

# SPECIAL INVESTIGATION REPORT

BUREAU OF AIR SAFETY INVESTIGATION

BASI REPORT 896/3051

Boeing 747 VH-EBU  
&  
Boeing 767 ZK-NBE

93km East of Narrandera

29 April 1989

**BASi**  
Bureau of Air Safety Investigation

 **Transport and  
Communications**





# SPECIAL INVESTIGATION REPORT

AIRCRAFT TYPE : Boeing 747 / Boeing 767  
 REGISTRATION : VH-EBU / ZK-NBE  
 NOMINATED/APPEARANT CLASS OF OPERATION : International Regular Public Transport  
 DEGREE OF DAMAGE TO AIRCRAFT : Nil  
 LOCATION OF INCIDENT : 93 km East of Narrandera NSW  
 DATE : 29 April 1989  
 TIME (local) : 0500  
 DEPARTURE POINT : VH-EBU Singapore  
 ZK-NBE Perth  
 DEPARTURE TIME (local) : N/A  
 DESTINATION : VH-EBU Melbourne  
 ZK-NBE Auckland  
 PILOT IN COMMAND : VH-EBU Australian Airline Transport Pilot Licence holder  
 ZK-NBE New Zealand Airline Transport Pilot Licence holder  
 OTHER PERSONS INVOLVED : Air Traffic Services Personnel

## Circumstances

A Boeing 747 (B747), operating a scheduled regular public transport flight from Singapore to Melbourne, and a Boeing 767 (B767), operating a scheduled regular public transport flight from Perth to Auckland were involved in an alleged close proximity incident near Narrandera NSW.

Due to staff shortages in the Melbourne Area Approach Control Centre (AACC), the Melbourne Sector 4 airspace was declared to be deactivated by the issue of a Notice To Airmen (NOTAM) 1523. Whilst this airspace was deactivated, transiting aircraft were required to comply with Traffic Information Broadcast Area (TIBA) procedures, specified by NOTAM 1522. The B767 flight path would transit this airspace during the period of deactivation.

The B747 was offered route shortening at a non-standard level of Flight Level 37 000 feet (FL370) within Sydney controlled airspace under the jurisdiction of the Sydney Area Approach Control Centre Sector 6. The non-standard level was assigned due to other

international traffic inbound to Sydney operating below the B747. No positive information update had been provided to the Sector 6 controller about the progress of the B767. Flight paths of both aircraft were within radar surveillance range and jurisdiction of the Sydney Sector 6 controller for some time prior to

the incident. The shortened route would place the B747 on a track which would cross that of the B767 at the same level and approximate time near Narrandera unless some separation action was taken.

The B767 subsequently entered Sydney Sector 6 airspace three minutes earlier than flight planned estimates indicated. As soon as that aircraft contacted Sector 6, it was instructed to descend from FL370 to non-standard level FL350 to provide vertical separation with the crossing B747. The aircraft queried the instruction which was verified by Sector 6. However, communications with the B767 were then lost and no readback of the assigned level was received.

Because of this, the Sector 6 controller then instructed the B747 to change heading intended to maintain separation and to eventually pass behind the B767.

## ZK-NBE (B767)

The B767 flight plan was submitted at Perth at 1438 Coordinated Universal Time (UTC) for a flight from

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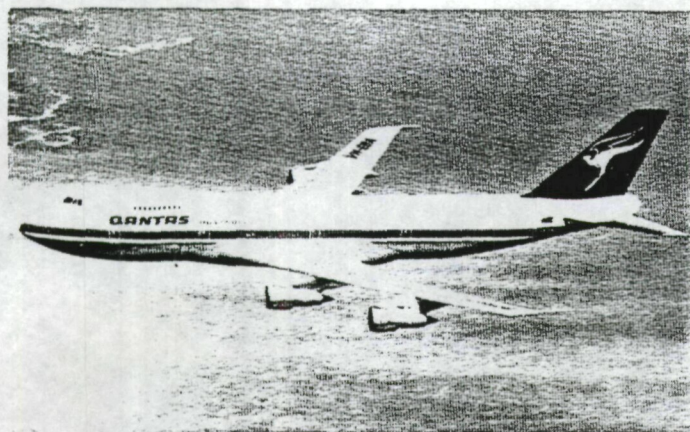
ZC2C MCC641 280856  
 GG ASSSZRX  
 280856 AMMZIXX  
 CORRECTION 280847 AMMZIXX STOP  
 1523 NOTAMN

