AIRCRAFT ACCIDENT REPORT

No. 89-053

Beechcraft 95-A55 Baron

ZK-SUN

10 nm north of Napier Aerodrome
Hawkes Bay Province

16 May 1989

Transport Accident Investigation Commission
Wellington - New Zealand

Price $35.00 (including G.S.T.)

ISSN 0112-6962

AIRCRAFT:	Beechcraft 95-A55 Baron	**OPERATOR:**	Mr J.R. McKinney
REGISTRATION:	ZK-SUN	**PILOT:**	Mr J.R. McKinney
PLACE OF ACCIDENT:	10 nm north of Napier Aerodrome Hawkes Bay Province	**OTHER CREW:**	Nil
DATE AND TIME:	16 May 1989; 1858 NZST	**PASSENGERS:**	Two

SYNOPSIS:

The Office of Air Accidents Investigation was advised of the accident at 2100 hours on 16 May 1989 and the on-site investigation was commenced the next day. The aircraft was flying from Hamilton to Napier at night in instrument meteorological conditions, and had commenced an instrument approach procedure for Napier. The aircraft collided with a hill. The pilot and two passengers received fatal injuries in the accident.

1.1 HISTORY OF THE FLIGHT:
See page 5.

1.2 INJURIES TO PERSONS:
Pilot: One Fatal
Pax: Two Fatal

1.3 DAMAGE TO AIRCRAFT:
The aircraft was destroyed by the impact.

1.4 OTHER DAMAGE
A short length of fencing was destroyed by the impact.

1.5 PERSONNEL INFORMATION:
See page 12.

Flight Times

	Last 90 days	Total
All Types	190.45	1338.60
On Type	0.75	0.75

1.6 AIRCRAFT INFORMATION:
See page 14.

1.7 METEOROLOGICAL INFORMATION:
See page 15.

1.8 AIDS TO NAVIGATION:
See page 16.

1.9 COMMUNICATIONS:
See page 18.

1.10 AERODROME INFORMATION:
See page 18.

1.11 FLIGHT RECORDERS:
Not applicable.

1.12 WRECKAGE AND IMPACT INFORMATION:
See page 19.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION:
No evidence of any condition that might have affected the pilot's ability to conduct the flight was discovered. See page 21.

1.14 FIRE:
Fire did not occur.

1.15 SURVIVAL ASPECTS:
The impact forces were beyond human tolerance.

1.16 TESTS AND RESEARCH:
See page 21.

1.17 ADDITIONAL INFORMATION:
See page4 22.

1.18 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES.
Nil.

2. ANALYSIS:
See page 30.

3. FINDINGS:
See page 43.

4. OBSERVATIONS
See page 44.

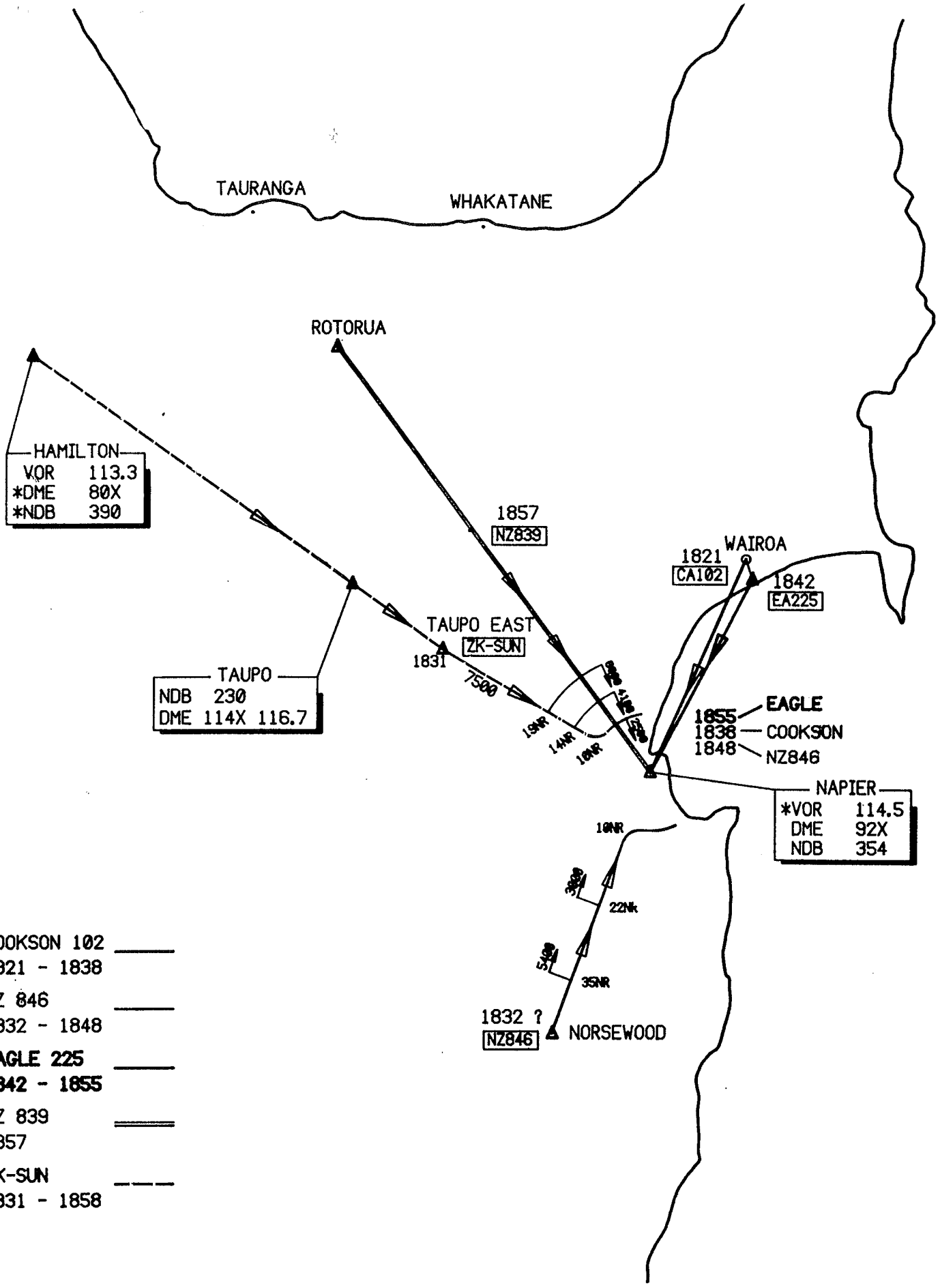
5. SAFETY RECOMMENDATIONS:
See Page 45.

6. GLOSSARY
See Page 49.

7. APPENDICES
A. Transcript of ATC Tape

* All times in this report are NZST (UTC + 12 hours)

LIST OF DIAGRAMS



AIRCRAFT ARRIVING AT NAPIER (1820 - 1900)

DIAGRAM 1

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 On the morning of the accident the pilot, who was a junior instructor employed by the Waikato Aero Club, arranged the hire of ZK-SUN, a Beech Baron, from the owners, a firm whose business included the hire of aircraft to other persons or organisations. The pilot, who had not flown an aircraft of this type before, flew a 45 minute dual sortie with the Chief Flying Instructor of the club during which sortie type conversion exercises were performed. Subsequently the pilot advised the owners of the aircraft that he would be "going on a private flight" from Hamilton to Napier and return.

1.1.2 The pilot was loading two passengers into ZK-SUN in the evening when the Chief Flying Instructor returned from a training sortie. The pilot sought the Chief Flying Instructor's advice as to how he should slow the aircraft down on approaching Napier, because he had had difficulty in slowing the aircraft down when rejoining the circuit at Hamilton that morning. The Chief Flying Instructor advised him that he should "reduce his speed as soon as he commenced the approach".

1.1.3 When filing the IFR flight plan with Hamilton Air Traffic Service, the pilot nominated Taupo as his alternate aerodrome. The aircraft departed Hamilton at 1803 hours.

1.1.4 At 1831:03 the pilot of ZK-SUN advised Napier Approach that he was at the Taupo East Reporting Point, which was 39 nm north-west of Napier, at 8000 feet. (See Diagram 1). His estimated time of arrival at Napier was 1845 hours. In response, the controller advised the pilot to anticipate the VOR/DME Approach Runway 16, via the Arc and cleared him to descend via DME Steps to 4000 feet. The minimum safe altitude was 7500 feet until 19 nm from Napier. At 19 nm from Napier the aircraft could descend to 6000 feet, at 14 nm to 4100 feet and 10 nm from Napier to 4000 feet.

