

# AIRCRAFT INCIDENT

## REPORT

**No. 92-021**

**McDonnell Douglas A4K Skyhawks NZ6211, NZ6212,**

**NZ6215 and NZ6217 and TA4K NZ6255**

**and Embraer 110 Bandeirante ZK-ERU**

**Auckland International Airport**

**21 November 1992**

**Transport Accident Investigation Commission  
Wellington - New Zealand**

**TRANSPORT ACCIDENT INVESTIGATION COMMISSION**  
**AIRCRAFT INCIDENT REPORT No. 92-021**

**Aircraft Type, Serial Number  
Registration:**

McDonnell Douglas A4K Skyhawks and  
NZ6211, NZ6212, NZ6215 and NZ6217  
and TA4K NZ6255 Embraer 110  
Bandeirante, ZK-ERU

**Number and Type of Engines:**

Skyhawks: 1 Pratt and Whitney J52  
Bandeirante: 2 Pratt and Whitney  
PT6A-34

**Date and Time:**

21 November 1992, 1330 hours \*

**Location:**

Auckland International Airport

**Type of Flight:**

Skyhawk Formation: Military Display  
Bandeirante: Scheduled Air Transport

**Persons on Board:**

Skyhawks: 1 Crew per aircraft  
Bandeirante: Crew: 2 Passengers: 12

**Injuries:**

Skyhawks: C: All Nil  
Bandeirante: C: 2 Nil Pax: 12 Nil

**Nature of Damage:**

Nil

**Pilot in Command's Licence:**

Skyhawks: Military pilots  
Bandeirante: Commercial Pilot Licence  
(Aeroplane)

**Pilot in Command's Age:**

Skyhawk Formation Leader: 39  
Bandeirante: 32

**Pilot in Command's Total  
Flying Experience:**

Skyhawk: 4000  
Bandeirante: 5000

**Information Sources:**

Transport Accident Investigation  
Commission Field Investigation

**Investigator in Charge:**

Mr R Chipindale

\* All times in this report are NZDT (UTC+13 hours)

## ABSTRACT

This report relates to the airmiss between a formation of RNZAF Skyhawk aircraft and an Embraer 110 Bandeirante aircraft during Air Expo 92 at Auckland International Airport on 21 November 1992. The safety issues discussed in this report are: the effectiveness of the procedures for promulgating arrangements for an airshow to individual military pilots and air traffic control officers, the observance of speed restrictions in controlled airspace by military aircraft, the supervision of airshows by the Civil Aviation Authority, the arrangements for the participation of the RNZAF display director to participate in the controlling of military display aircraft, the adequacy of the provisions made for air traffic control during the airshow, the desirability of simultaneous operation of display and non-display aircraft in an airspace designated for an airshow, and the adequacy of the documents relating to approvals for the conduct of airshows.

## 1. SYNOPSIS

1.1.1 On 21 November 1992 during the course of an air display at Auckland Airport, "Air Expo 92", an Embraer 110 Bandeirante aircraft which was climbing through 500 feet after take-off, passed within 700 feet of a formation of Royal New Zealand Air Force Skyhawk aircraft which crossed over it at approximately right angles to its track and travelling at a groundspeed of some 400 knots.

1.1.2 The Bandeirante aircraft, Flight NZ2153, was at about 300 feet agl when its Captain sighted the approaching Skyhawk formation's smoke trails.

1.1.3 The RNZAF "Skyhawk Red" formation leader sighted the Bandeirante aircraft at approximately the same time but realised that his formation's planned "fan break" manoeuvre would take his aircraft clear of the conflicting traffic and continued with his display when clearance to "continue in" was confirmed by Air Traffic Control.

1.1.4 The arrival of the Skyhawk formation was timed to coincide with the official opening of Air Expo 92 by the Governor General at 1330 hours.

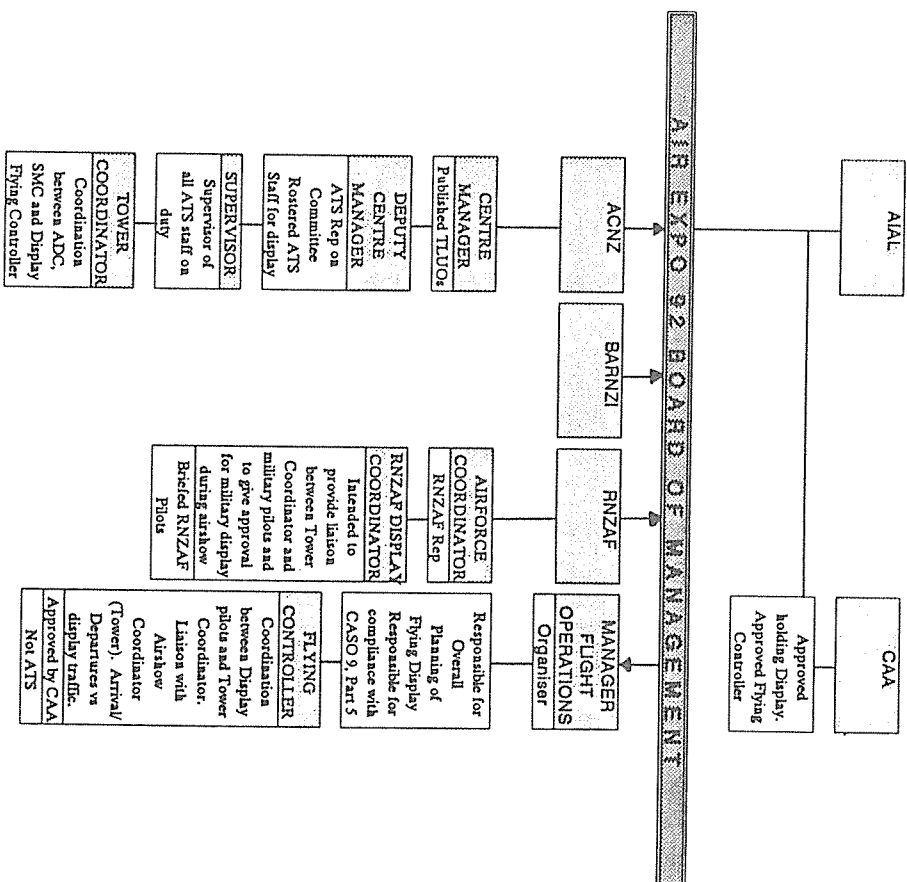
## 1.2 Significant Events

1.2.1 Planning for Air Expo 92 had commenced some 12 months earlier after acceptance, by Auckland International Airport Limited, of a proposal from an airline captain for such an event to be staged at their airport.