A) MELBOURNE FIR 1523 B) 04281400 C) 04282000 E) MELBOURNE CTA  
 DEACTIVATION  
 DUE STAFF SHORTAGE, MELBOURNE CTA TO THE NORTH AND WEST OF MELBOURNE  
 (AS DETAILED BELOW) DEACTIVATED.  
 ATC FREQ 125.7MHZ  
 127.4MHZ  
 130.5MHZ  
 131.0MHZ  
 338.2MHZ NOT AVBL.

NOTE: DEACTIVATED AIRSPACE IN THE MELBOURNE FIR:  
 A) CTA A OUTSIDE 30NM ML ABOVE AC45, WEST OF A LINE ML VOR- DLQ NDB AND INCLUDING THE LLFL 120 CTA A STEP EAST OF THAT LINE, AND  
 B) TCTA OUTSIDE 100NM ML WITHIN THE AREA BOUNDED BY A LINE COMMENCING DUE DEGREES TO THE SW CORNER OF THE SY FIR, THEN VIA THE 142E MERIDIAN TO THE FL200/FL250 TCTA STEP, CONTINUING TO A POINT 30NM NORTH OF GTH, NAR, THEN TO A POINT WHERE THE CTA A BOUNDARY EXTENDS TO THE NAR-WG TRACK, THEN VIA THE CTA A BOUNDARY TO 100NM ML.

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128.2 MHz or 118.5 MHz when beyond 150 nautical miles Sydney. Whereas the latter frequency was the correct frequency to be used in the Southern portion of Sector 6 airspace. The 118.5 MHz VHF facility site is located at Mt Canobolas, near Orange, almost on the direct track and only 130 nautical miles from Narrandera. The B767 crew had made all the required broadcasts on the TIBA frequency 128.95 MHz whilst within deactivated airspace. They first became aware that the event had been reported as an incident when they heard it from the media after arrival at Auckland. Investigation of the incident indicated the following:

- the Sector 6 controller had no co-ordination update provided for the Narrandera waypoint
- the flight progress strip ETA Narrandera was correctly based on ATD
- the Sector 6 controller was unable to descend the B747 due to other crossing traffic
- an SSR return was observed in the vicinity of Narrandera indicating FL370, which was believed to be the B767
- the Sector 6 controller could not determine the frequency used by the B767 on first contact because of the placement and operation of the VHF

control and presentation facilities on controller workstations

- the B767 did not respond to the level change instruction and the level readout display was slow to indicate a descent had been initiated
- the Sector 6 controller was not permitted to use the Mode C level readout for separation purposes
- the Sector 6 controller discussed the situation with more senior controllers and elected to turn the B747 right of track to avoid crossing the flight path of the B767
- radar separation standards were maintained at all times
- the aircraft had vertical separation of 2000 feet at the time of passing
- the B767 had not called 15 minutes prior to entering Sydney airspace for clearance in accordance with TIBA NOTAM procedures

The investigation concluded that there was no breakdown of the prescribed separation standards, and that although both aircraft had not been formally identified on radar there was sufficient information for the Sydney Sector 6 controller to anticipate that the aircraft painting over Narrandera at FL370 was the B767. The off-airway route shortening of the B747, initiated by air traffic control, added complexity to the prevailing traffic, airspace management and co-ordination requirements.

