Report 97-013

RNZAF Airtrainer and Eagle Air Metroliner III

TRA 30 and ZK-PBA

loss of radar separation

Bay Area Sector (5 nm south Hamilton)

1 July 1997

Abstract

At about 1240 hours on Tuesday 1 July 1997 a loss of separation occurred between an RNZAF Airtrainer and an Eagle Air Metroliner proceeding in opposite directions five nautical miles south of Hamilton Aerodrome. The aircraft were under radar control. The Airtrainer departed from Hamilton Aerodrome following the Eagle Air Metroliner which had commenced a missed approach with a simulated engine failure. The Metroliner then turned back toward the VOR while below radar coverage, simulating an inability to clear the terrain south of Hamilton. Subsequently the radar returns for each aircraft closed until they merged on opposite headings at the same indicated altitude. Visual separation was advised by the Metroliner pilot as the aircraft passed.

No deficiencies were identified in relation to established standard procedures for radar control. However the incident underlined some serious misunderstandings of a Flight Testing Officer and a commercial pilot undergoing a test. Other safety issues discussed included the need for an Air Traffic Control Officer to be alert to what has been said before acknowledging a transmission with, "Roger", and the airline's understanding of the intention of the relevant information in the New Zealand Aeronautical Information Publication.

Transport Accident Investigation Commission

Aircraft Incident Report 97-013

Aircraft types & registrations:	Airtrainer NZ 1930 & Fairchild SA227 Metroliner III, ZK-PBA
Date and time:	1 July 1997, 1240 hours[1]
Location:	About 5 nm south of Hamilton
Type of flight:	RNZAF instrument flying training Eagle Air flight test for ATPL
Persons on board:	Crew: NZ 1930: 2 ZK-PBA: 3
Injuries:	Nil
Nature of damage:	Nil
Investigator-in-Charge:	R Chippindale

[1] All times in this report are in NZST (UTC + 12)

1. Factual Information

1.1 On Tuesday 1 July 1997 an Eagle Airways Limited Metroliner departed from Auckland for Hamilton. At 1223 hours the flight, identified as Papa Bravo Alfa (ZK-PBA), contacted Auckland Area Control while cruising at 10 000 feet, requesting the VOR/DME approach to Hamilton runway 18 via the arc followed by a missed approach into the holding pattern at "three or four thousand feet". In response ZK-PBA was cleared to descend to 4000 feet.

1.2 The pilot-in-command of ZK-PBA was undergoing a flight test for upgrading to an Airline Transport Pilot Licence (ATPL). The Flight Testing Officer (FTO) had advised him to conduct the flight as if it were a charter from Auckland to Hamilton. Instrument flying conditions were simulated by the pilot wearing instrument flying goggles which limited his view to the inside of the cockpit.

1.3 The flight proceeded normally with simulated distractions of a cargo door warning light illuminating and the failure of the left engine hydraulic pump. At 1224.24 hours the aircraft was advised by the Bay Sector Radar Controller, "Papa Bravo Alfa is cleared VOR/DME approach runway 18, join DME Arc Hamilton QNH 1002." The aircraft responded, "Cleared VOR/DME approach runway 18 via the arc on 1002 Papa Bravo Alfa, we'd like to go straight into the approach off the arc if that's available." The Controller responded, "Affirm."

1.4 At 1229.00 hours ZK-PBA advised air traffic control (ATC) the aircraft was established on the arc. The Controller acknowledged this advice with an instruction to contact Hamilton Tower when established inbound. Just over a minute later the Controller countermanded this with an instruction to remain on the radar frequency. When the pilot advised the Controller ZK-PBA was established inbound at seven miles the instruction to remain on the radar frequency was repeated. One minute and 23 seconds later, at 1232.42 hours, when the aircraft was instructed to commence a missed approach due to departing traffic the FTO asked if they could continue as they had the traffic in sight. The Controller agreed to this request and advised the Hamilton Aerodrome Controller (Tower) by telephone that ZK-PBA was four miles final.

1.5 The Aerodrome Controller confirmed that he had the aircraft in sight and the Bay Controller asked, "He's still on my frequency, he's about to commence a missed approach, can I keep him rather than give him across to you?" The Tower Controller agreed and said he would call the Bay Sector Controller back for a release on Trainer 30 (Royal New Zealand Air Force (RNZAF) Airtrainer NZ 1930's call sign).