1.2.2 Civil Aviation Safety Order 9 required consent for an air display from "all operators based on the aerodrome concerned and any operators of scheduled services into that aerodrome". The initial concept for Air Expo 92 envisaged a reserved block for either one, two hour or two, one hour air displays. This format was not accepted by the representatives of the airlines based at Auckland Airport. The plan which was agreeable to them required an air display coordinated with their scheduled operations.

1.2.3 Planning meetings were held by the Air Expo 92 Board of Management at intervals throughout the intervening period to develop the coordination of scheduled airline operations and the display aircraft during the airshow. These

## PERSONNEL INVOLVED IN PLANNING FOR AIR EXPO 92



### KEY:

ACNZ Auckland Corporation of New Zealand  
ADC Aerodrome Control  
AIAL Auckland International Airport Limited  
ATS Air Traffic Services  
BARNZ Board of Airline Representatives of New Zealand (Inc)  
CAA Civil Aviation Authority  
CASO Civil Aviation Safety Orders  
RNZAF Royal New Zealand Air Force  
SMC Surface Movements Controller  
TLUO Temporary Local Unit Order

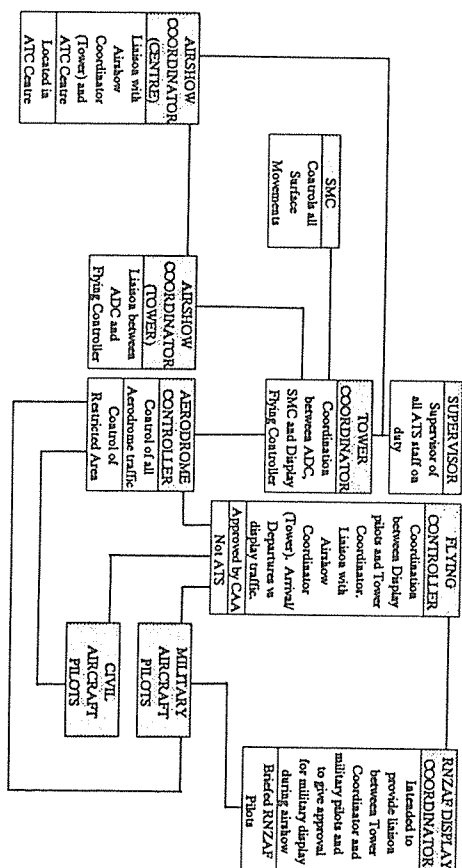
COORDINATION OF PERSONNEL IN AUCC AND TOWER

1.2.5 The operator of the Banderiante had agreed to cooperate with the airshow Organiser by accepting some delay to its schedules and the Captain of Flight NZ 2153 had received a written briefing on the arrangements for ensuring the separation of his aircraft from the display traffic. On the day of the incident, Flight NZ 2153 was approximately one hour behind schedule as a result of an aircraft unserviceability which was found after the passengers had boarded for the flight.

1.2.7 The “Application to Hold an Air Display”, submitted to the CAA by the Air Expo 92 Organiser, included reference to liaison with RNZAF representatives and attached as Appendix 8 an “RNZAF Flight Programme”. The letter which formed Annex 8 to the application included, in its paragraph 5, a requirement for 10 minutes separation between RNZAF “air activity and any other movement with the exception that other air activity could recommence as soon as the aircraft participating in the display by the Red Chequers had landed”.

1.2.9 The RNZAF Operations Group Standing Order No. 3/39 – Flying and Ground Displays - also required the following: "Provision is to be made .... such that no civil flying is permitted within 10 minutes before or after the military display unless with the specific clearance by the RNZAF display director."

1.2.11 The ACNZ Centre Manager at Auckland issued a Temporary Local Unit Order, 51/92, which advised in its introduction "This airshow will be different from most other flying displays in that ... scheduled operations will be



permitted to continue throughout the show, and that they will in fact have priority over any airshow aircraft. .... The policy of ACNZ is that while we will endeavour to meet this target, we cannot guarantee that scheduled traffic will not be faced with some delays. Our target is to maintain a safe flow of traffic, while minimising delays where possible, .....

1.2.12 The Centre Manager had rostered extra staff for the periods in which display traffic was programmed. The TLJO stated a Team Leader would attend the pilot briefings scheduled for the evenings prior to each of the flying display days and detailed in its Appendix 4 the duties of each of the supplementary ATS staff who would be involved with the airshow.

The duties for the various positions included:

**Supervisor\*:**

Had the delegated authority pursuant to Civil Aviation Regulation 33 for the Restricted Area. Any decision made regarding the status of the Restricted Area was only to be made with the agreement of the Aerodrome Controller and the Terminal Radar Controller.

\* During the period of the incident this position was filled by the Warch Supervisor on duty in the Centre.

Airshow Coordinator (Centre) was to:

Liaise with the Airshow Coordinator (Tower) on the sequence and timing of arriving traffic.

Liaise between all sectors in the Centre to organise Auckland traffic management.

Advise Airshow Coordinator (Tower) of any non-scheduled traffic for planning into sequence (specifically international flights).

Airshow Coordinator (Tower) was:

The contact between Centre and Tower for all operational and non-operational matters.

To liaise with the Flying Controller to arrange arriving scheduled versus display traffic.

To arrange activation/deactivation of release of Restricted Airspace between Tower/ Centre.

Tower Coordinator was:

The Operational Tower Chief.

To coordinate airshow traffic between Flying Controller, Surface Movements Controller and the Aerodrome Controller.

To assist Aerodrome Controller in sighting traffic.

To assist Aerodrome Controller in manipulation of strips on flight progress board eg. IFR sequence.

To arrange the departure sequence.

When required by the Aerodrome Controller, to provide arrival information and routing/holding instructions to arriving VFR traffic.

1.2.13 A Restricted Area had been promulgated by NOTAM with lateral dimensions coincident with the Auckland Control Zone and extending from the surface to flight level 150 with exclusions for VFR and helicopter routes. This Restricted Area was in place for three consecutive days at the appropriate times to cover any practice for individual display items on the Friday, and the actual display flying on the Saturday and Sunday.