The investigation noted that at the time that the B767 first made contact with Sydney Sector 6 on 128.2 MHz, the VHF transmission was very broken. This can be indicative of an aircraft either with transmitter problems or on the extreme range of VHF communications. On the first communication, Sector 6 instructed the B767 to descend to non-standard level FL350. This was intended to maintain vertical separation between the B767 and the crossing B747. The VHF reception of Sector 6 by the B767 was also most probably broken for

the same reason (ie, equipment problems or out of range) and the B767 aircrew queried that instruction. Sydney Sector 6 verified the instruction and added that the aircraft was required to report reaching FL350. There was no response to this instruction or readback of the new assigned level by the B767. This was most probably because it was then out of range of the Mt Oxley VHF facility, even at FL370.

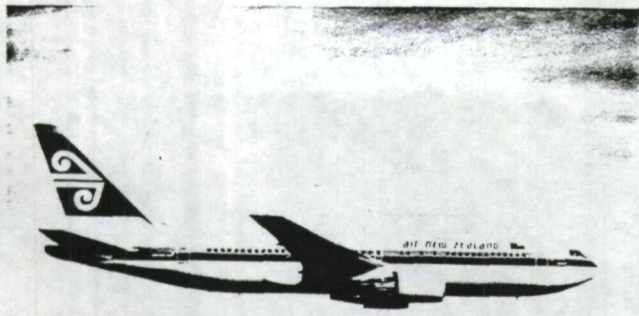
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2CZC MCC657 280910  
 GG ASSZR2X  
 280848 AMMZIXX  
 1522 NOTAM  
 A) MELBOURNE FIR 1522 (ATS) 04280810 B) 04281400 C) 04282000 E) ACFT OPR IN TEMPO DEACT AIRSPACE ARE TO ADOPT TRAFFIC INFO BROADCAST BY ACFT AND RELATED PROCEDURES (TIBA) AS SPECIFIED IN ICAO ANNEX 11 ATTACHMENT B. PROCEDURES ARE AS FOLLOWS:

1. A LISTENING WATCH SHOULD BE MAINTAINED ON THE TIBA FREQ 10 MIN PRIOR TO ENTERING DEACT AIRSPACE UNTIL LEAVING THE AIRSPACE.
2. TIBA FREQ 128.95MHZ ABV FL200, 126.35 FL200 AND BLW.
3. BROADCASTS SHOULD BE MADE:
  - (A) 10 MIN PRIOR TO ENTERING THE DEACT AIRSPACE
  - (B) 10 MIN PRIOR TO CROSSING A REPORTING POINT
  - (C) 10 MIN PRIOR TO CROSSING OR JOINING AN ATS ROUTE
  - (D) AT 20 MIN INTERVALS BTN DISTANT REPORTING POINTS
  - (E) 2-5 MIN BEFORE A CHANGE IN FLT LEVEL
  - (F) AT THE TIME OF A CHANGE IN FLT LEVEL AND
  - (G) AT ANY TIME CONSIDERED NECESSARY BY THE PILOT.
4. FORM OF BROADCAST IS TO BE STANDARD POSITION REPORT TO ALL STATIONS, EXCEPT FOR CHANGES OF LEVEL.
5. ACFT SHOULD OPERATE AT STANDARD CRUISING LEVELS EXCEPT TO AVOID TRAFFIC CONFLICTS OR WEATHER AVOIDANCE.
6. IN ADDITION TO THE ABV, IN DEACT OCA: (I) POSITION REPORTS SHALL BE MADE ON HF (II) COMMUNICATION AND SAR ALERTING ONLY WILL BE PROVIDED BY FLIGHT SERVICE
7. POSITION REPORTS SHOULD ALSO BE MADE ON THE NEXT APPROPRIATE ATC OR FIS AREA FREQUENCY TO OBTAIN CLEARANCES TO RE-ESTABLISH SARWATCH, 15 MIN PRIOR TO LEAVING DEACTIVATED AIRSPACE FOR CTA/FIA.
8. ALL ACFT MUST VACATE DEACT AIRSPACE PRIOR TO IT BEING REACTIVATED SO THAT APPROPRIATE ATC CLEARANCES MAY BE OBTAINED.