1.6 At 1235.21 hours ZK-PBA advised the Bay Sector Controller that the aircraft was commencing a missed approach. This was acknowledged and the pilot was instructed to climb ZK-PBA to 4000 feet. In response he advised, at 1235.27 hours, "Climbing to 4000 we're simulated at this stage, Papa Bravo Alfa." At about 1236 hours in response to a release for Trainer 30, Hamilton Tower advised the Bay Sector Controller, "The Metro's low level at this stage, probably pulled an engine." The Bay Sector Controller acknowledged, "OK that's fine."

1.7 When ZK-PBA was asked to, "Report level passing" by the Bay Sector Controller, the FTO responded, at 1237.42, "We're passing eight hundred, I do have the terrain in sight and we're turning back to the beacon." The Controller responded, "Roger no radar contact and are you twin engine yet? The FTO replied, "Negative have you got another departure?" At 1237.54 hours, the Controller advised, "Affirm - it's OK you are identified now six to the south."

1.8 The Airtrainer aircraft, Trainer 30, departed from Hamilton runway 18 at 1238 hours for Ohakea via the BUDEN-1 departure. The flight was an airways instrument flying training mission and the planned route to Ohakea was via Ohura and Maxwell at 6000 feet.

1.9 Starting at 1238.06 hours the following exchange took place between the Bay Sector Controller and ZK-PBA:

1238.06 Bay Sector: "Ah just confirm are you tracking south on BUDEN 'til passing three thousand."

1238.11 ZK-PBA: "I was already cleared up for the standard missed approach."

1238.22 Bay Sector: "Affirm but your altitude would have been a lot higher than that at that distance."

1238.27 ZK-PBA: 'Well today it isn't we're simulated so we're heading back to the beacon now."

1238.33 Bay Sector: "Roger cancel simulation cleared two engines climb to four thousand immediately."

1238.37 ZK-PBA: "OK climbing 4000 now Papa Bravo Alfa."

1238.52 Bay Sector: "Papa Bravo Alfa level passing now?"

1238.55 ZK-PBA: "One thousand feet. Have you got traffic here? We're visual at this stage."

1239.00 Bay Sector: "Airtrainer two to the south of Hamilton climbing through 700 feet."

1239.14 ZK-PBA: "We have the traffic in sight. Papa Bravo Alfa."

1239.42 Bay Sector: "Papa Bravo Alfa. Thanks."

1.10 The Manual of Air Traffic Services (MATS) Page COM 1 paragraph 10.2 states:

10.2 Radiotelephony (RTF) Procedures

ATS staff shall follow the RTF procedures contained in MATS and the OPS and COM sections of the AIP-PM (Aeronautical Information Publication-Planning Manual).

1.11 The AIP-PM pages COM 10 -11 include the following:

Standard Words and Phrases

The following words and phrases shall be used in radiotelephony communications as appropriate and shall have the meaning given below.

Word/Phrase	**Meaning**
AFFIRM	Yes
NEGATIVE	No *or* Permission is not granted *or* That is not correct

Word/Phrase	Meaning
ROGER	I have received all of your last transmission (*under NO circumstances to be used in reply to a question requiring READ BACK or a direct answer in the affirmative or negative*)
WILCO	I understand your message and will comply with it

1.12 The relevant radar recordings showed that the aircraft passed each other with no discernible separation. Standard radar separation is 5 nm and 1000 feet. The aircraft passed approximately 5 nm south of Hamilton.

1.13 The Bay Sector Radar Controller had commenced air traffic service training ten years earlier and had been a qualified controller for seven years. The Controller qualified as an Area Radar Controller in December 1993 and as an Approach Radar Controller in March 1994 and validated on the Bay Area sector on 14 August 1996, the sector being worked at the time of the occurrence. The Controller's most recent proficiency assessment had taken place at the time of the Bay Sector validation.

1.14 The Controller had worked 22 shifts in the Bay Sector in the last 30 days and had been recalled from a day off to replace the rostered Bay Sector Controller on the day of the incident. The Controller had been off duty the previous day and worked until 1110 hours on the day before that. The shift was from 0630 hours to 1400 hours. No record was available of the Controller's breaks. A requirement of a radar controller's position was that not more than two hours should elapse between breaks. The loss of separation occurred about 6 hours 10 minutes after the commencement of the shift.