1.2.14 CASO 9, Part 5 required the Flying Controller to ensure that all pilots participating in the event either attend a general briefing or be "individually briefed by the Flying Controller before flying at the event." With regard to military flying Appendix 1 to Part 5 of CASO 9 stated in paragraph 8;

*"As the operation of military aircraft is not subject to civil regulations, the organiser and the Flying Controller must take appropriate steps to ensure that the service flying display is carried out in accordance with the civil requirements specified in this CASO."*

1.2.15 Prior to the Display the Air Expo 92 Flying Controller promulgated a "pre-brief" letter. In paragraph 2 of the section of the pre-brief, relating to the briefings which preceded each day's display flying, was included:

*"All pilots involved in the flying display, including ... RNZAF ... are to attend."*

1.2.16 The RNZAF pilots did not attend the briefing nor were they briefed individually by the airshow Flying Controller or its Manager Flight Operations. They were however represented by the Air Force Coordinator who had provided the liaison throughout the planning for the airshow.

1.2.17 At earlier air shows in which the RNZAF had participated the requirement in the CASO for individual briefing of pilots had been met by the RNZAF representatives conducting an independent briefing after attending the airshow briefing. Although the RNZAF pilots did not attend the briefing as expected by the airshow Organiser they were briefed by the Air Force Coordinator. In the case of the Skyhawk pilots this briefing was conducted by telephone, but they did not receive a copy of the Flying Controller's "pre-brief" letter.

1.2.18 In addition all RNZAF pilots were issued with a written brief by the Air Force Display Director. This brief specifically included the instructions:

*"The following frequencies and call signs will ... be in use:*

*... Auckland Tower: 118.7 MHz. To be used for airline traffic and display aircraft while not in their display sequence ie. used to get airborne and while holding. Aircraft are to stay on 118.7 MHz until instructed to go to "Display".*

*... Display: 129.6 MHz. A quiet frequency for aircraft on display. No chatter is to occur on this frequency." and*

*... 2. Display Lines. Two display lines have been established, both aligned with runway 05/23 ... Apart from landings and take-offs on the 05/23*

taxiway, RNZAF aircraft and helicopters participating in Air Expo 92 are to use main runway 05/23 as the display line ...".

(RNZAF Air Force Flying Order paragraph 2011 stated:

*Definition: The following flying activities are to be classified as display flying when performed to a set programme before spectators:*

(c) ceremonial fly-past")

1.2.19 The RNZAF's written brief also included as Annex B the flying programme for Saturday 21 November:

SERIAL	TIME	ACTIVITY
11	1330 hrs	Skyhawks overhead fan break, remuster at (after which the word "Seagrove" had been amended, by hand, to read "2x north-west Huia Riponga Pt 1x Pukekohe Sewer")

Neither the written brief nor the flying programme attached thereto was addressed to the Air Expo 92 organiser or Flying Controller, or any of the Auckland ATS staff.

1.2.20 The coordination of the scheduled and display aircraft depended upon close liaison between the ACNZ Aerodrome Controller and the Flying Controller both of whom were seated within easy conversing distance in the Control Tower during the Display. They were not monitoring the same RTF frequencies. The Aerodrome Controller was using the normal Tower frequency of 118.7 MHz primarily, and the display Flying Controller 129.6 MHz. The planned liaison link between the Aerodrome Controller and the Flying Controller was the Airshow Coordinator (Tower). However co-ordination between the Flying Controller, Surface Movements Controller and Aerodrome Controller was the responsibility of the Tower Coordinator.

1.2.21 The RNZAF Display Director arrived in the Tower for the first time one hour before the first military flying was to take place. He was not expected by the ATS personnel in the Tower and the level of air traffic control actively involved with the display, which had started two hours before his arrival, precluded an effective introduction and explanation of his role to any of the ACNZ staff.

1.2.22 The Air Expo 92 "Fly Programme" listed the initial RNZAF Skyhawk appearance as a "flypast" and the Tower Coordinator had contacted the Terminal Radar Controller to facilitate an early turn, off the runway centre line, for Flight NZ 2153 after take-off. This was because the Tower Coordinator anticipated the Skyhawks would use the runway as the line for their "flypast". The promulgated "display lines" were parallel to runway 05/23. Unbeknown to her the "flypast" had been changed to a "fan break" which not only involved the formation approaching the runway from a point 90° to that which she expected but also involved a shorter transit time from the formation's Initial Point.

1.2.23 The Saturday "Fly Programme" published by Air Expo 92 showed flight NZ 2153 (EAG 153) as due to leave the blocks at 1200 hours and take-off at 1205 hours and the RNZAF A4K's as a "SKYHAWK FL YPAST" with a TOT (time over target) of 1330 hours and the finish of its display at 1333 hours.

1.2.24 As the Skyhawk formation leader was about to leave the hangar to board his aircraft, he decided to telephone the Auckland Control Tower to confirm the arrangements for his formation's display. At 1148 hours he spoke to the Tower Supervisor\* who, according to the leader, "was quite concerned that we were going to be on a display control frequency." The Supervisor said "we'd like you, when you are VFR to call us on 118.7. That's our Tower Frequency". The formation leader therefore agreed to remain on the Tower frequency as "I knew that the Air Force chap would be in the Tower and able to intervene if things weren't going quite as well as planned."

\* The person who answered the call announced himself as "Tower Supervisor". ACNZ advised that his title on the day was "Team Leader".

1.2.25 In the course of the telephone call between the Skyhawk formation leader and the Supervisor the leader said he would be "running in perpendicular to your runway there for a start at 1330". This information was not passed to the Tower Coordinator, the Aerodrome Controller or the Airshow Coordinator (Tower).

1.2.26 The Skyhawk formation leader understood the UHF frequency was a "display frequency" ie. one to be used between aircraft and the Tower during the display. This was not reflected in any written briefing material issued by the organisers or in the RNZAF Display Director's written Brief.

1.2.27 At 1326.54 hours the Skyhawk formation was holding at Pukekohe when the leader called Auckland Tower. After an acknowledgement he advised "Five south Pukekohe running in for TOT of three zero." The Tower acknowledged "Skyhawk Red, Roger. Descend to one thousand five hundred feet and cleared to enter the Control Zone direct." The instruction was read back correctly.

1.2.28 At 1328.36 the Skyhawk leader transmitted to Auckland Tower, "Skyhawk Red's seven miles south - running in." This call was not acknowledged.

1.2.29 At about this time the display Flying Controller, who was an ex-RNZAF pilot and display coordinator, was anxious to hear from the Skyhawk formation as the time for the opening ceremony was approaching. He had not been told that the Skyhawks had left their IP or that they had entered the control zone. He therefore endeavoured to contact the formation on the Display frequency and on the display Ramp frequency. He did not obtain a response on either of these frequencies or on a UHF frequency which he understood the aircraft may have been using.