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Perth to Auckland via waypoints overhead Adelaide and Sydney. The flight would transit deactivated airspace promulgated in Melbourne NOTAM 1523 at 0848UTC. This airspace was normally under the jurisdiction of Melbourne AACC Sector 4. The B767 would then enter airspace under the jurisdiction of Sydney AACC Sector 6 at Narrandera.

The flight plan Estimated Time of Departure (ETD) was 1530UTC with the associated Estimated Time Intervals (ETI) and Estimated Times of Arrival (ETA) providing en-route timings for the following coded waypoints:

ETI to MALIM	02.51	- ETA 18.21 UTC
NYA	02.58	- 18.28
ASSS	03.05	- 18.35
NAR	03.17	- 18.47
RUG	03.31	- 19.01

Once the departure message was received from Perth notifying the actual departure time as 1542UTC (12 minutes later than flight planned), the above estimates could then have been updated as follows:

ETI to MALIM	02.51	- ETA 18.33 UTC
NYA	02.58	- 18.40
ASSS	03.05	- 18.47
NAR	03.17	- 18.59
RUG	03.31	- 19.13

This could have given Sydney Sector 6 some expectation that the B767 would enter the deactivated airspace at 1828UTC (prior to MALIM waypoint) and exit deactivated airspace at NAR at 1859UTC.

Because of the deactivation of Melbourne airspace the normal step-by-step co-ordination exchanges between the Adelaide, Melbourne and Sydney controllers were not completed and the Narrandera strip and estimate could therefore not be accurately updated by the Sector 6 controller.

The last actual reported position of the B767 was to Adelaide control at 1748UTC when the aircraft reported over waypoint T6B at 1747UTC, FL370, estimating MALIM waypoint at 1830UTC; ie. three minutes earlier than could have been expected by the Sydney Sector 6 controller.

#### VH-EBU (B747)

The B747 flight plan was submitted in Singapore at 1132UTC for a flight from Singapore to Melbourne via waypoints overhead Derby, Parkes, Bindook (near Katoomba), Shellys (near Goulburn) and Eildon Weir.

This circuitous route was planned to keep the aircraft within controlled airspace, and clear of the Melbourne deactivated airspace which had been notified at 0856UTC (Melbourne NOTAM 1523). The aircraft had planned to descend from FL370 to the standard level of FL350 after passing Bindook and tracking towards Shellys and onwards to Melbourne.

The aircraft departed within a few minutes of the notified ETD of 1215UTC and proceeded as planned. Subsequently, at 1808UTC Adelaide control instructed the B747 to contact Sydney control on Very High Frequency (VHF) 128.2 Megahertz (MHz) at the next waypoint, T34A. (At 1812UTC, Adelaide control instructed another international aircraft also to contact Sydney control on 128.2 MHz as primary frequency, but offered 118.5 MHz as a secondary (alterantive) frequency).

The B747 contacted Sydney control on 128.2 MHz at 1813UTC and reported passing waypoint T34A, maintaining FL370 and estimating Parkes at 1849UTC. At 1836UTC Sydney control Sector 6 advised Melbourne control Sector 2 of the B747 inbound via Parkes and requested if a shorter track from Parkes to Wagga and Melbourne would be available in the Melbourne airspace. Melbourne control analysed the situation and concurred that the B747 could be given amended clearance to track Parkes, Wagga, Albury, Eildon Weir, Kinglake and Epping. At 1838UTC, Sydney Sector 6 passed this amended clearance to the B747. Then the B747 was given a frequency change from 128.2 MHz to 118.5 MHz to maintain continuous communications for the amended route.