1.15 The Controller considered that traffic volume at the time of the occurrence was "average".

1.16 The radar equipment in use did not provide a controller with any warning of an impending loss of separation. Purchase of a suitable system modification (short term conflict alert (STCA)) was approved by the Airways Corporation in April 1997, prior to this incident, and the software installation project has commenced. Implementation is expected in 1998. The modification will alert a controller by an on screen flashing indication. The STCA will depend on both aircraft being within radar coverage and in this particular instance may not have provided earlier warning of the impending loss of separation.

1.17 The FTO said he was satisfied the pilot-in-command complied with the Company procedures and the AIP-PM, Section OPS 10 IFR Procedures when the aircraft was turned back to the VOR on the missed approach before eight nautical miles from Hamilton DME even though the aircraft had not reached the 3000 feet normally required before the turn back to the Hamilton VOR. He believed he had advised the Bay Sector Controller that the aircraft was "simulated", at 800 feet, maintaining terrain clearance visually and turning back to the VOR. Further he understood the OPS 10 IFR procedures for the AIP-PM were well known to controllers although he was not aware if the Company procedures were known to them.

1.18 The Eagle Airways Flight Operations Manual stated:

> 7:07 **Engine Failure On Take-Off**
>
> (Runway) 18 (Minimum Acceleration Altitude 600 feet QNH)
> Track runway centreline to 600 feet QNH. Intercept Hamilton VOR Radial 176 TURN LEFT to set heading over the VOR. All reversal turns to commence with (in) 8 DME Hamilton.
>
> 27:08 **Single Engine**
>
> Apply power smoothly to maximum continuous torque for overshoot at 100% RPM. Rotate the aircraft to give a nose up position on the artificial horizon of 10 degrees. Select landing gear up and flap to 1/4. Accelerate to V_{YSE}[2] and select flaps up. Climb in accordance with engine failure on take-off performance procedures, in the above configuration (monitor EGT not above 650 °C, Torque not above 100%).

1.19 The New Zealand AIP-PM references relevant to this incident were:

RAC Section RAC Page 50/2

> ***Terrain Clearance, IFR Flights***
>
> Under radar control, ATC will assign levels which provide terrain clearance as follows:
>
> - In accordance with contour levels depicted on radar displays. . . .
> - the Minimum Safe Altitude for the route or procedure being flown, including DME and VORSEC (VOR/DME minimum sector altitude) chart steps;
> - in accordance with the altitude quoted on the 25 NM minimum sector altitude diagram as shown on the instrument approach charts;
>
> Not withstanding the previous paragraph, in VMC (visual meteorological conditions) by day, an IFR flight arriving or departing under radar control may be permitted to arrange its own terrain clearance. In such instances, the radar controller will instruct the pilot to, "MAINTAIN TERRAIN CLEARANCE VISUALLY".
>
> ....
>
> A departing aircraft may be cleared to make a visual departure onto a specified heading or track in which case the altitude at which terrain clearance passes from the pilot to the controller will be specified as part of the clearance.
>
> It is the responsibility of a pilot cleared to maintain terrain clearance visually to ensure obstacle clearance is maintained until an alternative procedure applies or to a specified limit or until the aircraft has landed.

RAC Section RAC Page 52

> **EMERGENCY ACTION**
>
> In the event of an aircraft being or appearing to be in any form of emergency, every assistance will be afforded by the radar controller.

[2] Indicated air speed required to achieve the best single engine rate of climb

Identification will be established as early as possible by the most suitable method consistent with ensuring safety of the aircraft and a suitable course of action will be agreed between the radar controller and the pilot. Where two-way RTF communication is impaired....

OPS 10 IFR Procedures Section Page 102

IFR PROCEDURES

Flight under IFR requires compliance with procedure specifications which provide horizontal and vertical terrain and obstruction clearances. In addition, the compliance with instrument flight procedures make possible the separation of aircraft by ATC. The IFR procedures are individually flight checked at the published altitudes and descent below the promulgated altitudes may result in invalid navigation signals being received. The purpose of this section is to explain the principles and criteria associated with IFR procedures.

IFR Departure Procedures

Published departure procedures provide routing to avoid most high terrain which may be in the relatively close proximity to the aerodrome. Where this is not possible minimum set heading altitudes or visual segments will be prescribed. In emergency circumstances however, terrain clearance cannot be guaranteed under all conditions of operation, due to aircraft performance.

The pilot-in-command must consider the one engine inoperative climb performance in relation to the height of terrain over which the climb is planned. Where adequate terrain clearance in IMC under ambient conditions cannot be ensured it must be determined before departure that, in the event of engine failure prior to reaching Minimum Safe Altitude, or the level acceleration altitude, adequate action can be taken to protect the aircraft. It is expected that this action will normally involve a return towards the departure aid until either Minimum Safe Altitude is reached or approval is granted for a re-join for approach and landing; in this respect the pilot-in-command must take into consideration the terrain over which the reversal turn may have to be completed.