1.1.5 Immediately after this exchange, at 1832 hours, an Air New Zealand F27 Friendship aircraft, callsign NZ 846, reported that it had passed the Norsewood Reporting Point, 45 nautical miles south-west of Napier, at 1835 hours, was descending to 10 000 feet and estimating Napier at 1849 hours. The controller cleared the F27 to continue its descent to 7000 feet. At 1834:39 ZK-SUN was cleared to continue its descent to 3000 feet.

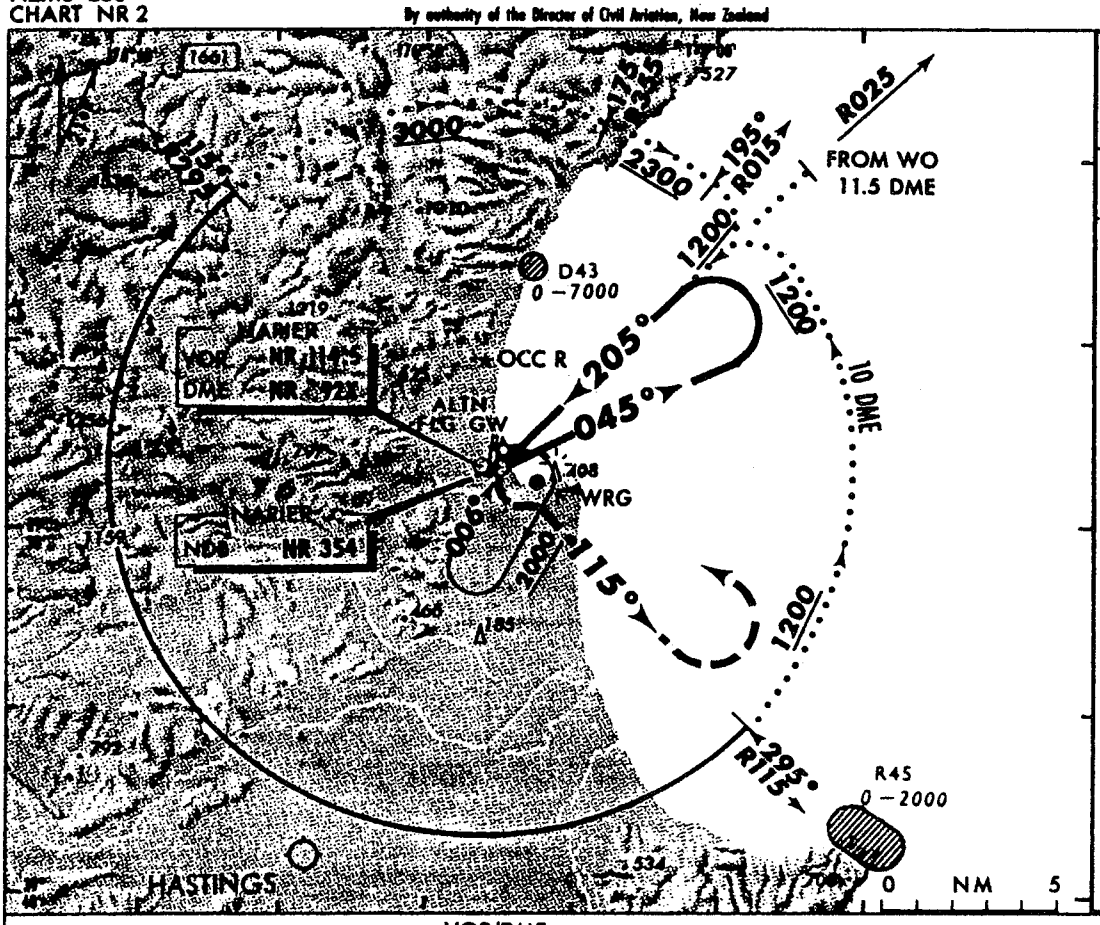
1.1.6 At 1834:53 NZ 846 reported its DME range from Napier as 27 nm and at 1835:04, in response to the controller's request, ZK-SUN reported at 28 nm and at 8000 feet. The controller then told the F27 that it would approach after ZK-SUN and could expect to overfly Napier and use the VOR Alfa procedure to land on runway 16. (See Diagram 2). (A transcript of radio telephone communications with Napier Tower is at Annex A).

1.1.7 At 1837:04 NZ 846 reported at 18 nm DME and 7000 feet while at 1837:15 ZK-SUN was at 22 nm and still at 8000 feet. The controller cancelled ZK-SUN's previous descent clearance. She cleared NZ 846 to 3000 feet and advised the F27 to expect the VOR Runway 34 approach via the 10 nm DME Arc. (See Diagram 3). This meant ZK-SUN would be required to land after NZ 846 and the pilot was cleared subsequently by a "stepped descent", two thousand feet at a time, to maintain one thousand feet vertical separation above the F27.

Diagrams 2, 3, 4 APPROACHES TO NAPIER

VOR OR NDB-ALFA NAPIER

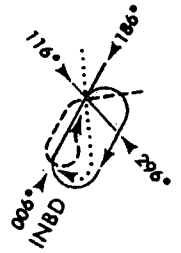
NZMS 255
CHART NR 2



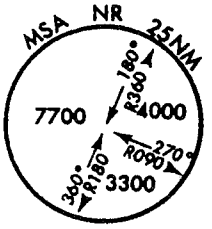
APPROACH AND AERODROME CONTROL
NAPIER TOWER
124.8 118.1

WHEN UNATTENDED
118.1

HOLDING NR 354

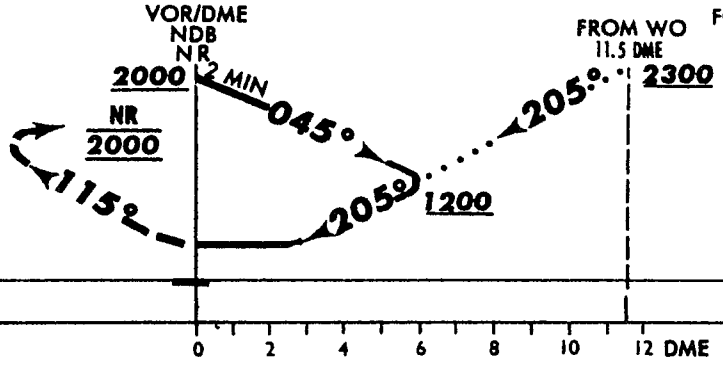


HOLDING SPEED
170 KT IAS MAX



USE QNH

FOR INTERPRETATION SEE SYMBOLS



ELEV 6ft
RWY 16 THR ELEV 6ft

DME DIST	MAPt NDB	3	4	5	6							
ALTITUDE	MDA	MDA	800	1000	1200							

CATEGORY	A	B	C	D
CIRCLING RESTRICTED *	**660**(654)-1900	**710**(704)-2800	**860**(854)-3700	NA
CIRCLING UNRESTRICTED	**660**(654)-1900	**1020**(1014)-2800	**1470**(1464)-3700	NA