1.2.30 The Tower Coordinator asked the Flying Controller if the pilot of the Bandeirante, which was waiting, could commence his take-off. The Flying Controller who understood the Skyhawks were still clear of the Control Zone agreed. The Tower Coordinator saw no reason to interfere when flight NZ 2153 was cleared by the Aerodrome Controller for take-off at 1328.47 hours. 11 seconds after the Skyhawk formation had advised that he was running in from seven miles south of the Aerodrome.

1.2.31 At 1329 hours the Skyhawk formation leader advised the Tower "Reds are not below four hundred feet and will be for the fan break." This was

not acknowledged. After instructing a taxiing DC 3 aircraft to hold, Tower advised the formation at 1329.14: "Skyhawk Red, Bandeirante rolling runway zero five this time."

1.2.32 The formation leader acknowledged advice of the aircraft taking off and asked "Confirm we are clear to continue in?" and was so cleared. Shortly after the Bandeirante became airborne the attention of the occupants of the Tower was drawn to the formation of Skyhawks on the aerodrome's southern boundary as the Skyhawks' leader gave the formation pilots the instruction to turn on their display smoke.

1.2.33 Tower asked the formation leader if he "had the Bandeirante airborne" to which the leader replied "That's affirmative. We're easing up." The formation continued to complete their fan break.

1.2.34 The Captain of the Bandeirante was the pilot not flying and as the aircraft commenced its initial climb after take-off he sighted the smoke from the Skyhawks. His first impression was that it was a patch of low stratus but he rapidly discarded that misconception and identified the Skyhawks approaching his aircraft at the same altitude. With a brief explanation to the First Officer he eased the control column forward to arrest the aircraft's rate of climb until it became apparent that the formation would pass clear of his aircraft.

### 1.3 Personnel Information

1.3.1 Each of the ATS staff on duty in the Control Tower at the time of the incident was appropriately rated and in current operating practice. The duty roster showed that each had observed the minimum rest breaks and none had been involved in excessive duty times.

1.3.2 The Aerodrome Controller at the time of the incident had qualified as an Aerodrome Controller on 1 December 1981 and was validated as an Aerodrome Controller in the Auckland Tower on 13 March 1990.

1.3.3 The Tower Coordinator at the time of the incident had qualified as an Aerodrome Controller on 27 January 1983. She had joined the Auckland unit on 17 June 1987 and had five years experience as a Controller at Auckland Airport.

1.3.4 The Manual of Air Traffic Services required all Controllers to undergo an annual proficiency assessment and each of the Controllers on duty in the Tower at the time had completed such assessments on time and achieved a satisfactory standard.

### 1.4 Aircraft Information

1.4.1 The A4K and TA4K Skyhawk aircraft were each painted in a disruptive pattern camouflage paint scheme designed to make them difficult to detect visually particularly at low level against a landscape. Each aircraft was fitted with a rotating anti-collision red beacon on the top of the fuselage behind the cockpit. On the underside of the fuselage a second red anti-collision light was installed. The anti-collision lights were operating.

1.4.2 Each of the Skyhawk aircraft was modified to enable its pilot to select an oil stream to be directed into the exhaust to produce a grey smoke trail during certain stages of their display flights.

1.4.3 The maximum air speed permitted by the RNZAF during displays was 360 knots over built up areas, otherwise Mach 0.92. The normal operating speed was 360 to 420 knots which was not reduced to below 250 knots until configuring for an instrument approach or landing. The standard visual approach pattern for a Skyhawk was 360 knots prior to "breaking" into the downwind leg.

1.4.4 The Skyhawk aircraft fitted with a head-up display were also able to preserve a video recording of the information which it displayed against the background ahead of the aircraft. The record of the number three aircraft was studied for the period of the approach of the formation to Auckland Airport and on into the fan break. Immediately prior to the fan break the Bandeirante aircraft came into view from the left, proceeding directly across the path of the formation. At that time the Skyhawk formation was essentially level laterally and maintaining 400 feet radar altitude with a groundspeed of 380 knots. From the visible ground features it was estimated that the particular aircraft from which the record was made would have been approximately 1200 feet agl at the time the formation passed over the Bandeirante.

1.4.5 The Bandeirante aircraft had a predominantly white/grey paint scheme with a mainly blue tail fin and rudder, and two narrow adjacent parallel stripes, one green the other blue, separated the upper white of the fuselage from its grey belly. The upper and lower wing surfaces were grey.

1.4.6 The aircraft was fitted with white wing tip strobe lights and fin and under-belly red anti-collision beacons. The landing lights situated midspan were selected 'ON' for take-off and were still on as the aircraft was passed by the formation.

### 1.5 Meteorological Information

#### 1.5.1 ATIS

Auckland Terminal Information Lima issued at 1240 hours was current at the time of the incident.

The information was as follows:

"... Expect ILS approach runway 05. Runway dry. Expect delays due to airshow. Surface wind 140 degrees magnetic at 5 to 10 knots. Cloud 3 (octus) 2500 feet. Temperature 17. Dew point 11. QNH 1016. Conditions suitable for a visual approach. Reported 2000 foot wind 020 at 5 knots ..."

1.5.2 The Bandeirante pilot described the weather at the time of the incident as "CAVV. Wind 120°/5 knots visibility of 50 km".

1.5.3 From the video record taken by the Skyhawk it was apparent that heavy rain showers were in the vicinity, one being in view to the immediate west of the aerodrome.

### 1.6 Communications

1.6.1 The communications plan for the control of the aircraft in the Restricted Area created for the airshow was that the Tower frequency, 118.7 MHz would be retained for its normal use of controlling aerodrome traffic; all helicopters were to keep a listening watch on this frequency. The display aircraft would be cleared into the Control Zone on the Tower frequency and remain on



it until cleared to Display frequency 129.6 MHz. Upon completion of their display they would be returned to Tower.

1.6.2 Separate surface movement frequencies were available for normal aerodrome and display traffic.

1.6.3 The Flying Controller was able to monitor and transmit on the Display frequency and display Ramp frequency 134.7 MHz. He did not monitor the Tower frequency. Equally the Tower Controller was not monitoring the Display frequency.

1.6.4 The RNZAF Display Director did not have any facility to monitor or transmit on any RTF frequency.

1.6.5 A UHF frequency was available for RTF between the RNZAF display aircraft. It was not used between the Tower and the formation during the period in which the incident occurred.

## 1.7 Radar Recording

1.7.1 Recordings of the primary and secondary radar returns, as they would have been available at radar screens for the Aerodrome Controller and the Terminal Radar Controller, were examined. A video recording of the information available provided the opportunity to study the events in slow time.