OPS 10 IFR Procedures Section Page 125

The Instrument Approach: Missed Approach Procedures

A missed approach is the procedure to be followed when an instrument approach has been made but a landing is not effected.

....

During the final approach, a published missed approach may be requested from ATC or in an emergency initiated at any time.

Following a pilot initiated missed approach, the pilot must notify circumstances and intentions immediately:

- If in controlled airspace, by advising ATC. If required ATC may issue additional or alternative instructions; or
- If in uncontrolled airspace....

Note: The missed approach procedure is designed to provide a minimum obstacle clearance of 98 feet to an aircraft climbing along the specified missed approach path at a gradient of 2.5% (150 feet/NM) from the prescribed point

(MAPt-non-precision) or altitude/level (DA/H-precision) from which the missed approach procedure commences. If this climb gradient can not be achieved (e.g. degraded climb performance with an engine inoperative under certain conditions of weight/temperature/altitude), the DA/H or MDA/H should be increased or other action taken to achieve the required obstacle clearance.

1.20 The sequence of events which led to ZK-PBA simulating an inability to climb was a scenario in which the aircraft, at maximum landing weight, lost the use of the hydraulic pump in the left engine then had a fire warning for the right engine after the undercarriage had been lowered in preparation for landing. The pilot responded to the fire in the right engine by carrying out the appropriate procedure up to and including the simulated feathering of the engine's propeller. The simulated weather at minimum altitude was such that a landing could not be made and a missed approach was initiated. With no hydraulic system to raise the undercarriage the heavy aircraft would not climb with the undercarriage lowered.

1.21 The pilot under test realised that he should have left the engine windmilling and raised the undercarriage before completing the fire drill. If a decision to land had been made subsequently the undercarriage could have been lowered by "free fall". With this procedure, when the requirement for a missed approach was simulated, the aircraft's rate of climb would not have been hampered by the inability to retract the undercarriage. His only practicable action was to simulate partial unfeathering of the right propeller to drive the hydraulic pump which he asked the co-pilot (FTO) to do as the aircraft proceeded toward high ground. The next requirement was to maintain clearance from the high ground which could only be achieved by turning back toward the VOR at low altitude.

1.22 The briefing given to the pilot-in-command by the FTO advised that the FTO would act as a "not particularly helpful co-pilot". Nevertheless the pilot under test stated that he was happy with the radio calls made by the co-pilot (FTO) to ATC during the course of the flight and particularly after the commencement of the missed approach procedure.

1.23 The term "simulated" meant different things to the Controller and the FTO. The Controller understood it meant that an instructor had simulated an engine failure and the aircraft would thus have a reduced performance. The FTO intended it to mean that he was simulating an emergency with or without an engine failure. The single-engine V_{YSE} airspeed of the Metroliner was 128 knots and the normal climb out speed of the Airtrainer was 100 knots.

1.24 As neither the Airtrainer or the Metroliner were on the Radar Controller's radar screen at the time procedural separation had to be applied for the release of the Airtrainer from Hamilton after the Metroliner had commenced its missed approach. The planner applied longitudinal separation based on time to approve the release to Hamilton Tower.

1.25 MATS page RAC 5.11 at 19.1 states:

19 LONGITUDINAL SEPARATION MINIMA BASED ON TIME

These may be established by requiring aircraft to:

- depart at a specified time;

  or

- lose or gain time to arrive over a location at a specified time;

  or

- hold over a location until a specified time.

When a speed differential or comparison is required by these separations:

- the same speed reference, applicable to the phase of flight, shall be used, e.g. IAS to IAS,

  and

- if IAS is used, the speeds shall be checked when the aircraft are within 4000 feet of one another prior to applying the separation.

19.1 BETWEEN DEPARTING AIRCRAFT (See also wake turbulence)

The following applies to aircraft departing from the same aerodrome:

- **T1** . . .
- **T2** (two minutes) between take-offs when the preceding aircraft will maintain a speed of 40 knots for faster than the following aircraft, and both propose to follow the same track; or
- **T5** . . .

1.26 The potential of several courses of action to avoid incidents of this type was discussed with the Airways Corporation.

