy each of the stands in turn, there are generally several vertical white lines on the face of each board, corresponding to different types of aircraft, some being marked singly and some as groups.

Thus to self manoeuvre successfully onto stand, the left seat pilot must constantly scan ahead for the AGNIS and to the right for the PAPA indications, and identify the correct stopping guidance line for his aircraft. The pilot in the right seat cannot give guidance, as the parking aids are not correctly aligned for interpretation from that side.

There is currently no device for signalling to crews that they have moved too far forward, nor any form of "emergency stop" signal which may be activated by the ground staff in the event of an unforseen problem on the parking area. In the absence of any manual marshalling guidance, ultimately it is left to the pilots to determine if the parking stand is unobstructed prior to commencing to park. It is also impractical in large wide-body aircraft such as the Boeing 747 to ensure clearance from close in obstacles around the parking area, due to the high flight deck position and lack of all round visibility from wing tip to wing tip.

In this particular case, neither pilot had used the system on previous visits to Heathrow, having had manual marshalling guidance onto stand. On this occasion, the left seat pilot noted that the leftmost line on the PAPA board was marked for use by the B747, and proceeded to park the aircraft in the correct alignment with this position, moving to the most forward parking position available on this particular stand. However, the second of the 3 vertical strips marked on the PAPA board was annotated for use by 6 types of aircraft - one of them being the B747 SP. This parking position would have resulted in the aircraft remaining somewhat further out in the parking area. The marking of the board however indicated the letters SP below the B747 rather than the more usual left to right type designations used for all other types.

The pilot in the right seat stated that he did comment that they should use the second "hash mark", but was unable to confirm the correct alignment of the aircraft from that seat, due to the parallax error. The left seat pilot did not assimilate the other pilot's comment.

The Cockpit Voice Recorder (CVR) was removed from the aircraft, and taken to AAIB Farnborough for replay. However, because electrical power had been left on the aircraft for a significant time prior to the CVR circuit breaker being pulled, the 30 minute time available on the tape loop did not cover the period of the event.

Other Aspects

On inspection of the aircraft flight deck, it was noted that the front windshields were contaminated and smeared, reducing clarity of vision (Figure 3). It was also calculated that, at the time of the occurrence, the position of the sun would have been such as to appear just above the PAPA board position when viewed from the flight deck. Cockpit window cleaning is generally carried out by ground personnel at crew request, and the last recorded window cleaning was noted in the Technical Log on 26 March, two weeks prior to the accident, although contamination may of course occur at any time in flight.

The left seat pilot's class 1 medical certificate contained the limitation that he must use spectacles for the correction of near and distant vision, which was being complied with at the time of the occurrence. The vertical dimension of the lettering of the aircraft type designators on the PAPA board is 11 cm. Within the normal standards of visual acuity allowed for professional aircrew, the maximum distance at which the lettering on the board could be read by a pilot has been calculated as between 50 and 75 metres. This would allow a time period of approximately 30 seconds to identify the correct reference line and complete the parking manoeuvre at typical aircraft parking speeds.

Amendments to the UK AIP, recently published by the CAA, detail sufficiently the types of stand entry guidance systems in current use at Heathrow and other UK airports. Any subsequent revisions will be notified by amendment and NOTAM as necessary.

Safety Recommendations

92-50 Heathrow Airport management should carry out a survey of stand entry guidance system marking, with a view to reducing the number of stopping positions displayed, and removing any possible ambiguity which may exist. This should include standardising the labelling for the B747 SP

to allow it to be read from left to right when viewed from the flight deck. Labels depicting aircraft types no longer frequenting particular stands should be removed. The assessment should also include any possible ambiguity arising from background features around and behind the indicator boards, as well as the clarity and conspicuity of the board markings by day and night.

92-51 Heathrow Airport management should ensure that safety devices fitted to mobile airbridges are maintained in a fully operational state. The current Operational Instruction (DOI/8/86) relating to airbridges should be revised and updated, to define a minimum serviceability standard.

92-52 The CAA should begin a consultative process with aerodrome operators, with a view to the introduction of a prominent "emergency stop" indicating system for each self manoeuvring stand, to be activated in the event of an unforseen occurrence where the aircraft is required to stop urgently.