1.7.2 Mode "C" transponder altitude encoding was also displayed although the Skyhawks did not produce a return during the initial run in and some confusion was created by aircraft in the formation squawking at the same time. The Bandeirante did give good returns and this assisted with the reconstruction of the incident.

## 1.8 Other Information

1.8.1 The RNZAF in their letter notifying the Air Expo 92 Project Director that they would participate in the display advised that "our regulations require the following":

(a) Issue of a class one NOTAM

(b) 10 minutes separation between our activity and any other air movement ..., and

(c) Our Display Director to have access to the display control communications during our display or authority to operate a portable radio on the display frequencies.

1.8.2 The RNZAF Coordinating Officer subsequently agreed that the RNZAF would dispense with the requirement for a 10 minute separation between all other traffic and their display.

1.8.3 The RNZAF requirement for access to the "display control communications" was not made known to ACNZ management nor their controllers who were on duty on the day. When the RNZAF Display Director arrived in the Tower he was not expected by the Controllers. They understood the Air Expo Flying Controller would be their means of liaison with all display aircraft pilots and that he would be their advisor on the display programme. Nevertheless the RNZAF Display Director could have had a headset to monitor the Tower and/

or Display RTF and was offered, but declined, the opportunity to take over from Air Expo 92 Flying Controller for the duration of the military flying display.

1.8.4 A meeting between the Air Expo 92 Manager Flight Operations and Flying Controller and the RNZAF Coordinator and his Display Director was held a week prior to the Expo.

1.8.5 The initial appearance of the Skyhawks was shown on the display "Saturday Fly Programme" as a flypast, but the RNZAF programme which was not made available to the Air Expo 92 Organiser or the ATS controllers in the Tower listed the event as a "fan break". The ACNZ controllers expected a flypast and had no expectation of a fan break or understanding of what such a manoeuvre involved, particularly that the aircraft would be running in from their IP at a groundspeed which was in the vicinity of 400 knots. No exemptions from the normal maximum speed in the Control Zone had been published or agreed to by the ATS staff.

1.8.6 At approximately 1327 hours the Air Show Coordinator (Tower) and the Flying Controller decided that 1330 hours as a TOT for the opening of the display would not be practicable because of a back up of scheduled airline movements which they wanted to clear before the military display began. Therefore they agreed on a revised time of 1333 hours.

1.8.7 As the Aerodrome Controller was using a headset and the loud speakers in the Tower were not in use the Air Show Coordinator (Tower) did not hear the Skyhawks being cleared into the Control Zone. The Aerodrome Controller was not advised of the agreement to revise the TOT for the Skyhawks.

## 2. ANALYSIS

### 2.1 Miss Distance

2.1.1 Their aircraft were closing rapidly at similar heights when first sighted by the Bandeirante Captain and the Skyhawk formation leader. The Bandeirante was in the after take-off climb phase when the rate of climb was about 1500 feet per minute. In the time taken to cover the intervening distance to the point where the Skyhawks flew overhead the Bandeirante Captain had reduced the aircraft's rate of climb. However, it still achieved a 200 to 300 feet increase in altitude. The Skyhawks were inbound at 400 feet above mean sea level (Auckland Airport environs are at sea level basically) but their video showed that in the pull up to the fan break they had gained height to some 1100 to 1200 feet agl (radar altimeter height) as they passed over the Bandeirante.

2.1.2 The exact point of crossing in relation to the video presentation was not established, but it would appear that a vertical separation of at least 500 feet may have existed. The Bandeirante Captain estimated it to be in the region of 150 feet.

2.1.3 Some warning for the event had been anticipated by the Bandeirante pilot who heard the Skyhawk leader's calls relating to their run in, and the Skyhawk formation leader who when advised of the clearance given for the Bandeirante to take off queried if he "was cleared to continue in". Each pilot saw



the other's aircraft and at that time was able to take the appropriate action to ensure their aircraft would not collide.

2.1.4 The Bandeirante pilot was not sure of the Skyhawks' intended flight path however and had to assume, until they started to pull up, that they might continue level until the aircrafts' flight paths crossed. For the Skyhawk formation leader the climb path of the Bandeirante was more predictable and his aircraft had an excess of performance which made it an easier matter for him to climb over the Bandeirante.

## 2.2 Coordination of Display Traffic

2.2.1 The concept of coordinating a display with scheduled airline movements had not been attempted before in New Zealand, the normal practice being to close the display aerodrome to all other operations for the duration of the flying display.

2.2.2 The requirement for coordination of flying displays with scheduled movements was accepted by the Organiser and all subsequent planning recognised this as a basic consideration.

2.2.3 To achieve this coordination it was necessary to ensure that display aircraft and scheduled operations would be provided with normal air traffic control separation. One tool which was employed to achieve this was the establishment of the Restricted Area with similar lateral dimensions to the Auckland Control Zone and a suitable vertical extent.

2.2.4 The Restricted Area was promulgated by NOTAM. It was apparent that although the RNZAF subsequently modified their requirement for ten minutes' separation from other traffic, they assumed that the NOTAM promulgating the restricted airspace would, in effect, ensure that the use of the airspace so described was restricted to their aircraft for the duration of their display.

2.2.5 Such was not the case and it was the intention of the ACNZ that their controllers would coordinate scheduled aircraft within the restricted airspace but clear of those involved in the display.

2.2.6 The ACNZ Aerodrome Controller, in the eyes of ACNZ, was the person with the overall responsibility for the safe separation of traffic in the Restricted Area. To assist him in this task he had, apart from supporting ACNZ staff, the Air Expo Flying Controller. For the display flying prior to the arrival of the Skyhawks the Flying Controller exercised "control" over the display aircraft by RTF on Display Frequency, 129.6 MHz.

2.2.7 It was the ACNZ Aerodrome Controller's understanding that the flypast by the Skyhawks was not part of the "display". Therefore when Skyhawk Red called for clearance into the Control Zone at one thousand five hundred feet and he so cleared them he expected them to continue straight in for a flypast to be overheard the Governor General's dais at 1330 hours. For the same reason he did not advise the ACNZ Flying Controller that they were running in for the opening ceremony.

2.2.8 The coordination of the opening ceremony depended upon the the Flying Controller advising the official party of the approach of the Skyhawks. The omission of advice to the Flying Controller of the Skyhawks' presence in the

Control zone was also a causal factor in the incident, in that in ignorance of this, the Flying Controller advised the Tower Coordinator that it was in order for the Bandeirante to take off.