#### Investigation Summary

Investigations indicated that the crew of the B767 were given the Melbourne NOTAMs 1522 and 1523 on the flight deck just prior to departure from Perth. They did not consider that there had been a breakdown of separation resulting from the incident. The B767 crew considered that the incident had been resolved as a Sydney control supervisor had spent some time discussing the matter on air with them. They acknowledged that they had the appropriate NOTAMs but had not fully understood the significance of Para.7 of NOTAM 1522.

The B767 crew believed that their clearance from Perth via planned route was valid through all Australian airspace and that the wording of Para 7 "SHOULD" was not a mandatory requirement even though they had been advised of the frequency by Adelaide as 128.2 MHz. It should be noted that the VHF site for the 128.2 MHz facility is at Mt Oxley, approximately 260 nautical miles north of Narrandera, near Bourke. As VHF communications are restricted to line of sight propagation characteristics, the use of this frequency placed the B767 at the limit for communications over this distance at FL370, and out of communications at FL350.

The crew of the B767 were using Jeppesen charts which, similar to the Australian documentation, carried ambiguous frequency data indicating that the choice of frequencies to be used in the Trans Continental Control Area (TCTA) and Western Routes (from Sydney) were



Loss of communications with the B767 left the Sydney Sector 6 controller with minimal options to maintain separation between the B747 and the B767. The chosen action was to vector the B747 away from the flight path of the B767. Sydney Sector 6 contacted the B747 thirty seconds later and instructed that aircraft to turn right onto a magnetic compass heading of 270 degrees for separation purposes. Sector 6 continued to call the B767. When no contact could be established, the B747 was given traffic information with the relative bearing (2 o'clock) and distance (30nm) from the B767, with the advice that the aircraft was out of communications at that time. The B747 reported sighting the B767 traffic.

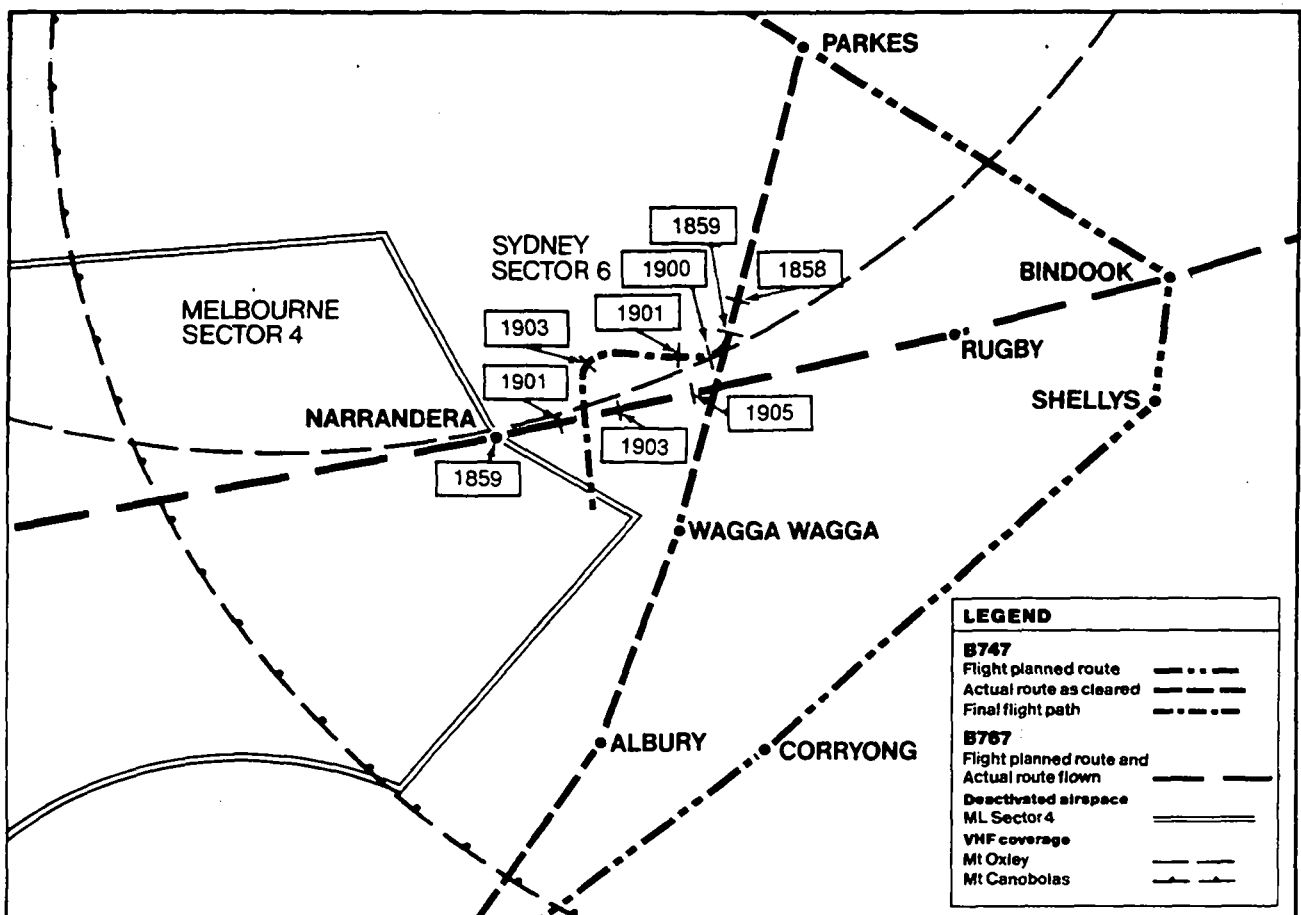
Subsequently, at the time of passing, (1900.30UTC by radar plot), the aircraft were separated by 10.5nm horizontally, travelling in opposite directions and achieving 2000ft vertical separation. Sydney Sector 6 continued to call the B767 until communications were established on 118.5 MHz at 1901.40UTC, some 4 minutes 20 seconds after contact was lost at 1857.20UTC. The B767 then reported maintaining FL350. At that time the aircraft was 2000 feet below and 17 nm from the B747 and increasing the horizontal separation.