1.27 The first was to continue instrument approach flying training and testing under IFR with a requirement for the FTO or instructor to discuss the exercise with the Tower Controller immediately prior to the flight if there was a potential for the aircraft to be unable to comply with the ATC clearance as a result of a simulated emergency. The disadvantages of this are:

- the Tower Controller still may not be able to facilitate the flight as he/she is not the only controller involved in providing the necessary separation between aircraft for instrument procedures conducted under IFR, and
- the instructor must ensure the Tower Controller who is briefed on the exercise will be on duty for the planned duration of the flight.

1.28 The second was to conduct such flights under VFR. This is not practicable because separation must be provided from other IFR traffic which still involves the considerations in the first proposal.

1.29 The third was to make provision for a "block" of airspace for such training so that the various permutations of difficulties generated by the FTO, or instructor, and pilot responses could be allowed to continue for the student or licence applicant's benefit. This solution is feasible but it would:

- delay other traffic, and
- require amendments to existing procedures.

2. Analysis

2.1 This incident was investigated to establish why an experienced FTO and an experienced air traffic controller had different expectations of each other in a situation which would be handled no differently by either party if the circumstances occurred during a scheduled passenger flight.

2.2 No conflict existed initially between the two aircraft as the Metroliner, ZK-PBA, was the faster aircraft and ahead of Airtrainer TRA 30, which was flying in the same direction. As soon as ZK-PBA turned back the two aircraft were flying on opposing headings on the same track, at low level with marginal radar coverage.

2.3 The pilot-in-command of ZK-PBA recognised that the set of circumstances which were presented to him during the course of his test should not have led him into the predicament which required the turn away from high ground during the missed approach. As he was still endeavouring to retrieve the situation he was not monitoring critically the RTF calls which the FTO made.

2.4 As the FTO was experienced and appeared to be making all the correct calls the pilot-in-command concentrated on flying the aircraft and taking the action necessary to mitigate the consequences of his error in procedure after the fire drill for the engine. He had no outside reference as he was wearing instrument flying goggles.

2.5 The FTO was confident that his action in advising the Bay Sector Radar Controller that the aircraft was turning back at 800 feet was all that was necessary as he had advised the Controller they were simulated and had the terrain in sight, and he believed there was no conflicting traffic.

2.6 Although the aircraft was on an IFR flight plan and still under radar control the FTO considered the Controller should have understood, from his advice that he had the terrain in sight, that he was effecting his own terrain separation. This is not in accordance with the information in the AIP-PM nor was it the Controller's understanding but the FTO's intention was to spare the controller any concern about the proximity of this aircraft to the terrain.

2.7 The FTO asked the Controller after he reported that the aircraft was turning back, "....have you got another departure?" He was reassured because he believed the Bay Sector Controller had confirmed there was "no traffic". Nevertheless had he heard the Controller's response, "Affirm - it's OK you are identified now six to the south.", this would have been similarly reassuring.

2.8 The Controller's reassuring "It's OK you are identified now, six to the south." was based on a failure to comprehend the significance of the pilot's advice 12 seconds earlier, that he was turning back to the beacon but was only passing 800 feet instead of the normal 3000 feet altitude. Both the Airtrainer and the Metroliner were off the Bay Sector Controller's radar screen prior to that time, the Metroliner because it had descended out of coverage and the Airtrainer because it was still climbing into coverage after take-off. Although the Metroliners return was in the approximate position which the Controller expected, its change of direction was not immediately apparent due to the interval between each radar return.

2.9 While the Controller was entitled to keep ZK-PBA on the radar frequency, when the Tower Controller agreed to this, the loss of radar coverage of the Metroliner during the final section of its approach and the delay in identifying the departing Airtrainer until it climbed into radar coverage after take-off made this decision a factor in the incident. Keeping ZK-PBA on the radar frequency would not have been a factor however if the Metroliner had not turned back toward the VOR unexpectedly.

2.10 The Controller had responded to the pilot's advice of the premature turnback with "Roger" which means, "I have received all of your transmission". In the absence of any query it implies, "I have heard and understood your transmission."

2.11 The controller was responding to a transmission which contained three separate pieces of information, the aircraft's altitude, which had been requested, advice that the pilot had the terrain in sight which was relevant to the aircraft's height and position and that the aircraft had turned back towards "the beacon". Each was important to the controller and the aircraft's safety. Although the controller was not expecting the latter two items the pilot had no way of knowing his message had not been understood. The onus was on the controller to challenge the information without delay if not aware of the meaning of the message. If the pilot's message was confirmed as having been received but not challenged he could not be aware it had not been understood.