2.2.9 The ACNZ Tower Coordinator was aware of the traffic which the Aerodrome Controller was handling and believed that he was correct in clearing the Bandeirante for take-off as the Skyhawks were running in. Like the Aerodrome Controller, she had not been briefed to expect the Skyhawks to be approaching at a speed in excess of 250 knots, the normal maximum for the Control Zone or below the 1500 feet to which they had been cleared to descend. Nevertheless the Skyhawks did not arrive ahead of their advised ETA of 1330 hours.

## 2.3 Supervision

2.3.1 The holding of the display was approved by the CAA in accordance with the provisions of Civil Aviation Regulation 39A. This Regulation required that the display be conducted in accordance with the requirements of CASO 9 (Part 5). CASO 9 required:

"As the operation of military aircraft is not subject to civil regulations, the Organiser and Flying Controller must take appropriate steps to ensure that the service flying display is carried out in accordance with the civil requirements specified in this CASO".

In the next section the CASO emphasised the importance of a thorough briefing and required not only that a written briefing be circulated to all pilots but also that a formal verbal briefing should be given on each day of the event which "All participating pilots shall be required to attend".

2.3.2 The Flying Controller endeavoured to ensure the requirements of the CASO were met by issuing a written "pre-brief" and requiring therein all pilots involved in the flying display, including the RNZAF, were to attend a compulsory verbal briefing. Although the RNZAF representatives received the briefing notes and attended the verbal briefing none of the RNZAF pilots who were to fly in the formation flypast attended the briefing or were given a copy of the prebrief. Air Traffic Control was represented by the Deputy Centre Manager and a Team Leader. The Air Expo 92 display prebrief, although available in the Tower, was not drawn to the attention of the Aerodrome Controllers.

2.3.3 Both RNZAF and ACNZ representatives provided their own briefing material for the event and held briefings with the personnel concerned. However, the opportunity for the personnel most directly involved to have first hand knowledge of the details of the display from the Organiser was denied them.

2.3.4 In the case of the RNZAF pilots based at Ohakea they were inadequately briefed. The Skyhawk formation leader instituted a personal briefing with the Auckland Tower Team Leader (see note to paragraph 1.2.24) prior to departure from Ohakea which resulted in the Skyhawk Red formation leader calling the Tower on the VHF frequency expected by ATC rather than on the UHF which he had planned to use.

2.3.5 There were other important facets of the Organiser's pre-briefing of which the Skyhawk pilots were not aware, in particular:

The Aerodrome Controller, Tower Coordinator and Air Expo 92 Flying Club Controller each expected them to complete a straight and level flypast.

The Restricted Area would not be cleared of other traffic during their time in it.

The flypast was not considered by the Aerodrome Controller to be a part of the display as such.

The RNZAF Display Director would not be monitoring their RTF or be able to transmit to them, direct, to clear them to begin their display, and

They were not expected to exceed the maximum speed for normal operations in the control zone for their flight past the display.

2.3.6 For their part the Tower staff were not expecting an RNZAF representative in the Tower and did not appreciate that the RNZAF aircraft pilots expected to have the Restricted airspace to themselves.

2.3.7 Although the CAA representative was not required to ensure compliance with the CASO he did attend the Friday night briefing. However he was not aware of the absence of the RNZAF pilots.

2.3.8 The Organiser expected the RNZAF pilots to attend but was advised by the Flying Controller that at previous air shows individual RNZAF pilots had not attended. As those air shows had been approved under the same CASO the Organiser saw no reason to pursue the matter as he and the Flying Controller had briefed the RNZAF representatives in detail one week earlier.

2.3.9 The Tower Coordinator was aware that the Skyhawks had entered the Control Zone and were approaching for the official opening of the Air Show and that the Aerodrome Controller had cleared the Bandetrane for take-off.

2.3.10 Although the Tower Coordinator was responsible for the coordination of airshow traffic between the Flying Controller, Surface Movements Controller and Aerodrome Controller she did not know that the Flying Controller had not been advised the Skyhawks were in the Control Zone when she asked him if it was all right for the Bandetrane to take off.

2.3.11 The Airshow Coordinator (Tower) was responsible for liaison with the Flying Controller to arrange arriving scheduled versus display traffic. The Tower Coordinator also employed him to assist with "looking for slots for departures", and in this capacity he had agreed that a delay of three minutes was necessary before the arrival of the Skyhawks to ensure the scheduled traffic would be clear for the military activity. As the Skyhawks had been kept on the Tower frequency for the flypast, by the Aerodrome Controller, the display Flying Controller could not contact them on his frequency. Again as the Aerodrome Controller had not advised him that the Skyhawks had entered the Control Zone he was not aware that they would arrive ahead of the revised TOT, which had been agreed between the Airshow Coordinator (Tower) and himself, when he gave advice based on this to the Tower Coordinator.

## 2.4 Summary

2.4.1 This incident occurred because the leader of the Skyhawk formation had a different expectation of the environment in which he was expected to

conduct his display, from that of the Tower Coordinator and Aerodrome Controller who were not aware of the critical details of the flypast which they required to ensure safe separation from other aerodrome traffic.

2.4.2 It was made clear to the Organiser that because the military aircraft were not required to comply with civil regulations their compliance with the requirements of the CASO had to be ensured to meet the terms of approval for the air display. When it became apparent that the RNZAF did not intend to make their pilots available to participate in the personal briefings the CAA approval for the air display was in jeopardy and the situation required addressing positively.

2.4.3 The RNZAF understanding that they would have the Restricted Airspace to themselves for their displays was not correct. The NOTAM relating to the display made it clear that a variety of aircraft could use the airspace while it was restricted and that the control of air traffic would be vested in the Aerodrome Controller. It was not clear from the NOTAM that a mix of display and non-display aircraft might use the Restricted Airspace at the same time. However this was made clear in the pre-brief letter and the Air Expo 92 pilots' briefing on the evening preceding the display.

2.4.4 The Air Expo 92 Organiser had sought throughout to ensure effective liaison with both the RNZAF and the ACNZ. The preparation could have been accomplished thoroughly had the RNZAF and ACNZ attended each planning meeting. While procedures were in place for each of the contingencies which they envisaged the final ingredient to ensure the safety and success of these arrangements was the effective promulgation of the details to those directly affected.

2.4.5 When the RNZAF pilots did not attend the pre-display briefing in response to the direction to do so in the "pre-brief" letter and the requirements of the CASO 9 were thus breached the Manager Flight Operations had to decide between cancelling the RNZAF participation and not complying with the CASO. As the CAA Officer who approved the Airshow attended the briefing and made no comment on the absence of the RNZAF pilots and as the Flying Controller advised the Organiser that other air shows involving the military had proceeded without an individual briefing of the RNZAF pilots, the Organiser accepted the situation.