The investigation also revealed that the crew of the B767 and the Air Traffic Service staff did not fully understand the intentions and procedures expressed in the appropriate Melbourne NOTAMs. This is not a reflection of the comprehension skills of the personnel, but an indictment of the complexity and ambiguity of the NOTAMs and the procedures.

### Significant factors

The following factors were considered relevant to the development of the incident:

1. Adelaide control provided frequency change instructions to the B767 which provided only one frequency to call Sydney control Sector 6. (128.2MHz) without nominating a secondary frequency of 118.5 MHz, as had been done with other aircraft.
2. Adelaide control co-ordinated the B767's T6B position report and estimate MALIM with Melbourne Sector 4, which was supposedly unmanned.
3. Because Melbourne Sector 4 airspace was deactivated, the B767 estimate MALIM was not co-ordinated with Sydney Sector 6, even though the information was accepted and acknowledged by an unknown person in Melbourne.
4. Sydney Sector 6 had lost VHF contact with the B767 because it was on the extreme limit of range from the site through which communications were attempted.
5. There were no VHF coverage diagrams available to air traffic control positions to indicate the coverage limitations from specific sites.
6. The Sydney Sector 6 controller apparently did not recognise the characteristics of the broken VHF transmission from the B767 as typical for a transmission originating from an aircraft at maximum range.
7. The ergonomic placement of the VHF frequency call indicator lights on the Sector 6 workstation made it extremely difficult for the operator to determine the frequency on which an aircraft was actually calling



as all call indicators operated simultaneously when the retransmission was active.

8. There were no procedures for air traffic controllers to indicate on the flight progress strips the frequency being used to communicate with an aircraft.
9. The off-airways routing of the B747 placed that aircraft across the flight paths of other traffic. This added to the complexity of the airspace management and the total reliance on continuous communications with all aircraft.

