# Aviation Safety Investigation Report 199401312

## Boeing Co
## B727

## 17 May 1994

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# Aviation Safety Investigation Report

# 199401312

**Occurrence Number:** 199401312 **Occurrence Type:** Incident
**Location:** 235km SW Sydney
**State:** NSW **Inv Category:** 3
**Date:** Tuesday 17 May 1994
**Time:** 1336 hours **Time Zone** EST
**Highest Injury Level:** None

**Aircraft Manufacturer:** Boeing Co
**Aircraft Model:** 727-277
**Aircraft Registration:** VH-ANA **Serial Number:** 22641
**Type of Operation:** Air Transport Domestic High Capacity Passenger
**Damage to Aircraft:** Nil
**Departure Point:** Melbourne VIC
**Departure Time:** 1307 EST
**Destination:** Sydney NSW

**Crew Details:**

| Role | Class of Licence | Hours on Type | Hours Total |
|---|---|---|---|
| Pilot-In-Command | ATPL | 4247.0 | 10737 |
| Flight Engineer | | 3944.0 | 9275 |

**Approved for Release:** Monday, November 4, 1996

FACTUAL INFORMATION

History of the flight

The aircraft, with 97 passengers and nine crew, was conducting a scheduled passenger service from Melbourne to Sydney. After approximately 10 minutes in cruise at flight level (FL) 350, the cabin altitude warning horn activated. The flight deck instrumentation indicated that the cabin altitude was 12,500 ft and climbing at 700 ft/min.

The flight engineer confirmed that the engine bleed air valves and the airconditioning packs were on, and selected the pressurisation controller to manual. When these actions did not restore control of the pressurisation system the pilot in command initiated an emergency descent.

Noting the aircraft's pitch attitude change the purser proceeded to the flight deck and saw that the flight crew were wearing oxygen masks. She returned to the cabin and directed that the flight attendants stop the meal service and resume their seats immediately. As the flight attendants returned to their stations some assumed that an explosive decompression had occurred or was about to occur.

The pilot in command requested the flight engineer to deploy the passenger oxygen masks. Several passengers had problems fitting their masks, and some with children experienced difficulty sharing masks. A flight attendant left his seat in the rear cabin and assisted passengers in using the masks.

While wearing her oxygen mask the purser did not make any announcements using the public address (PA) system. The mask was not fitted with a microphone, and the purser believed that it was necessary to remove the mask to use the hand held microphone.

Some passengers placed meal trays and bags in the aisle. The second senior flight attendant, located in the rear of the cabin, had a better view of the passengers than that afforded the purser. The flight attendant used the PA system to assist passengers in the use of the oxygen masks and to direct that the aisle be cleared.

During the descent the pilot in command initiated a diversion to Canberra. As the cabin altitude descended below 12,500 ft, the cabin altitude warning horn ceased. When the aircraft had descended to 11,000 ft and engine power was increased, the flight engineer was able to regain control of the pressurisation system. On completion of the emergency descent, the pilot in command communicated with the purser, and advised the passengers of the reason for the descent and diversion to Canberra. The cabin was secured and the subsequent landing and disembarkation at Canberra were normal.

Aircraft inspection

Extensive inspection of the aircraft did not disclose a definite reason for the loss of pressurisation. However, a degraded acoustic lining was found on a duct located ahead of the equipment cooling overboard exhaust valve. Evidence was available to suggest that debris from the degraded liner may have prevented the valve from fully closing. The valve is normally fully open when the aircraft is at low altitude and progressively closes with increasing altitude. Advice was received from the manufacturer that a fully open equipment cooling overboard exhaust valve has the capacity to dump air sufficient to prevent the aircraft from pressurising.

Pressurisation aspects

From the time at which the aircraft reached its cruising altitude and the engine power was reduced, the available engine bleed airflow was insufficient to compensate for a partially open equipment cooling exhaust valve. The aircraft had been in cruise for approximately 10 minutes and during that time the cabin altitude climbed 7,000 ft higher than normal. This was consistent with the 700 ft/min cabin rate of climb observed by the crew when alerted by the warning horn. The steadily deteriorating cabin pressurisation would have been evident on the cabin altitude and cabin rate of climb indicators.

Flight recorder

The flight data recording system fitted to this aircraft records only the minimum 20 parameters required by regulation. No information to assist the investigation was available regarding pressurisation, air conditioning, or bleed air operation. However, the recorded information was examined to determine the circumstances of the emergency descent.

The information established that the emergency descent commenced at about 1336 EST when the aircraft was maintaining FL350 at 280 kts indicated airspeed. The descent was discontinued at about 1340 when the aircraft had reached FL110. The recorded average rate of descent was 6,497 ft/min, and the maximum airspeed was 356 kts.

Flight crew actions

The flight crew response to the incident was initiated after the warning horn sounded to indicate that the cabin altitude had exceeded 12,500 ft. The flight engineer had not recognised, prior to the warning, either the rise in the cabin altitude indication or the indication of the cabin rate of climb. The indications would have been present from the time the aircraft was established in cruise and engine power was reduced. During the climb to cruise, the indications would have been almost normal. The warning horn, which can be silenced by the flight engineer, continued to sound throughout the descent.

The flight crew did not communicate with the cabin crew until after the completion of the emergency descent and did not advise when the oxygen masks were no longer required. Consequently, the flight attendants and passengers were aware only that the aircraft was descending rapidly and that oxygen was apparently required.