2.4.6 The CAA Officer on the other hand, considered his responsibility to be over once the Airshow was approved and attended the briefing only to resolve "any changes that came up". He was not aware of the absence of the RNZAF pilots from the briefing so he had no cause for comment.

2.4.7 The CAA's reliance on strict compliance with the CASO by the organisers, to ensure the safety of the display, was not well founded. While the CASO referred to "all pilots" in several places it was obvious from the context that this meant only "all civil pilots" in some cases. However under the heading "Military Participation" the CASO required the Organiser to "take appropriate steps to ensure that the service flying display is carried out in accordance with the civil requirements specified in this CASO". While the obvious answer for the organisers was to omit the military flying if their pilots did not attend the briefings the impact of such an omission on the show was a persuasive factor for

overlooking this important detail, particularly as the Organiser understood that other air shows had gone ahead in similar circumstances.

2.4.8 In the case of the scheduled traffic the pilot of the Bandeirante was well prepared and acted in accord with the agreed procedures.

2.4.9 The RNZAF made concessions in relation to their initial requirement for ten minutes separation from any other traffic prior to the commencement of their display, and provided well qualified representatives during the planning and preparation that occurred. There was, however, a surprising lack of appreciation on their part, given the continuous representation during the planning phases, of the necessary liaison with ACNZ for the Display Director to implement his responsibilities.

2.4.10 The ACNZ management made significant efforts to ensure that they would meet the challenge of the particularly demanding task of integrating scheduled movements at a busy international airport with an integrated flying display lasting six hours without a break.

2.4.11 While two comprehensive Temporary Local Unit Orders were published detailing the responsibilities of the individuals in the augmented controller structure in the Tower, the vital link between the military display aircraft Display Director and the Aerodrome Controller was not established. This was the essential element which would have provided on request the detailed information of each display aircraft's intentions necessary for the Controller to plan the most demanding of tasks, safe separation between aircraft in the confines of the control zone.

2.4.12 Although the Air Expo 92 Flying Controller had been a forward air controller in the RNZAF and had been an RNZAF Display Director he was not aware of the last minute changes which had been made by the military to their display programme. The Aerodrome Controller did not involve him when clearing the Skyhawks into the control zone for their "flypast" nor was he required to do so.

2.4.13 If the Aerodrome Controller had advised the Flying Controller that the Skyhawks were entering the control zone he might have been told this was contrary to the desirability of an amended TOT which had been decided between the Flying Controller and the Airshow Coordinator (Tower). Nevertheless he may not have been advised directly on the Skyhawk's intentions as the Flying Controller was under the impression that agreement had been reached that the Skyhawks would not do a fan break but would fly straight and level past the official dais.

2.4.14 Had the RNZAF Display Director been involved he would have provided two safeguards. One: he had the latest information on the detail of the military display readily available, and two: he had the final authority to clear the aircraft in for the display or to amend or abort sections of it as the situation warranted. It was his clear understanding that no military display, including the Skyhawk fanbreak, was to be commenced without authority from him as the military Display Director. Therefore he might well have intervened if he had been in the control Tower loop and realised that the Skyhawks were running in.

2.4.15 The effectiveness of an organisation in the ATC environment which

required several people to be aware of each others decisions in the busy environment created by the combination of display and scheduled traffic was not well considered.

2.4.16 The Aerodrome Controller and the Tower Coordinator did not advise the Flying Controller or the Airshow Coordinator (Tower) that the Skyhawks were running in for their "flypast". Equally the Flying Controller and the Airshow Coordinator (Tower) did not advise the Aerodrome Controller that they had decided it was desirable to clear all scheduled aircraft from the area prior to the military display and to do so had agreed on a new TOT for the Skyhawks.

2.4.17 For the Aerodrome Controller to be able to discharge his responsibility he had to be assured that all relevant inputs would be fed to him. The links between the various personnel in the Tower were not adequate to ensure that this would be achieved in the high workload environment created by integrating normal commercial traffic with the airshow traffic.

### 3. FINDINGS

3.1 The display was approved by CAA in accordance with CASO 9.

3.2 Each of the aircraft involved was airworthy and their pilots suitably qualified for the tasks expected of them.

3.3 The Air Expo 92 Board of Management made every endeavour to ensure the display was run in accord with the approval given by the CAA.

3.4 The requirement for each pilot involved to attend the briefing held at Auckland Aerodrome was explicit in the CASO and the instructions issued by the Air Expo 92 Organiser.

3.5 When it became apparent that the RNZAF were not going to make their pilots available for a personal briefing the advice of the CAA should have been sought or the military flying omitted from the programme.

3.6 The RNZAF did not make adequate arrangements for the briefing of the Ohakea based pilots.

3.7 As a matter of principle all display pilots should have been required to attend the pre-display briefing.

3.8 The ACNZ Aerodrome Controller did not advise the Flying Controller that the Skyhawks had entered the Control Zone and were running in for their flypast.

3.9 The ACNZ Aerodrome Controller was not aware that The Airshow Coordinator (Tower) had agreed with the Flying Controller that the Skyhawks should be delayed by three minutes.

3.10 The Flying Controller was unable to contact the Skyhawks at the time they were expected to commence the flypast and thus believed they had been delayed.

3.11 The RNZAF did not make suitable arrangements for their Display Director to fulfill his function during the military flying display.

3.12 The ACNZ Aerodrome Controller was unaware that the information which he had on the intention of the Skyhawk formation leader was incorrect. Thus he was unable to ensure safe separation between the Skyhawks and other aerodrome traffic.

3.13 The Tower Coordinator shared the Aerodrome Controller's confidence that adequate separation would be maintained between the departing Bandeirante and the approaching Skyhawk formation when the Controller cleared the Bandeirante for take-off.

3.14 The Skyhawk leader reacted properly when he heard the Bandeirante's take-off clearance.

3.15 The Aerodrome Controller took the correct action when he detected a possible conflict between the departing and arriving aircraft.

3.16 Had the Aerodrome Controller and the Tower Coordinator attended the verbal briefing on the day before the event it was still unlikely they would have had a better appreciation of the Skyhawks' intentions.

3.17 The liaison between the RNZAF and the ACNZ was inadequate to ensure the safety of the display.

3.18 The tenets of the Manual of Air Traffic Services, or the Temporary Local Unit Orders issued for the Air Expo 92 were not intended to ensure the cohesive exchange of information in the Tower, whether between ACNZ Controllers themselves or between ACNZ Controllers and the Flying Controller and RNZAF Display Coordinator, or between the Flying Controller and the RNZAF Coordinator.