* Circling NA west of RWY 16/34

CHANGES: editorial

IFG
~~7 APR 88~~
29 Jul 89

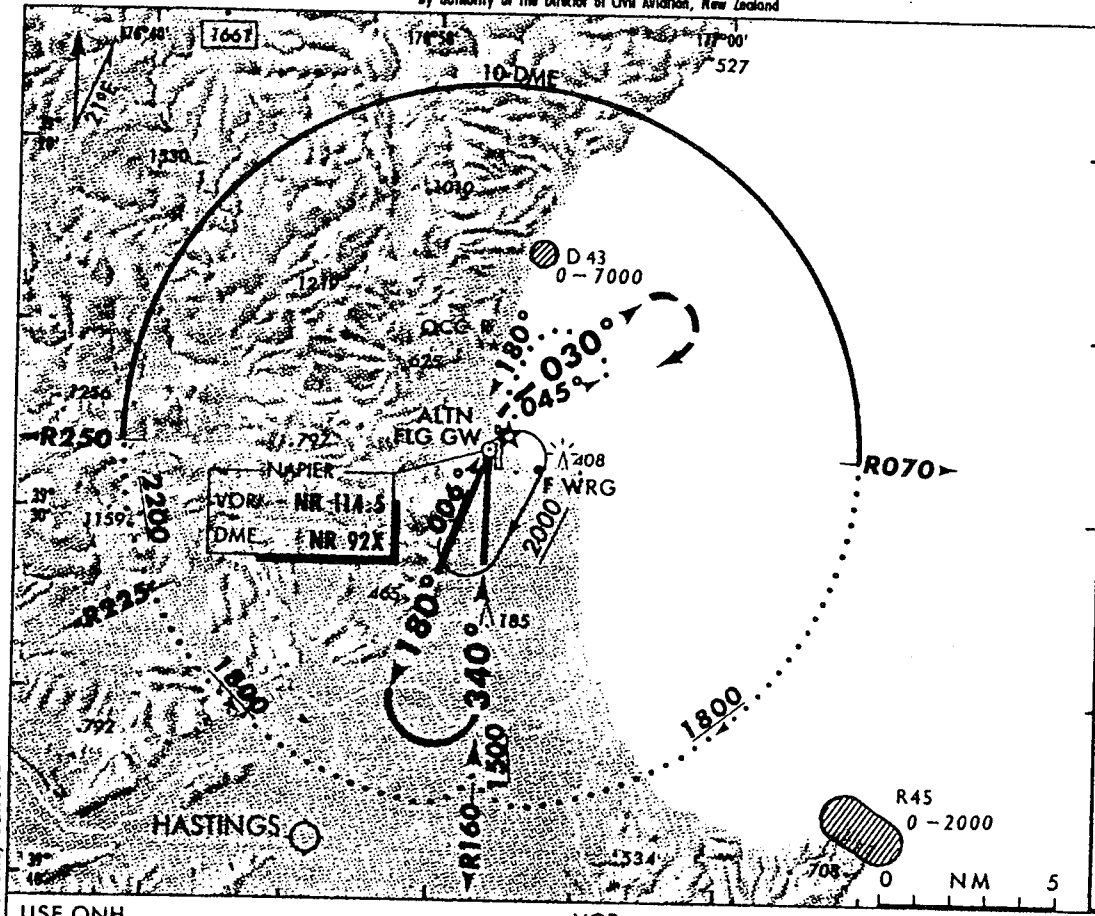
Diagram 2

VOR OR NDB-ALFA NAPIER

NZMS 255
CHART NR 4

By authority of the Director of Civil Aviation, New Zealand

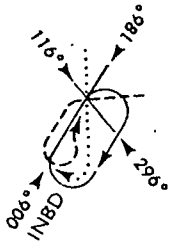
VOR RWY 34
NAPIER



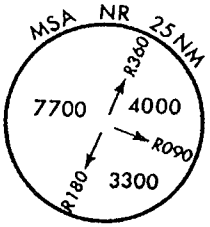
APPROACH AND AERODROME CONTROL
NAPIER TOWER
124.8 118.1

WHEN UNATTENDED
118.1

HOLDING NR 114.5

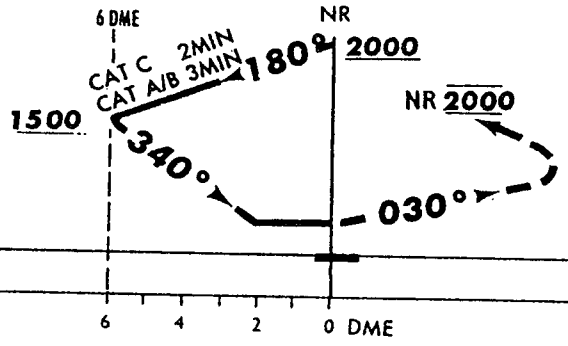


HOLDING SPEED
170 KT IAS MAX



USE QNH

FOR INTERPRETATION SEE SYMBOLS



ELEV 6ft
RWY 34 THR ELEV 5ft

DME DIST	6	5	4	3	2.2	MAPt VOR						
ALTITUDE	1500	1250	1000	750	MDA	MDA						

CATEGORY	A	B	C	D
S-VOR	**550**(544)-1600		**550**(544)-2800	NA
CIRCLING RESTRICTED *	**660**(654)-1900	**710**(704)-2800	**860**(854)-3700	NA
CIRCLING UNRESTRICTED	**660**(654)-1900	**1020**(1014)-2800	**1470**(1464)-3700	NA

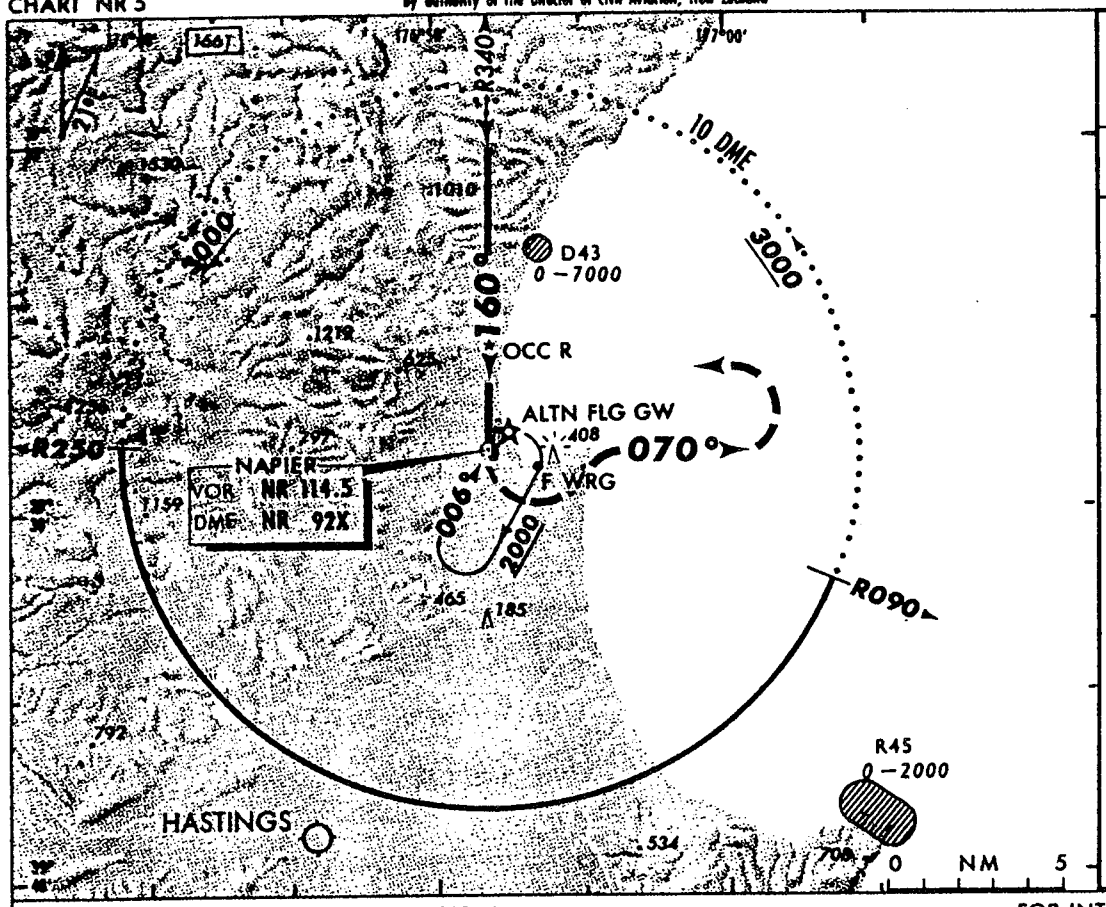
* Circling NA west of RWY 34/16

CHANGES: Circling minima, visibility minima, holding speed, missed approach instructions, editorial

VOR/DME RWY 16
NAPIER

NZMS 255
CHART NR 5

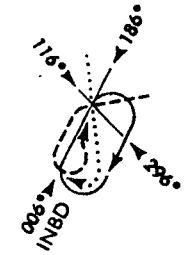
By authority of the Director of Civil Aviation, New Zealand



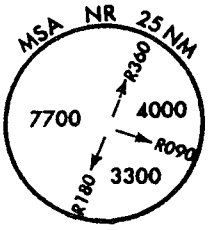
APPROACH AND AERODROME CONTROL
NAPIER TOWER
124.8 118.1

WHEN UNATTENDED
118.1

HOLDING NR 114.5

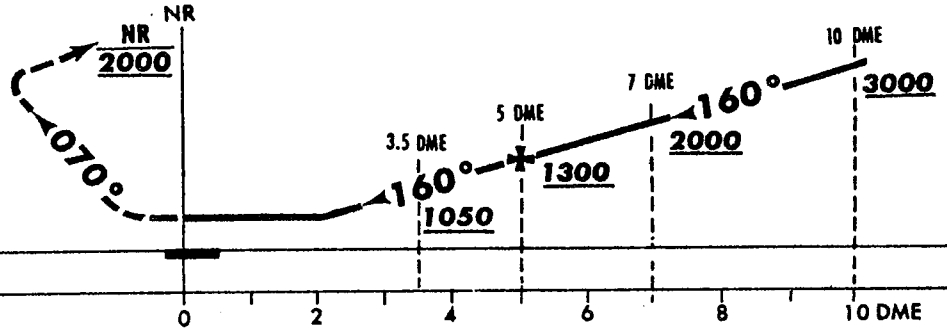


HOLDING SPEED
170 KT IAS MAX



USE QNH

FOR INTERPRETATION SEE SYMBOLS



ELEV 6ft
RWY 16 THR ELEV 6ft

DME DIST	MAPt VOR	1.8	2	3	4	5	6	7	8	9	10	
ALTITUDE	MDA	MDA	600	900	1200	1500	1800	2100	2400	2700	3000	

CATEGORY	A	B	C	D
S-VOR/DME	**550**(544)-1600		**550**(544)-2800	NA
CIRCLING RESTRICTED*	**660**(654)-1900	**710**(704)-2800	**860**(854)-3700	NA
CIRCLING UNRESTRICTED	**660**(654)-1900	**1020**(1014)-2800	**1470**(1464)-3700	NA