2.12 In using the T2 separation to release the aircraft the Bay Planner relied on his general knowledge that an Airtrainer was slower than a Metroliner instead of confirming the relative airspeeds of the aircraft as required by MATS. This was not a factor in the incident as although the difference in airspeeds was less than required the longitudinal separation when the Airtrainer departed was greater than would have been achieved with two minutes separation of aircraft with a 40 knot difference in IAS.

2.13 Twenty-four seconds after the FTO advised the Bay Sector Controller that the aircraft was turning back the Controller became aware from the radar that ZK-PBA was not tracking as expected and immediately asked for confirmation that the aircraft was tracking south to 3000 feet. This indicated that the Bay Sector Controller did not hear the pilot correctly in the first instance or, despite the acknowledgement, had not heard all that he did say.

2.14 The nature of IFR training and testing is such that an instructor will generate unusual situations and equally that the student may do the unexpected. The Controller was aware that this was a "training" flight and while the aircraft was flying between Auckland and Hamilton the FTO had given the Controller all the advice of his intentions that the Controller expected.

2.15 The aircraft was on an IFR flight plan and thus it was incumbent upon the pilot-in-command to ensure the aircraft was operated in accordance with the rules for instrument flight. If the pilot-in-command erred it was the responsibility of the FTO to correct any mistakes.

2.16 In this case the FTO made several adjustments to compensate for the training nature of the flight, when responding to instructions from the Controller. In the first case he asked for dispensation from an instruction to commence a missed approach early on the basis of sighting the conflicting traffic. This is an everyday occurrence in such flying.

2.17 Not until the pilot under test made an error in his conduct of the flight did the FTO start to presume on the latitude available to him for his test. His assumptions that the Controller would understand that he would provide his own terrain clearance from the comment that he had the terrain in sight, and would provide separation in response to his advice that the aircraft was inbound at 800 feet were not well founded.

2.18 The most serious assumption on the FTO's part was that the Bay Sector Controller would make provision for him to discontinue a standard missed approach procedure, due to approaching high terrain and the aircraft's simulated inability to climb. This assumption was made on the basis of a statement that the aircraft was turning back to the "beacon", some 2200 feet below the normal height.

2.19 The FTO's assumption that the Controller would make provision for his "turnback" was based on his belief that the Controller would recognise the implication of his advice that the aircraft was "simulated" in conjunction with the information in the AIP-PM relating to IFR departure procedures. In particular he was relying on the statement:

> Where adequate terrain clearance in IMC under ambient conditions cannot be ensured it must be determined before departure that, in the event of engine failure prior to reaching Minimum Safe Altitude, or the level acceleration altitude, adequate action can be taken to protect the aircraft. It is expected that this action will normally involve a return towards the departure aid until either Minimum Safe Altitude is reached or approval is granted for a re-join for approach and landing; in this respect the pilot-in-command must take into consideration the terrain over which the reversal turn may have to be completed.

This belief was reinforced by the Controller's response of "Roger" to his advice that the aircraft was turning back to "the beacon: at 800 feet.

2.20 Although the conditions prevailing on the missed approach were similar to an IFR departure from Hamilton a missed approach is not an IFR departure. Nevertheless had the FTO communicated his intentions to the Controller more clearly it is likely that the incident would not have occurred. "Aviate, navigate and communicate" is a lore of aviation but it was not surprising that the bald advice that the aircraft was turning, rather than early advice of an intention to turn and the reason for the departure from the standard missed approach procedure, caught the Controller unawares.

2.21 The Controller was appropriately trained, experienced, and under no undue stress. In the Controller's estimation the workload was "average". The Controller had always understood the term, "simulated" to mean no more than an engine failure had been simulated and as a consequence the aircraft would have a loss of climb performance. The Controller had no knowledge of any airline's special procedures which would be invoked by pilots if an aircraft suffered a loss of performance at a time which prevented it from maintaining the expected climb gradient.

2.22 Ingrained in the Controller's training was an ability to make rapid adjustments to facilitate the requirements of any pilot who declared an in-flight emergency. Unless an emergency was declared the Controller considered that a Controller was entitled to expect an aircraft to comply with normal procedures even if one or more of its engines lost power.