3.19 The reliance by the CAA on the organisers complying with a CASO without further supervision, after approving a major airshow subject to such compliance, was not a sound decision.

3.20 This incident resulted from the inadequate promulgation of the detailed arrangements for the conduct of Air Expo 92 to the RNZAF pilots and Air Traffic Service staff involved.

#### 4. SAFETY RECOMMENDATIONS

4.1 As a result of this investigation it was recommended to the Director of Civil Aviation that he:

Require his Rules Rewrite Team to review the requirements for granting an approval to conduct an airshow, to:

Ensure the CAA approval for the event is not given until agreement is obtained from the military that they will comply with the relevant civil requirements and the specific provisions for air traffic control during the event have been reviewed in detail (045/93), and

Assign a CAA Officer to ensure the Organiser of any airshow complies with the approval throughout the running of the event (046/93), and

Prohibit the simultaneous operation of display and non-display aircraft

within any airspace designated for an airshow (047/93), and  
Arrange a meeting with the RNZAF and ACNZ to review the RNZAF's understanding of the observance of the airspeed restrictions in controlled airspace (048/93).

4.2 The Director of Civil Aviation responded to the above recommendations as follows:

045/93:

*"The recommendation will be considered by the Team when the task of rewriting the requirements for airshows is undertaken. It should, however, be noted that the CAA is planning to follow the Swedish recommendation of 'getting out of the business of day-to-day approvals'. The Team will be instructed to establish standards for the conduct of Airshows or Displays, which are to be observed by those persons conducting such events. Indeed, the proposed Amendment 33 to the Civil Aviation Regulations 1953 proposes adding a subclause (2) to Regulation 39A as follows "Nothing in this regulation requires any person to obtain the proper approval of the Director before conducting an air pageant or air display that complies with requirements prescribed by rules made under the Civil Aviation Act 1990". It is envisaged that there will be a rule to require agreement to observe any requirements (civil, military or of the organiser) as a prerequisite to the acceptance of a persons participation in the programme. There will also be a rule to require the person conducting the airshow to consult and review any air traffic control provisions for the show."*

046/93:

*"As outlined above the CAA is following a policy of setting standards that industry is required to observe. The Director will, of course, carry out inspections and audits in the interests of aviation safety as required by Section 15 of the Civil Aviation Act 1990 but this will not necessarily mean that a CAA officer will be present at each and every airshow conducted to standards prescribed in a rule. There will probably be a rule requiring any person to notify the Director of their intention to conduct an airshow so that arrangements can be put in place to monitor what happens, but the CAA does not propose to station an officer at the organiser's shoulder to oversee or direct what happens. The Civil Aviation Act 1990 (Section 12(3)) sets a clear policy that participants in the civil aviation system must take responsibility for their own activities."*

047/93:

*"The recommendation has been passed to the Rules Rewrite Team for inclusion in the airshow rules when drafted."*

048/93:

*"The CAA would be happy to act as a facilitator in order to achieve the objective recommended by TAIC."*

4.3 As a result of this investigation it was recommended to the Chief

Executive of the Airways Corporation of New Zealand that he:

Review the existing understandings with the RNZAF in relation to the observance of airspace restrictions in controlled airspace (041/93), and

Ensure any exemption from compliance with airspace restrictions in controlled airspace is properly promulgated (042/93), and

Ensure that before he agrees to provide Air Traffic Control at any airshow a realistic evaluation of the workload on the ATS Controllers is conducted and the appropriate arrangements made to ensure no individual controller will be overloaded (043/93), and

Review the organisation links between ATS staff responsible for out of the ordinary Air Traffic Control situations and ensure that they provide for the optimum flow of essential information between the individuals involved (044/93).

4.4 The Airways Corporation responded to the above recommendations as follows:

*"We have considered the safety recommendations and advise that the Corporation will implement them in full."*

4.5 As a result of this investigation it was recommended to Chief of Air Staff that he:

Require all military formation leaders/aircraft captains participating in an airshow to attend the pre-display briefing conducted by the organisers (037/93), and

Require his pilots to comply with the Civil Aviation Safety Order or any other civil document governing the conduct of a particular airshow in which military aircraft are involved or advise the organisers of any parts of such instructions with which he is not prepared to comply (038/93), and

Ensure appropriate provision is made to give effect to the requirement for military pilots participating in an air display to have clearance from the RNZAF Display Director before commencing his display (039/93), and

Establish an understanding with CAA/ACNZ on the need or otherwise for military aircraft to exceed the promulgated airspace restrictions in controlled airspace (040/93).

4.6 The Chief of Air Staff responded to the above recommendations as follows:

037/93:

*"The RNZAF accepts that formation leaders/aircraft captains should attend pre-flight briefings."*

038/93:

*"The RNZAF has always required this."*

039/93:

*"We have always required this as well but, on this occasion, there was a failure. As a result, a review of written guidance to Display Directors is under action by Operations Group Headquarters."*

040/93:

*"We will remind the ACNZ of the need but find it incredible to suggest the need was not seen on this occasion."*

9 August 1993

M F Dunphy  
Chief Commissioner

## GLOSSARY

ACC	Area Control Centre
ACNZ	Airways Corporation of New Zealand Limited
AGL	Above ground level
AFTN	Aeronautical Fixed Telecommunications Network
AIAL	Auckland International Airport Limited
APP	Approach
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATS	Air Traffic Service
CAA	Civil Aviation Authority
CAR	Civil Aviation Regulation
CASO	Civil Aviation Safety Order
CAVU	Ceiling and Visibility Unlimited
ETD	Estimated Time of Departure
FIR	Flight Information Region
FO	First Officer
HF	High Frequency
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IP	Initial Point
kHz	Kilohertz
km	Kilometres
MHz	Megahertz
NDB	Non-Directional Beacon
NM	Nautical Miles
NOTAM	Notice to Airmen Containing Information the Timely Knowledge of which is Essential to Personnel Concerned with Flight Operations
Pt	Point
QNH	Barometric Pressure at Sea Level
RNZAF	Royal New Zealand Air Force
RTF	Radio Telephone
SID	Standard Instrument Departure
SSR	Secondary Surveillance Radar
TLUO	Temporary Local Unit Order
TOT	Time Over Target
TWR	Tower
UHF	Ultra High Frequency (300 to 3000 MHz)
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules
VHF	Very High Frequency (30 to 300 MHz)