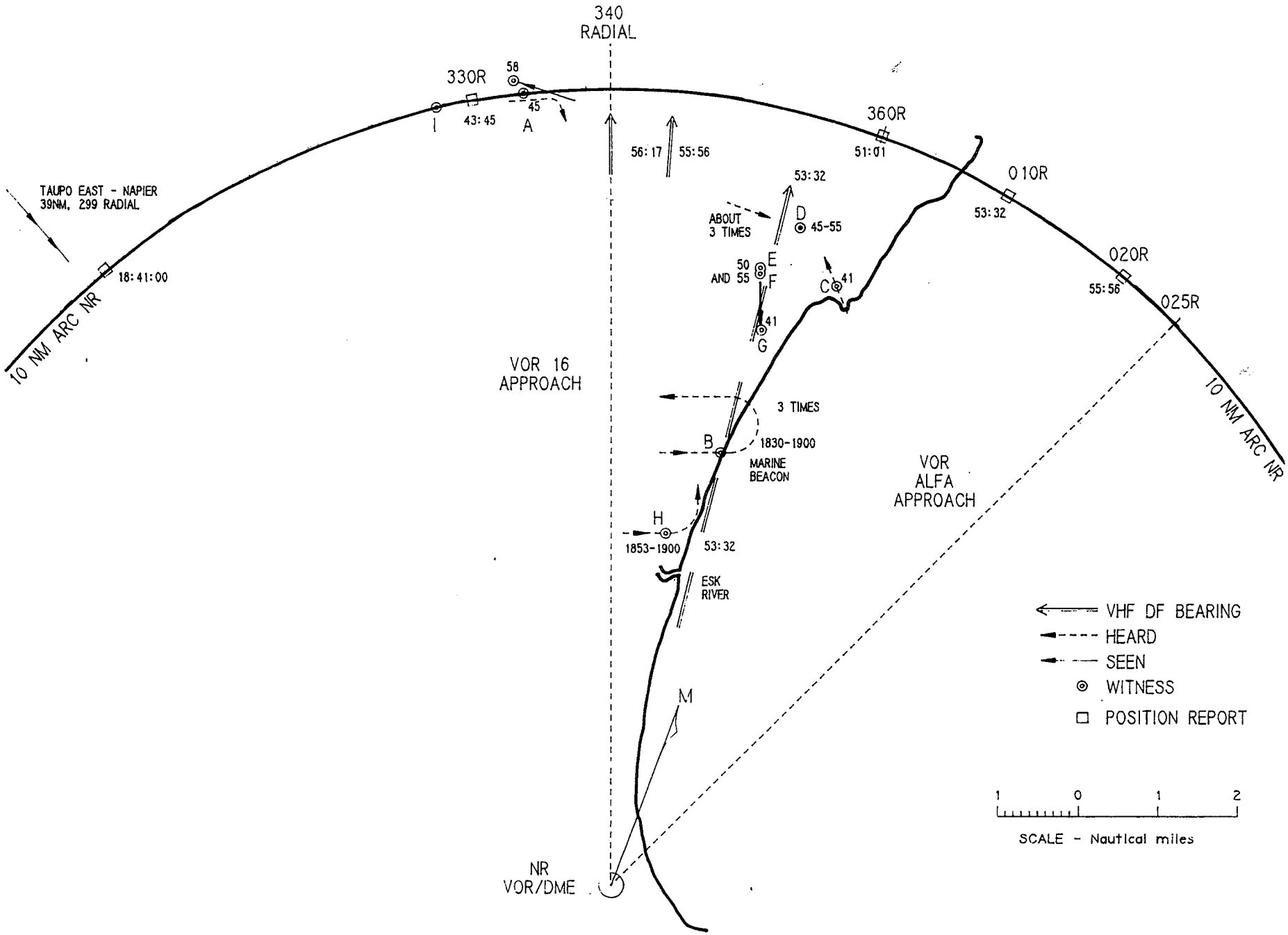
* Circling NA west of RWY 16/34

CHANGES: editorial

IFG
~~7 APR 88~~ 29 JUL 1988

Diagram 4

VOR/DME RWY 16
NAPIER



WITNESS LOCATIONS

DIAGRAM 5

1.1.8 At 1839:21 NZ 846 reported that it was at 10 nm from Napier and the controller cleared it to fly round the DME arc to make the VOR Approach to runway 34, followed by a circling approach (when visual) to runway 16. At 1839:42 ZK-SUN reported at 16 nm and was in turn cleared to fly the Approach for runway 16 via the Arc, with descent restricted initially to 5000 feet. (See Diagram 4)

1.1.9 NZ 846 advised, at 1841:05, that it was descending through 2000 feet and was about to turn onto the final approach track for runway 34. The controller cleared ZK-SUN down to 3000 feet and the pilot acknowledged this, stating that he was joining the DME arc. The time was then 1841:27. At 1842.18 the controller asked ZK-SUN for a report on passing the 330 radial (ie. on a magnetic bearing of 330° from the VOR). Eight seconds later the aircraft's altitude was reported at 5000 feet.

1.1.10 At 1843:31 NZ 846 reported, "7 nm, at 1500 feet" and at 1843:57 ZK-SUN advised passing the 330° radial. The controller noticed that this bearing agreed with that displayed on her VDF. She instructed the pilot to "continue on round the arc to turn inbound for the VOR Alfa Circling One Six Approach not below 3000" to which the pilot responded "Continuing around the arc to ah — for the One Six Alfa Ap..... not below 3000". The controller did not query the discrepancy in the title of the approach used in the read-back. ZK-SUN was then down to 4000 feet.

1.1.11 NZ 846 reported visual contact at 1844:40 and was cleared to make a circling approach to runway 16; it landed at about 1848 hours.

1.1.12 ZK-SUN called "Approaching *2000" at 1846:15 (using the incorrect call sign Uniform Foxtrot Sierra — this was the callsign of a light training aircraft owned by the Waikato Aero Club); the controller re-cleared the aircraft to "2000 feet on the approach". A minute later at 1847:16 the controller asked the pilot "confirm you are inbound now" to which the pilot replied "Still on the arc . . . at two five hundred". At 1848:15 the controller cleared ZK-SUN "unrestricted on the approach".

*Note: The tape recording of this report was indistinct and the altitude may have been reported as either "2000" or "3000" (feet).

1.1.13 For the next two minutes the controller was involved with other traffic, but she requested a check radial at 1850:56 whereupon the pilot reported, without any delay, that he was passing through the 360 radial. The controller instructed an arriving Eagle Airways aircraft, callsign Eagle 225, to make one "lap" of the Napier holding pattern due to ". . . traffic taking a bit longer than expected on the arc . . .". ZK-SUN reported descending through 2000 feet at 1851:46; in response to a request from the controller the pilot reported at 1853:32 (again without any delay) that he was crossing the 010° radial. The controller observed a VDF bearing of 354° but made no comment. At 1855:56 the pilot reported "on the three two — ah — zero two zero, turning inbound soon".

1.1.14 The controller had observed further bearings from ZK-SUN on her VDF. These had changed from 354° to 344° at 1855:56. The controller advised the pilot that his bearing (on the VDF) was 344° to which he responded "That's affirmative, sorry, 344/345° (at 1856:17). The controller then told the pilot "Previous bearings were giving about 354° you are now showing 340°. Just

confirm your radial passing please". The pilot did not respond in the four second break before she instructed the Eagle aircraft, which had been held over the beacon, to make another orbit in the holding pattern.

1.1.15 An Air New Zealand aircraft, callsign NZ 839, then called Napier with a joining message, at a range of 50 nm. The ensuing RTF exchanges lasted from 1856:53 to 1858:06 with one gap of 22 seconds. The controller than attempted to call ZK-SUN, six times, but there was no response. An attempt was made to relay via the aircraft in the holding pattern, but without success.