2.23 Against this background the Controller did not comprehend the FTO's advice that the aircraft was turning back from a missed approach at the same time as the Airtrainer was departing from Hamilton. This led the Controller to acknowledge his transmission with, "Roger" indicating the Controller had heard and understood what he had said and further reassure the pilot about the departing aircraft by advising him, ". . . it's OK you are identified now six to the south."

2.24 The radar recordings indicated that the aircraft were about six nautical miles apart when the Controller recognised the potential for a loss of separation and instructed the Metroliner to cancel its simulation and climb immediately on two engines to 4000 feet. The Controller's decisive action did not take place in time to reduce the risk of collision between the aircraft as vertical separation was not achieved, but visual separation was achieved by the pilots as the aircraft passed.

2.25 The difficulties involved in the courses of action with the potential to avoid incidents of this type, which were discussed with the Airways Corporation, established that the flexibility formerly available to FTOs and IFR instructors for IFR approach training cannot now be provided. Each course of action had a difficulty and the solution with the best potential to avoid such incidents would still require comprehensive discussion and amendment to existing IFR to put into practice.

2.26 Until a procedure can be developed and approved, test and training flights under IFR are required to comply with the clearances issued unless an emergency arises. An IFR exercise can be continued, if the aircraft emergency being simulated makes it impracticable to conform to a clearance, providing an alternate clearance is requested and approved before the aircraft departs from its existing clearance. FTOs and other flying instructors have to accept any resultant reduction in the value of the flight because all flights under IFR must be provided with the appropriate separation irrespective of their purpose.

3. Findings

Findings and any safety recommendations are listed in order of development and not in order of priority.

3.1 The Controller and the FTO were properly qualified and fit for duty.

3.2 The Metroliner aircraft was not being flown in accordance with the air traffic control clearance issued.

3.3 The crew of the Metroliner did not advise the Controller of their intention to depart from the standard missed approach procedure with sufficient clarity.

3.4 Either the Metroliner FTO or pilot-in-command should have requested an alternative clearance when the circumstances of their flight made it desirable for the aircraft to depart from the standard missed approach procedure.

3.5 Confusion existed over the meaning of the word, "Simulated" between the FTO and the Bay Sector Controller.

3.6 The FTO's understanding of the guidance in the AIP-PM, in relation to the action expected in the event of a loss of aircraft performance on a missed approach, was incorrect.

3.7 Had the pilot-in-command of the Metroliner complied with the missed approach clearance there would have been no risk of a collision.

3.8 Had the pilot-in-command of the Metroliner complied with the missed approach clearance the Controller's decision to keep the aircraft on the radar frequency throughout the missed approach would not have been a contributing factor.

3.9 There would be significant benefit from a discussion between domestic aircraft operators and the Airways Corporation and any future providers of air traffic control services, on the nature of the procedures which operators plan in the event of a critical loss of aircraft performance preventing them from complying with an ATC clearance.

3.10 The Bay Sector Controller's acknowledgement of an out of the ordinary message which the Controller had not understood, with "Roger" is a matter for concern.

3.11 The ATS Planner's calculation of the procedural separation, while based on an incorrect estimate of aircraft speeds, did not contribute to the incident.

4. Safety Recommendations

4.1 It was recommended to the Chief Executive of the Airways Corporation of New Zealand that he:

4.1.1 Ensure controllers are aware of the nature of the actions which operators intend their pilots to take in the event of a loss of aircraft performance at a stage which prevents one of their aircraft complying with an IFR departure clearance, (088/97); and

consider making provision for controllers to experience, in a flight simulator or other training environment, the practicalities of pilots keeping controllers informed while dealing with an in-flight emergency, (090/97); and

Remind controllers of the potential for a serious situation to be overlooked if they answer a transmission which may state information critical to the safety of flight, with "Roger" when they have not understood the contents of that message. (091/97)

4.2 The Airways Corporation of New Zealand responded as follows:

4.2.1 088/97
We believe that the Civil Aviation Act and the rules derived from it make it adequately clear that in any emergency situation the pilot is permitted to act in any way necessary to preserve the safety of the aircraft and its occupants. Controllers are already adequately trained to deal with such emergencies on the basis that anything might happen and to control other aircraft, not necessarily to achieve normal separation, but, in such a way as to provide as much separation as practical and, to the extent possible, give the emergency aircraft a wide berth and as much assistance as possible. We expect that pilots understand this principle well enough and that a controller will be better able to assist if the pilot gives as much information as possible. If it is considered that this is not understood we believe that it is appropriate for the CAA to deliver this message to pilots through the normal channels available to them.