Cabin crew actions

The purser responded to the available information which suggested a rapid descent due to depressurisation. However, the cabin crew had no indication of the actual cabin altitude. Concerned as to the possible effects of hypoxia, the purser considered that the appropriate action, in accordance with the Flight Attendant Manual, was to be seated with the oxygen mask fitted, and to do nothing further until advised by the flight crew.

The Flight Attendant Manual states that, when responding to a depressurisation, flight attendants must first ensure their own safety and wait until the aircraft has reached a safe height before assisting others. The response by flight attendants to the limited information available varied. While some complied with the purser's instruction to sit down immediately, others moved about the cabin, attending to passengers' concerns and to actions such as securing the galley. The purser was unable to provide the flight attendants with information regarding the occurrence other than that which was already apparent. However, she had expected that her instruction would be understood by the flight attendants to require that they should do nothing further until advised.

The passengers were not given instructions on the use of the oxygen masks at the time of their deployment. A flight attendant from the rear of the cabin provided assistance to some passengers who were experiencing difficulty. The second senior flight attendantant, also recognising that some passengers required help, made a specific PA announcement on the use of the masks. She then contacted the purser for guidance, but was told to do nothing. However, the flight attendant then made two further announcements concerning the incorrect placement of meal trays and baggage by passengers. The announcements were intended to be forceful, but conveyed to some an impression of panic.

The investigation found that some of the cabin crew did not have a realistic awareness of the effects of hypoxia during depressurisation. However, they considered that hypoxia was imminent and responded accordingly.

The purser was not aware that the design of the oxygen mask was such that PA announcements could be made while wearing the oxygen mask. The investigation determined that flight attendant revalidation training included instruction in the use of the hand-held microphone while wearing an oxygen mask.

The second senior flight attendant had joined Ansett Airlines when her previous airline was merged with Ansett. The flight attendant's previous training had emphasised the use of personal initiative, and to be prepared to take control where necessary.

Crew coordination

Coordination of the actions of the flight and cabin crews was not attempted until after the aircraft had completed the emergency descent. Company procedures did not require that the flight crew communicate with the cabin crew during the descent. During the 12 months prior to this occurrence the crew members had completed coordinated recurrent emergency procedures training.

Passenger concerns

A cabin safety questionnaire was sent to 66 passengers. Twenty-six replies were received. Significant responses were:

- passengers were unaware of what was happening, which was distressing to some.

- some oxygen masks did not drop immediately and had to be manually released.

- there was a lack of understanding of the functioning of the oxygen masks.

- the cabin crew were professional and helpful.

- some PA announcements were assessed as panicked.

## ANALYSIS

### Pressurisation aspects

The reasons why the steadily deteriorating cabin pressurisation was not recognised earlier, or why the cabin altitude warning horn was permitted to continue to sound, have not been determined. Once the depressurisation had been recognised, the warning horn would have served only as a potential distraction.

As the aircraft altitude decreased during the emergency descent the equipment cooling exhaust valve would have progressively opened and released the acoustic lining material which had most probably blocked the valve. When engine power was again applied, the lower cabin differential pressure and the improved engine bleed air flow enabled the flight engineer to regain control of the pressurisation system. The system was then able to function normally for the remainder of the flight.

### Flight attendant actions

Flight attendants are expected to have a strong sense of responsibility for the passengers' safety. During an emergency situation, they are not only expected to work as a team, but to also be able to respond as individuals, demonstrating a high level of personal initiative. Consequently, although instructed to remain seated until after the aircraft had reached a safe height, the compliance, or otherwise, by cabin crew depended upon their perception of passenger distress and the need for immediate intervention. That perception would have been subject to their positioning in the cabin and consequently their ability to monitor the passengers. The flight attendants who responded to passengers' needs during the descent were better positioned than the purser to observe the passengers.

The indications of confusion regarding the implications of the occurrence, and the perception of a lack of direction from the purser,in part reflect the lack of information available to the cabin crew but also suggest deficiencies in their training programs.

The purser had no indication of the actual cabin altitude and was therefore unable to assess the extent of the apparent depressurisation. Consequently, she assumed that hypoxia was a primary consideration for the cabin crew and responded in accordance with established company procedures. However, the actions of the second senior flight attendant and another flight attendant reflected their expectation that they should respond to safety concerns and passenger distress.

Training had not provided the flight attendants with an adequate understanding of aviation principles and of the aircraft systems. This is evidenced by the purser's concern regarding the use of the oxygen masks and the PA system, and the lack of understanding by some flight attendants of the possible effects of hypoxia, and of explosive decompression. It is possible that the crew's response was influenced by an emphasis during training on major emergency events.

The different responses to the occurrence by the two senior flight attendants probably reflected differences in emphasis of their individual training and of their experience.

### Crew coordination

A coordinated controlled response to this occurrence was not achieved, despite the crew members having received training in these procedures. This was principally due to a lack of effective communication leading to poor situational awareness by some flight attendants.

## CONCLUSIONS

### Significant factors

1. It is likely that the equipment cooling overboard exhaust valve was jammed partially open by debris from a degraded acoustic lining.

2. At cruise power the engine bleed air supply was insufficient to compensate for air loss through the valve.

3. The flight crew was not aware of the increasing cabin altitude until the warning horn activated.

4. Inadequate communication between the crew members resulted in poor situational awareness and poor coordination of the response.

## SAFETY ACTION

As a result of this investigation the following safety actions were initiated.

The operator conducted a fleet inspection to ensure the integrity of the acoustic linings of air ducts.

The operator has instituted revised procedures to ensure that the purser is in control of the cabin during unusual or emergency situations. The revised procedures include a requirement for the second senior to keep the purser informed of all critical events and a requirement that all PA announcements are to be made by the purser.