1.1.16 The controller called the Chief Controller at 1901:50, saying "... an aircraft supposedly on the DME arc and he's going one way and then the other and now he's not talking to me at all". The Chief Controller arrived soon after, but because he was not rated for approach control duties, he was unable to take over the handling of the IFR traffic. However, he relieved the controller of extraneous duties such as answering the telephone.

1.1.17 The Police at Napier informed the controller at 1908 hours that an aircraft had "crashed" in the Esk Valley, to the north-west of Napier.

1.1.18 A witness ("A" on Diagram 5), who lived below the point on the 10 mile arc at which aircraft turned onto the final approach for Napier, heard an aircraft overflying. He thought the aircraft was heading towards the airport and was lower than normal. The time was later estimated as between 1843 and 1848 hours.

1.1.19 Witness "B" lived near the coast near a marine light (white/green/red flashing) about 10 km ($5^1/_2$ nm) north of Napier. At some time between 1830 and 1900 hours he heard an aircraft which seemed to approach initially from the west, overfly, and return twice more before departing. The aircraft sounded "really low". As it came over the house it sounded quieter, then the sound increased again as it turned. It was "virtually dark" at the time and drizzling.

1.1.20 Witnesses "C", "D", "E", "F" and "G" lived within a 1 nm radius, at the positions shown. The neighbourhood of witnesses "E" and "F" was illuminated by house and exterior lights.

1.1.21 Witness "C" was familiar with the Beech "Baron" aircraft as he was a commercial pilot and qualified on type. Between 1845 and 1850 hours he heard the aircraft come from the south and pass directly over his house. He went outside and it sounded as though it was heading north-west then turned toward the west. It sounded low; the witness estimated the height as 1200 feet. He was concerned by this because of the aircraft's heading. The engines sounded as though they were operating between cruise and climb power. He estimated the cloudbase as below 300 feet in the vicinity and the visibility as less than 500 m; there was light rain.

1.1.22 Witness "D" heard the aircraft pass overhead two or three times, at some time between 1845 and 1855 hours. Where he was, the visibility was over 1 nm and it was not raining at the time.

1.1.23 Witness "E" heard the aircraft at about 1900 hours. She thought the aircraft circled, went away, came back, circled again and went away.

1.1.24 Witness "F" heard the aircraft at 1850 hours by her clock. About five minutes later she heard it again. She went outside this time and could not

see it but it seemed to have come from the west and gone to the north. It was audible for about 2 minutes on each occasion and did not seem to turn in the vicinity of the house.

1.1.25 Witness "G" heard the aircraft flying quite low and apparently from the direction of Napier. She went outside and saw the navigation lights indicating that the aircraft was flying towards her, in the direction of Napier. It was in the vicinity for one to two minutes.

1.1.26 Witness "H", who lived near the Esk River, heard an unfamiliar aircraft in the area between 1853 and 1900 hours. It seemed to approach from the west and fly away to the north-west: it disappeared very quickly.

1.1.27 At about 1900 hours witness "I", who was listening to a radio receiver which was tuned to the Napier Tower frequency, stated that he heard a pilot report that he was at 2600 feet and going around again to get established on the arc. In his opinion, the pilot "didn't sound very happy". The witness went to a window and looked outside; he heard the aircraft but could not see it. It sounded to him as though it was flying at reduced power. The witness was unable to receive transmissions from Napier Tower because there was intervening high ground.

1.1.28 At about 1900 hours witness "A" heard the noise from an aircraft which sounded to him to be the same as that which he had heard before, but "very loud". He went outside and saw the aircraft navigation and anti-collision lights. He believed the aircraft was flying level and "alarmingly low". The engines sounded smooth and, when he was outside, not particularly noisy. It was drizzling at the time. He could discern the tops of trees which were a little higher than the house (1300 feet amsl), and fog seemed to be just on the tops of the trees. There was no sign of a landing light.

1.1.29 There was a loud thump, a lot of crunching and then other thumps as a result of which the witness telephoned the Police. Because he was on a party line it took about 2 minutes to place the call, which the Police log showed was received at 1900 hours.

1.1.30 ZK-SUN struck a gently sloping hillside, about 100 feet below the peak, approximately 100 m from the house of witness "A". The momentum carried the wreckage uphill some 200 m beyond the initial impact point and rescuers who arrived on the scene shortly afterwards found the body of the pilot but in the darkness were unable to locate any other occupants. The Police then arrived and cordoned off the area until daybreak. The bodies of the other occupants were then found, some distance beyond the wreckage.

1.1.31 The accident occurred in darkness at approximately 1858 hours NZST. The accident site was on the eastern face of a grassy hillside at 1420 feet amsl, 10 nm north of Napier Aerodrome. Grid Reference 411064 NZMS260 Sheet V20 "Esk". Latitude 39°17'S, longitude 176°50'E.

1.5 Personnel information

1.5.1 The pilot in command James Richard McKinney, age 30, held Commercial Pilot Licence — Aeroplane, number 4781, valid until 21 July 1989. His licence was endorsed "Subject to wearing correcting lenses. Not valid for instruction in multi-engined aeroplanes. Not valid for spinning or

aerobatic instruction". He held an instrument rating and Category "C" instructor rating. His logbook did not contain a Type Rating Certificate endorsed for multi-engine aircraft but did contain an endorsement "Cougar type rating satisfactory" signed by an instructor and dated June 1988.

1.5.2 After a medical examination for the renewal of his licence on 30 June 1988 he was assessed fit, subject to wearing correcting lenses.

1.5.3 The total flight time recorded in his Pilot's Logbook was 1322.55 hours and subsequent flights recorded in timesheets of the Waikato Aero Club brought this total to 1338.6 hours. His total time in multi-engined aircraft was 53.91 hours of which 0.75 hours was on the Beech 95-A55, 4 hours on PA34 and the remainder on GA7 aircraft. His night flying experience was 46.9 hours, all of it on single engined aircraft. His last recorded night flight was on 6 May 1989. The pilot's total instrument flight time recorded was 78.9 hours of which 35.9 hours was actual instrument flight. During most of the actual instrument flight, the pilot had been instructing on single engined aircraft. There was no record of him having received instruction in DME arc procedure.

1.5.4 In the previous 90 days he had recorded 15.8 hours of instrument flight. Almost all of this flight time involved holding patterns and NDB or VOR approaches. One DME arc approach was recorded on 18 January 1989 and one on 31 March 1989. These appeared to have been the only such approaches that the pilot had made. During the previous 90 days he had flown 190.45 hours of which 4.15 hours were on multi-engined aircraft. During the previous seven days he had flown 21.50 hours of which only the 45 minute check flight on ZK-SUN was on a multi-engined aircraft.

1.5.5 On 16 May 1989 he was on the second of two rostered days off, having previously had four rostered days on duty.

1.5.6 The pilot had passed an instrument rating flight test to single-pilot multi-engined standard on 14 September 1988 on a Grumman GA7 Cougar aircraft and this rating was still valid. The flight test report showed that the DME arc procedure was not tested. He had previously been tested on 23 August 1988 but had failed this test because he became disoriented during the turn onto final approach of a VOR procedure and flew in the reciprocal of the correct direction. On that occasion the examiner had generated an increased workload by simulating an engine failure as the aircraft turned towards the final approach heading. The pilot had 16.4 hours multi-engine instrument time but had not flown a multi-enginned aircraft at night before he took off on this flight.

1.5.7 None of the aircraft which the pilot had flown under IFR was equipped with the type of ADF or autopilot fitted to ZK-SUN.

1.5.8 In the pilot's logbook were recorded three previous flights to Napier, all by day:

15 September 1988 in a Piper PA28-181 Archer
31 January 1989 in a GA7
10 February 1989 in a GA7

On none of these flights was an instrument approach recorded. It was the pilot's practice to record each of his instrument approaches and the type of procedure used.

1.5.9 The duty Air Traffic controller at Napier commenced training in 1986 and after gaining experience at Wellington and Palmerston North, was posted to Napier as an Air Traffic Services Cadet in 1988. After on-the-job training she was awarded her Aerodrome and Approach Control Ratings validated for Napier in July 1988 and Gisborne in March 1989. She was also qualified to give on-the-job training to Cadets and to perform proficiency rating assessments and local area validations of other controllers.

1.5.10 She had 12 hours flying experience as a pilot but did not hold a current Pilot Licence. She had flown as a passenger, sitting beside the pilot, in aircraft on single-pilot IFR operations. (Air Traffic Control procedures did not require controllers to have flying experience.)

1.5.11 On 16 May 1989 the controller signed on duty at 1345 hours. The previous day she had been on duty from 1345 to 2000 hours.