### Recommendations

It is requested that the Civil Aviation Authority give consideration to the following recommendations to ensure that air traffic control personnel:

1. Use consistent phraseology when initiating frequency change instructions.
2. Issue the correct frequency change instruction for the area in which an aircraft is, or will be, operating.
3. Are reminded of the necessity to accomplish frequency changes before an aircraft is out of VHF range from the previous VHF outlet.
4. Are provided with documentary evidence of the VHF coverages available from the outlets under their control.
5. Are provided with training in VHF communications characteristics of the CAA radio telephony systems.
6. Have the control and presentation of the VHF/UHF frequency call lights modified so that controllers can immediately determine the frequency on which an aircraft is calling.
7. Have procedures prescribed to indicate the frequency, coded if necessary, on which an aircraft is communicating, and all subsequent frequencies recorded on the flight progress strip applicable to a particular controller where more than one frequency is terminated at that workstation.
8. Be advised of this incident as an example of where the offering of track shortening and non-standard levels can result not only in increased communications, control workloads and co-ordination, but may suddenly and unexpectedly result in reduced safety standards.

### CAA Response

In response to this BASI report the Civil Aviation Authority (CAA) has amended certain instructions pertaining to "Charts", "National ATS Contingency Plan Guidelines", "Frequency Call Light Displays", and ATS procedures.

Whilst agreeing, in general, with the findings of the report, the following comments are made in relation to the report's eight recommendations:

#### Recommendations 1, 2 & 3

The Authority endorses these recommendations and will reinforce to all ATS staff the need to use standard phraseologies, wherever practicable. A phraseology such as "ABC contact me on ..... [frequency]", is, for example used to instruct an aircraft to change frequency within a sector, as defined by the National ATC Sectorisation Plan.

All three recommendations describe techniques that are taught to all Air Traffic Controllers, who are then

required to indicate the correct application of such techniques by passing proficiency checks and obtaining the appropriate sector rating. If the controller then fails to issue a correct frequency change, an error has been made and the check control system acts accordingly.

The use of staff circulars, originated by the Authority's Airways Operations Group, is also being considered as a means of providing ATS staff with general information on matters of technique that have been identified by such incidents. The intention would not be to identify specific incidents, but rather to list any items requiring attention and provide a brief outline on action being taken in relation to such items.

#### Recommendation 4

A new chart "Planning Chart Australia" will become effective in June 1990 to provide, in part, an indication of VHF coverage at 20000 feet, pertinent ATC VHF frequencies, and the ATC sectors to which they apply. This chart will be available for pilot and ATS staff so that both parties can utilise this information, as required.

#### Recommendation 5

All ATS staff are taught the characteristics of the various VHF and HF communications systems. The intended publication of the new PCA chart will provide additional reference material in this regard.

#### Recommendation 6

The Authority will implement this recommendation.

#### Recommendation 7

Changes to existing procedures are not considered necessary. Flight strips are already over burdened with information and on any given route the frequencies are known to all controllers using the route sections involved. Procedures are laid down when to change an aircraft from one frequency to another and if different to normal then the controller will write the new frequency on the strip as a "one off" situation.

The implementation of recommendation six will also help the controller keep track of the actual frequency being used when more than one terminate at a particular workstation.

TIBA procedures have been amended since this incident and the National ATS Contingency Plan now includes specific instruction on communications failure situations. Furthermore, AOI/COM 9-1 is being amended to specifically assign responsibility for notifying the next ATS frequency in use when TIBA procedures have been implemented.

#### Recommendation 8

The availability of track shortening and non-standard levels have been severely limited by the introduction of new instructions to ATC staff.

AOI/RAC 2-25 has been amended to prohibit the use of non-standard levels outside radar coverage, except where operationally required for safety reasons, on one way routes or, as approved by the shift supervisor.

In conclusion, the Authority thanks BASI for the report and its recommendations which, as indicated above, have been instrumental in constructive improvements being made to existing ATS procedures and practices.