In situations where an emergency does not exist a pilot is required to comply with the ATC clearance or specifically request another one which is able to be complied with. Pilots must not assume that statements related to the operating status of the aircraft or expressions of intent on their part constitute authority to depart from the terms of a clearance in non emergency situations. This is particularly important when expressions (such as "simulated") are used which are not accepted standards of communications for ATS purposes. Again CAA is the appropriate organisation to relay this warning to pilots in general.

4.2.2 090/97
Pilots should understand that in an emergency when they depart from the terms of a clearance they take personal responsibility for the safety of their aircraft. Controllers can and will assist to the extent that they are informed but do not need to understand the practicalities of the extent to which this is possible because the pilot in effect has taken over from the responsibilities of the controller. Once again CAA should be the organisation responsible for delivering this message to pilots.

4.3 It was recommended to the Director of the Civil Aviation Authority that he:

4.3.1 Review the terminology and practices in use for IFR flight tests and training. (089/97)

18 February 1998

Hon. W P Jeffries
Chief Commissioner

Glossary of aviation abbreviations

AD	Airworthiness Directive
ADF	automatic direction-finding equipment
agl	above ground level
AI	attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
amsl	above mean sea level
AOD	aft of datum
ASI	airspeed indicator
ATA	actual time of arrival
ATC	Air Traffic Control
ATD	actual time of departure
ATPL (A *or* H)	Airline Transport Pilot Licence (Aeroplane *or* Helicopter)
AUW	all-up weight
^{o}C	degrees Celsius
CAA	Civil Aviation Authority
CDI	course deviation indicator
CFI	Chief Flying Instructor
C of A	Certificate of Airworthiness
C of G (*or* CG)	centre of gravity
CPL (A *or* H)	Commercial Pilot Licence (Aeroplane *or* Helicopter)
DME	distance measuring equipment
E	east
ELT	emergency location transmitter
ETA	estimated time of arrival
ETD	estimated time of departure
^{o}F	degrees Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	flight level
g	acceleration due to gravity
GPS	Global positioning system
HF	high frequency (3000 to 30 000 kHz)
hPa	hectoPascal
HSI	horizontal situation indicator
IAS	indicated airspeed
IFR	Instrument Flight Rules
IGE	in ground effect
ILS	instrument landing system
IMC	instrument meteorological conditions
kg	kilogram(s)
kHz	kilohertz
KIAS	knots indicated airspeed
km	kilometre(s)

LAME	Licensed Aircraft Maintenance Engineer
LF	low frequency
LLZ	localiser
Ltd	Limited
m	metre(s)
M	Mach number (e.g. M1.2)
°M	degrees Magnetic
MAP	manifold absolute pressure (measured in inches of mercury)
MAUW	maximum all-up weight
METAR	aviation routine weather report (in aeronautical meteorological code)
MF	medium frequency (300 to 3000 kHz)
MHz	megahertz
mm	millimetre(s)
N	north
NDB	non-directional radio beacon
nm	nautical mile
NOTAM	A notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.
NTSB	National Transportation Safety Board (United States)
NZDT	New Zealand Daylight Time (UTC + 13 hours)
NZGA	New Zealand Gliding Association
NZMS	New Zealand Mapping Service map series number
NZST	New Zealand Standard Time (UTC + 12 hours)
OGE	out of ground effect
okta	eighth of sky cloud cover (e.g. 4 oktas = 4/8 of cloud cover)
PAR	precision approach radar
PIC	pilot-in-command
PPL (A *or* H)	Private Pilot Licence (Aeroplane *or* Helicopter)
psi	pounds per square inch
QFE	an altimeter subscale setting to obtain height above an aerodrome
QNH	an altimeter subscale setting to obtain elevation above mean sea level
RCC	Rescue co-ordination centre
RNZAC	Royal New Zealand Aero Club
RNZAF	Royal New Zealand Air Force
rpm	revolutions per minute
RTF	radio telephone or radio telephony
S	south
SAR	Search and Rescue
SSR	secondary surveillance radar
°T	degrees true
TACAN	Tactical air navigation aid
TAF	aerodrome forecast
TAS	true airspeed

UHF	ultra high frequency
UTC	Coordinated Universal Time
VASIS	visual approach slope indicator system
VFG	Visual Flight Guide
VFR	visual flight rules
VHF	very high frequency
VMC	visual meteorological conditions
VOR	VHF omnidirectional radio range
VORTAC	VOR and TACAN combined
VTC	Visual Terminal Chart
W	west