1.5.12 The Chief Controller was posted to Napier in 1989. At the time of the accident he was rated for aerodrome control but not for approach control. He was not on duty as a controller on 16 May 1989.

1.6 Aircraft information

1.6.1 Beech 95-A55 "Baron" aeroplane, serial number TC402, was constructed in 1963. It was imported into New Zealand in 1977 and registered as ZK-SUN. It was rebuilt in 1986 after being immersed during the Southland floods of 1984. It had flown 8578 hours since new.

1.6.2 A non-terminating Certificate of Airworthiness was issued on 9 July 1986. Its validity was dependent on annual inspections in accordance with New Zealand Civil Airworthiness Requirement, F1. The aircraft had been maintained in accordance with the operator's maintenance schedule. The most recent avionics check was completed on 17 February 1989. No outstanding defects were logged. Maintenance Release number 316786 was valid for air transport operations. The aircraft had flown fourteen hours since last inspection.

1.6.3 The engine and propeller data were:

Engines — Continental IO-470-L
Left: Serial number CS 90795-2-L
Time Since New 6386 hours
Time Since Overhaul 864 hours

Right: Serial number CS 90992-3-L
Time Since New 3826 hours
Time Since Overhaul 864 hours

Propellers — McCauley 22AF34 CS SN
Left: Serial number 785044
Time Since New 482 hours

Right: Serial number 795058
Time Since New 482 hours

1.6.4 The minimum recommended continuous power setting in flight was 15 inches MP.

1.6.5 The take-off mass of ZK-SUN on the accident flight was estimated to have been about 2170 kg (4784 pounds), with the centre of gravity 2.115 m (83.25 inches) aft of datum. These results were within the permissible limits.

1.6.6 A pilot familiar with both aircraft reported that ZK-SUN was more sensitive in pitch than the GA7. The aircraft would gain or lose 200 feet readily if the height was not closely monitored. It accelerated "very fast" when commencing a descent.

1.6.7 Descent rate at cruising speed, with undercarriage and flap up, would be approximately 800 feet per minute with 15 inches MP. To maintain 125 knots while descending at 600 feet per minute required the undercarriage to be down, and low power (about 21 inches MP). To achieve 1000 feet per minute descent rate on approach would require minimum manifold pressure and undercarriage down. The airspeed would have been about 120 knots.

1.6.8 ZK-SUN was equipped for flight under IFR with one pilot. The navigation equipment installed consisted of two VOR receivers with associated omni bearing selector/ course deviation indicator displays, one ILS receiver, one marker beacon receiver, two Motorola T12B manually tuned ADF receivers and two relative bearing indicators, one DME transmitter/receiver and an EDO Century III autopilot.

1.6.9 The pilot's instrument panel included an artificial horizon and gyro direction indicator. The aircraft was equipped with two 3-pointer altimeters.

1.7 Meteorological information

1.7.1 A small depression near Northland moved eastwards during the afternoon and evening of 16 May 1989 while a weak ridge of high pressure moved slowly north over central New Zealand. A weak frontal zone extending south-east from the depression lay to the north of East Cape. The wind gradient over North Island was weak and the surface winds at Napier were less than 10 knots during the afternoon, chiefly from the south or south-west. The upper winds up to 10 000 feet were estimated to have been light with variable directions. The winds in the vicinity of Napier at 1900 hours NZST on 16 May 1989 were estimated to have been:

1000	280°T/05 knots
3000	120°T/05 knots
5000	140°T/05 knots
7000	260°T/05 knots
10000	220°T/10 knots

1.7.2 The weather in the area was cloudy with patches of rain. The observer at Napier reported adjacent precipitation all afternoon with a cloud base of about 2000 feet and patches of stratus at 500 or 1000 feet. The New Zealand Meteorological Service advised that the ranges to the north-west of Napier were likely to have been obscured by cloud and rain at times.

1.7.3 The actual weather recorded at Napier Aerodrome at 1800 hours was:

Surface Wind:	250°T at 8 knots
Visibility:	15 km
Cloud:	1/8 stratus at 1000 feet
	3/8 stratocumulus at 2500 feet
	7/8 altostratus at 8000 feet
Temperature:	13°C
QNH	1014.6 hPa

1.7.4 The Automatic Terminal Information Service (ATIS) was broadcasting the QNH as 1014 hPa.

1.7.5 A Special Aerodrome Report (SPAR) was issued at 1430 hours and was still in force at the time of the accident:

"Visibility 15 km reducing to 5000 metres in rain. Cloud 1/8 at 1000 feet, 5/8 at 2000 feet, special VFR at times."

A SPAR was issued when the weather deteriorated below specified minima; in this case less than 8000 m visibility. This report would have been provided to the pilot at Hamilton, when he filed his flight plan, if he had requested a meteorological briefing. The controller stated that the weather at Napier did not change significantly while she was on duty.

1.7.6 Pilots flying in the vicinity reported that the cloud base was about 1500 feet and visibility good to the south of Napier, but that close to the aerodrome itself there was heavy rain and limited visibility at about the time of the accident. To the north cloud had banked up against the hills. Witnesses in the vicinity of the accident site reported that it had been drizzling earlier in the evening; estimates of cloudbase and visibility varied. The witness who saw the aircraft's lights go out just before he heard the impact said that the aircraft appeared to be just below the cloud base. In the vicinity of the accident site, the night was reported to be black and there was no moon or stars.

1.7.7 Pilots of aircraft approaching Napier at about the time of the accident reported that conditions were smooth. There was no significant turbulence.

1.7.8 The end of evening civil twilight at Hamilton and Napier on 16 May was at 1744 and 1733 hours respectively.

1.7.9 It was not established that the pilot had received a meteorological briefing prior to this flight.

1.7.10 At Hamilton the weather at 1900 hours was reported to be:

Wind:	Calm
Visibility:	70 km
Cloud:	2/8 stratocumulus base 6000 feet
Temperature:	12°C
QNH:	1013.2 hPa

Conditions had been similar during the day.

1.8 Aids to navigation

1.8.1 The navigation aids at Napier consisted of DME, VOR and a medium frequency NDB. All were functioning normally when checked by a Ministry of Transport Calibration Flight aircraft on the day after the accident. No irregular operation of these aids was reported by aircraft in the vicinity at the time of the accident.

1.8.2 The radio navigation equipment in ZK-SUN, had been fitted subsequent to the purchase of the aircraft and the layout had some unsatisfactory features. For example, the two ADF indicators were remote from their associated receivers and it was not self-evident which indicator was associated with which receiver.

1.8.3 The autopilot was straightforward to use in the heading mode. However a witness familiar with the aircraft said that the autopilot system could be confusing to a pilot who was not familiar with it. Prior to selecting "pitch" or "altitude" (hold) on the autopilot it was necessary not only to trim the aircraft manually in pitch, to reduce the control forces to within the autopilot's limits, but also to preset the autopilot's own pitch trimmer to match. Failure to do this could result in the aircraft pitching up or down, abruptly.

1.8.4 The VOR indicators fitted to the aircraft did not display radials directly. Their principal use was in navigating TO or FROM a VOR along a set track. Most light aircraft equipped with VOR receivers had this type of OBS/CDI indicator fitted.

1.8.5 The track (course or bearing) was set by rotating an outer scale to an index mark with the OBS knob; a "TO/FROM" flag then showed as appropriate and the central CDI needle showed if the aircraft was on track, or whether to turn LEFT or RIGHT to regain track.

1.8.6 In order to display a RADIAL (bearing FROM), the OBS knob was rotated until:

the flag indicated "FROM" and,
the CDI needle became centred.

The RADIAL was then read against the index mark. Typical times for this procedure were between 6 and 12 seconds.

1.8.7 The T12B ADF receivers installed in ZK-SUN required manual tuning to the appropriate NDB, unlike later and more common digital synthesized-frequency types, which only required selection of the NDB frequency on a digital display, then aural identification of the NDB identification signals.

1.8.8 The manual tuning procedure required:

setting the frequency band,

rotating the tuning dial to approximate the frequency required,

fine tuning, either aurally or using the signal meter on the receiver,

(If the NDB was distant, it would be necessary to first select "ANTENNA", perform these steps, then select "ADF")

This tuning process required more time and skill to achieve than the digital tuning types did; typically 30 to 60 seconds was required. During this time a pilot may have wanted to reduce the volume on the communications receiver(s).

1.8.9 The approach plates for Napier (Diagrams 2, 3 and 4) displayed information on terrain, in the form of spot heights. The highest terrain on the chart was indicated by a box around the spot height; in the case of Napier that shown was 1661 feet. The spot heights nearest to the accident site were 1010 and 527 feet, while 1530 feet was indicated some 9 nm to the west. The hill that the aircraft struck rose to 1520 feet, while 2 nm beyond (and still on the chart) was a peak of 1876 feet. A trig point just off the chart was at 2068 feet.