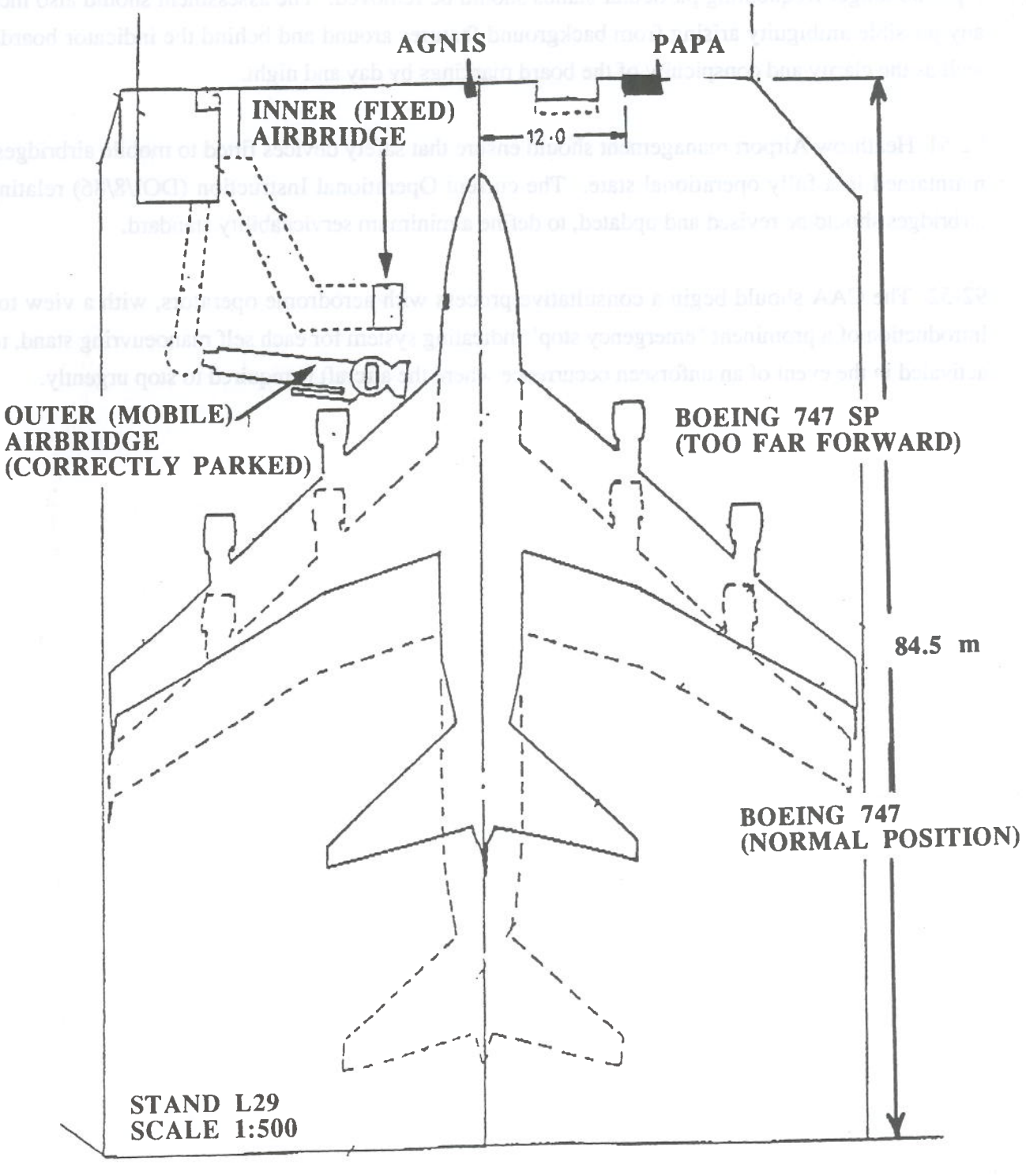

FIGURE 1 GENERAL LAYOUT AND BOEING 747 PARKING POSITIONS

FIGURE 2 GENERAL ARRANGEMENT OF AGNIS AND PAPA UNITS