1.8.10 Also depicted on the approach plates was a light, to the east of Napier Aerodrome, shown as "F WRG". This was the fixed directional light,

oriented on 020°, leading into the harbour. It was 23 feet high, although the depiction of the adjacent lighted obstruction symbol at 408 feet (especially on the VOR/DME 16 plate) could have suggested otherwise. There were two towers, 69 feet high, at the north end of the aerodrome, 0.8 nm from the runway, also showing fixed white, red and green directional lights, but these were not depicted on the approach or landing charts.

1.8.11 There was a powerful (17 nm) marine light on Whirinaki Bluffs, 5 nm north of the aerodrome. This light flashed white, red green; it was not shown on the approach plates.

1.8.12 The standard ICAO abbreviations "F" (fixed) and "FLG" (flashing) were defined in the Aeronautical Information Publications Planning Manual at Page GEN 2-4, but six pilots, each with 5000 hours or more flying time, questioned at random interpreted the "F" in "F WRG" to mean flashing rather than fixed.

1.9 Communications

1.9.1 The pilot of ZK-SUN maintained normal radio communications with the appropriate Air Traffic Service ground stations during the flight. These were recorded on magnetic tape. A transcript of these communications is at Annex A.

1.9.2 The radio transmission reported by the witness near the accident site was not recorded on Napier ATS tape. However, the tape would not record aircraft transmissions which were made while the controller was transmitting. It was unlikely that the aircraft's transmissions would have been masked by high terrain.

1.10 Aerodrome information

1.10.1 Napier is a controlled aerodrome. At the time of the accident the single controller was performing both approach and aerodrome control duties. No formal arrangements had been made to provide a relief controller if one were needed for any reason as it was assumed that the chances of an off-duty controller being available were sufficiently high to obviate the need for the rostering of staff for this purpose.

1.10.2 Napier Air Traffic Service had a complement of four controllers, and two flight data staff who provided an information service.

1.10.3 Napier Tower had no radar equipment so procedural techniques were used for the separation of traffic flying under IFR. The controller was dependent on height and position reports from pilots for the information needed to maintain separation.

1.10.4 A VDF had been installed in the Tower, situated in front of the controller's position. This equipment indicated the bearing of an aircraft from the tower when that aircraft transmitted on VHF. The equipment was not permitted to be used for the control of IFR flights, but to locate aircraft visually and, in an emergency, provide navigational assistance. The VOR and VDF ground stations were separated by about 500 m. There was no significant difference in bearings of aircraft at the distances involved in this accident. The existence of the VDF equipment had not been promulgated to pilots.

1.10.5 The instrument runway at Napier was 16/34 (oriented 165°/345° magnetic). It was served by four instrument approaches:

(a) The VOR/DME approach to runway 16, which was only available via a DME arc approach at 10 nautical miles radius (Diagram 4).

(b) The VOR approach to runway 34, which could be commenced either from a DME arc or by a conventional teardrop approach from overhead the beacon (Diagram 3).

(c) The NDB approach to runway 34, which was similar but not identical to the VOR 34 approach.

(d) The "VOR or NDB-Alfa" Approach (Diagram 2) which was an approach on a final track of 205°M for a circling approach, either by reference to VOR or NDB and with entry either by conventional teardrop pattern or by DME Arc or directly from the Wairoa to Napier track.

1.10.6 Minimum sector altitudes were high in the vicinity of Napier, being generally 7000 feet, overland, to within 10 nautical miles.

1.10.7 The prescribed meteorological minima for VFR flight at night were 3000 feet cloud base and 16 km visibility.

1.10.8 The Flight Service staff at Taupo (the nominated alternate) were not on duty at the time of the accident. The runway lighting could, therefore, only be used if someone had arranged for it to be switched on if required. The Taupo Flight Service log disclosed no record of such an arrangement on 16 May 1989 and the Flight Service Officers who were on duty had no recollection of such a request, which would have been unusual.

1.12 Wreckage and impact information

1.12.1 The initial impact was upslope on a 13° sloping hillside, at a height of 1420 feet amsl. Propeller slashes which averaged 1160 mm apart were exactly vertical. Measurements at a constant height above the bottoms of the first propeller slashes indicated that the aircraft was banked about 10° to the right at initial impact.

1.12.2 If cruising power (2300 revolutions per minute) had been set the spacing of the slash marks would be consistent with a groundspeed of some 175 knots.

1.12.3 Parallel scars in the ground, on a track of 278°M, ended at the embedded ADF sense aerial and DME aerial. In a hole in the ground immediately beyond these scars, about two metres long and half a metre deep, were clear imprints of the two engine nacelles.

1.12.4 Damage to a fence, beyond the initial impact point, showed that the aircraft had rebounded into the air. Heavy debris, such as propellers, engine mounts and an alternator, was spread over a fan-shaped area which crossed a deep gully and led to a higher ridge beyond (at an elevation of 10° from the initial impact). Also included in the fan were cockpit items such as the control columns.

1.12.5 Some 180 m away, at the top of the next ridge, were interwoven scars suggesting they were made by debris which was rotating when it struck the ground. The complete top of the fuselage lay just short of these marks.

1.12.6 Twenty metres further on were the rear fuselage and wings. The wheels and engines were in the general vicinity. The nosewheel was still contained within portions of the nose structure; the main undercarriage struts showed no signs of distress and there was no disruption of the structure in the vicinity of the main wheels.

1.12.7 The pilot's seat (to which the pilot was still strapped when found) lay 15 m beyond the main wreckage; the other two occupants, also still strapped to parts of their seats, were some 30 m further on.

1.12.8 The flaps appeared to be extended about ten degrees and the flap jack extensions were consistent with such a deflection.

1.12.9 Each of the extremities of the aircraft was located at the accident site.

1.12.10 The elevator trim tab was deflected so as to apply up trim; the rudder trim tab was neutral.

1.12.11 Pre-impact integrity of the flying controls was established.

1.12.12 There was no indication of any pre-impact failure of the structure.

1.12.13 The engine controls were in positions compatible with rich mixture and intermediate manifold pressure and revolutions per minute, but disruption when the engines came adrift made these indications unreliable.

1.12.14 A considerable amount of fuel was still contained in the tanks. It was clear, green and smelled of Avgas.

1.12.15 The subscale of the pilot's altimeter was at 1016; the co-pilot's altimeter was at 1012.

1.12.16 One of the communications radios was tuned to 124.8 MHz, the frequency of Napier Tower, the other to 121.8 MHz, the frequency of the Napier ATIS.

1.12.17 When located in the wreckage the VOR receivers were both tuned to 114.5 MHz, the frequency of Napier VOR. One indicator showed 334° on the OBS index, the other showed 156° (nearly the reciprocal). The needle of the first indicator showed $2^1/_2$ dots left deflection; the other showed one dot left deflection. The first indicator showed the aircraft as being on the 339 radial, the other the 334 radial. The impact point was on the 332 radial from Napier.

1.12.18 Both of the ADF receivers were selected to "ADF". One tuning indicator was in the vicinity of 380 to 400 kHz, the other was approximately 212 kHz. The indication of frequency on the type of receiver fitted was only approximate and some disruption had occurred in the accident. A pilot familiar with the aircraft believed the indicators were accurate to about plus or minus 10 kHz. The bearing indicators showed trapped readings of 145° and 260° relative to heading, or 063° and 178°M. (The bearing of Napier was 152°M). The frequencies of beacons on the route flown by ZK-SUN were:

Hamilton	390 kHz
Taupo	230 kHz
Napier	354 kHz

1.12.19 A considerable quantity of paper was collected from the vicinity of the accident site. This included:

(a) Virtually all the contents of a complete Instrument Flight Guide, including the Napier Approach plates

(b) An En Route Chart appropriately folded for the route from Hamilton to Napier

(c) The flight log. This showed:

(i) The ATIS information:

Information Foxtrot:	Runway 16
Wind:	210°/5 knots
Visibility:	15 km
Cloud:	1 octa 1000 feet
	4 octa 2500 feet
QNH:	1014 hPa

2000 feet wind 230°/10 knots

(ii) The last recorded clearance:

"VOR 16 via ARC
50
30"

(d) A defect log, showing no outstanding defects recorded.

1.13 Medical and pathological information

1.13.1 Subsequent pathological and toxicological examination disclosed no factor which would have affected the pilot's ability to control the aircraft. Mr McKinney's spectacles were not found, but expert, aviation medical advice was that lack of them would have had no significant effect on Mr McKinney's ability to conduct a flight at night under IFR. Since they were designed to correct slight myopia in one eye, their absence would not have affected his night vision, or vision under cockpit lighting.