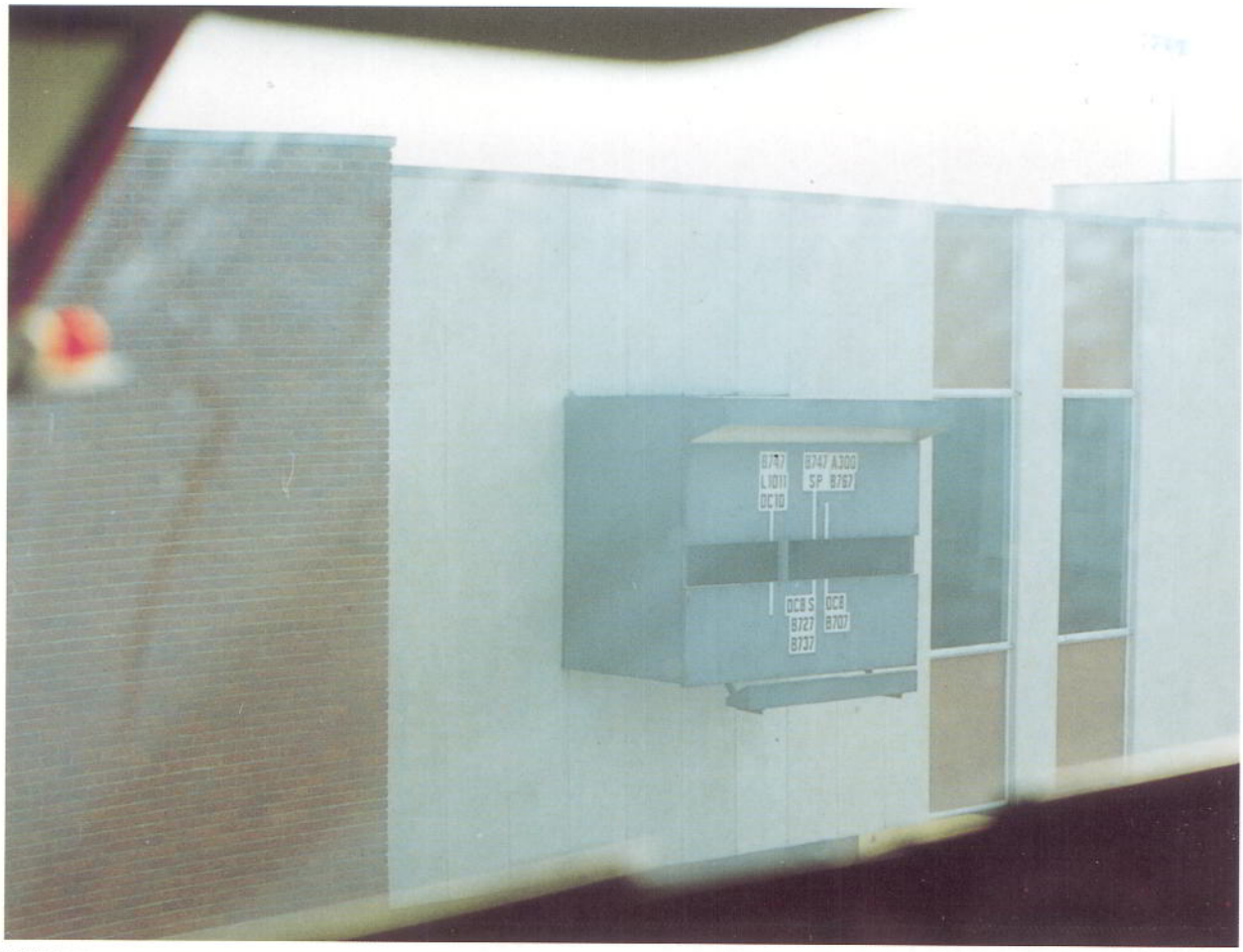

FIGURE 3 VIEW FROM THE LEFT FLIGHT DECK SEAT TOWARDS PAPA UNIT
(WITH AIRCRAFT PUSHED BACK SLIGHTLY FROM ORIGINAL POSITION)