1.16 Tests and research

1.16.1 The flight, engine and navigation instruments were removed from the wreckage for laboratory examination.

1.16.2 No useful indications were gained from microscopic and ultraviolet examination of the instruments.

1.16.3 All of the indications on the flight and engine instruments were affected by impact damage. The damage to the artificial horizon was compatible with a severe upward impact while the aircraft was in straight and level flight. No other useful information was obtained from these instruments.

1.16.4 An Air Traffic Services consultant assisted with the analysis of air traffic control aspects of the investigation.

1.16.5 A senior lecturer in human factors psychology from Otago University provided guidance on pilot workload and rationale for the sequence of events.

1.17 Additional information

1.17.1 The pilot's flight plan as filed showed "WAC" as the operator. This almost certainly was intended to indicate Waikato Aero Club. Inquiries with the management of the Club and the hirer of the aircraft established that the pilot represented this flight to them as a private operation.

1.17.2 Taupo Aerodrome which the pilot filed as an alternate for this flight was unattended for the duration of the flight and no arrangements were made for the aerodrome lighting to be switched on in the event that the aircraft had to divert to that location. Civil Aviation Regulation 62 required that the pilot ensured the "condition" of aerodromes which may be used on a flight were "suitable".

THE AIR TRAFFIC SITUATION

1.17.3 The sequence of aircraft arriving at Napier is shown at Diagram 1.

1.17.4 When ZK-SUN first contacted Napier Tower at 1831 hours, the other aircraft in contact with Napier was a Piper Aztec (Cookson 102) making a scheduled commuter flight. This aircraft had reported over Wairoa at 1821 hours; it landed at Napier without incident at 1838 hours.

1.17.5 Immediately after ZK-SUN contacted Napier, an Air New Zealand F27, NZ 846 reported as having passed Norsewood, 45 miles south-west, descending towards Napier. This aircraft landed at 1848 hours.

1.17.6 At 1842 hours, an Eagle Airways Bandeirante, Eagle 225, reported at Wairoa. This aircraft was required to hold at Napier from 1855 hours until 1908 hours, when it was cleared to make an approach to Hastings before returning visually to Napier. It landed at 1915 hours.

1.17.7 At 1857 hours another Air New Zealand F27, NZ 839, reported at 50 nm on track from Rotorua. The accident to ZK-SUN occurred while the controller was communicating with this aircraft. It was required to hold at Napier from 1912 to 1925 hours, when it was cleared to make an instrument approach to Hastings before returning visually to Napier. It landed at 1937 hours.

1.17.8 ZK-MSL, a private Piper Seneca, reported at Wairoa at 1907 hours. It was required to hold at Napier from 1920 to 1931 hours, when it was cleared to proceed to Hastings. It landed at Hastings at 1937 hours.

1.17.9 The controller stated that, in her opinion, the change in approach procedure which she gave to ZK-SUN was not made at the last minute, no difference from the planned rate of descent was necessary and the pilot did not need to change his "general heading". Also it was certainly "much less complex" for the pilot than (for example) joining the holding pattern. She expected pilots would have briefed themselves on all of the approaches to an aerodrome, before departure. She believed that for a pilot to brief himself on the new approach he "would only be required to flip over the page in his Instrument Chart Supplement Flight Guide". Because the change in approach gave the pilot an extra 7 miles of travel on the arc, she did not consider the pilot would have had any difficulty in re-briefing himself on the new approach.

1.17.10 As was normal there was no available information which would have indicated to a controller the experience level of the pilot in command, that

the aircraft was a single pilot flight or if the pilot flew into Napier on a regular basis.

1.17.11 The following are extracts from the Manual of Air Traffic Services which applied at the date of the accident:

"SECTION RAC 2: AIR TRAFFIC SERVICES ORGANISATION

18 Air Traffic Control Clearances

An ATC clearance is authorisation for the pilot to proceed under conditions specified by an ATC Unit.

The terms 'clearance' and 'instruction' shall have the same meaning for the purposes of this manual.

19 Transmission of Clearances

19.1 Clearances shall be issued sufficiently early to ensure that they are transmitted to the aircraft in time for the pilot to comply with them.

SECTION RAC 3: CONTROL OF VFR AND IFR FLIGHTS

21 Clearances Issued to IFR Flights

. . . Except when operating in accordance with radar procedures which specifically cater for contingencies such as loss of communications or failure to establish contact, ATC clearances shall not be issued on the assumption that further control action will be taken at a later stage to avoid confliction.

SECTION RAC 4: AERODROME CONTROL

34 VDF Operations

VDF facilities are not calibrated.

. . . In emergency situations the VDF may be used for . . . providing navigational assistance when requested by the pilot of an IFR flight following the failure of aircraft navigational equipment.

. . . The VDF shall not be used for:

— Separation of aircraft

— Monitoring of IFR flight procedures, except that if during the course of normal ATS duties a VDF bearing is noted that is considered significantly different from the aircraft's expected bearing, the pilot shall be informed.

SECTION RAC 5: SEPARATION OF CONTROLLED FLIGHTS

1.4 When alternative means of separation are usable, the controller shall select the least restrictive, having regard to such factors as work load and RTF loading."

1.17.12 The Civil Aviation Regulations 1953 stated at Regulation 37:

"Air Traffic Control Clearances:

. . . (2) A pilot in command shall not depart from the requirements of an air traffic control clearance, unless an emergency arises which requires him to take immediate action . . ."

Regulation 59 stated:

"Responsibility of pilot in command:

. . . (2) The pilot in command shall have final authority as to the disposition of the aircraft while he is in command . . .

. . . (4) The pilot in command may follow any course of action he considers necessary in emergency situations which, in the interests of safety, require immediate decision and action. When such an emergency authority is exercised, the pilot in command shall endeavour to keep the appropriate air traffic control fully informed . . .

1.17.13 The NZAIP Planning Manual stated on page RAC 1-38

"if an ATC clearance is not acceptable to the pilot in command an alternative clearance may be requested."

AIR TRAFFIC CONTROL RESPONSE TO NAVIGATION DIFFICULTY

1.17.14 The Manual of Air Traffic Services stated:

"SECTION RAC-7: ALERTING SERVICE AND SAR

8.7 Navigation Difficulty

When an aircraft is experiencing navigation difficulties ...

The question of terrain clearance must be considered, particularly if the aircraft is flying at low level. Terrain and obstructions well outside the estimated position of the aircraft must be taken into account, and the pilot advised to climb if necessary."

BASIC TRAINING OF CONTROLLERS

1.17.15 Controllers received their basic training in aerodrome and approach control at the Aviation College at Christchurch. During this training it was impressed on them that their priorities were safety, orderliness and expedition, in that order. Emphasis was placed on the economical use of RTF. Many trainee controllers had no flying experience but the Aviation College included instruction on "pilot problems" in the training of air traffic controllers. Controllers were encouraged to make flightdeck familiarisation flights.

1.17.16 Emergencies were introduced into the controllers' training in a variety of ways, and controllers were instructed that they must give priority to aircraft with emergencies. However, these emergencies were generally clear-cut, usually being declared by the pilot. There were no scenarios wherein an emergency situation built up subtly over a period, as in this accident.

TYPE RATING AND CONVERSION TRAINING

1.17.17 The following were extracts from CASO 12, Part 18, Section 1, Aircraft Type Rating — Pilot:

"1.2 Certification of Type Rating

1.2.2 . . . A pilot type rated on an aeroplane forming part of a group listed at Appendix IV **shall be deemed to be type rated** on all aeroplanes included within that group. . . .

1.2.7 Licence privileges related to an aircraft type rating may be exercised in respect of the aircraft listed in Appendix IV . . . as a group.

1.4 Minimum Conversion Flight Instruction

1.4.1 The minimum conversion instruction flight time, including the flight test, **for issue of a type rating shall be:**

(a) For a multi-engined aeroplane not exceeding 5700 kgs maximum certificated take-off weight (MCTOW):

(i) Initial issue — five hours, and

(ii) **Subsequent types** — one hour.

1.4.2 The minimum conversion flight time will be dual instruction unless otherwise specified . . .

1.5 Restrictions in the use of type rating

1.5.2 The issue of a type rating for any aeroplane not exceeding 5700 kg MCTOW . . . shall not authorise the holder . . . to act as pilot in command of that type of aircraft **on air transport operations under instrument flight rules** until, after being issued with the type rating he has completed either:

(a) Five hours flight time as pilot-in-command under visual flight rules on that aircraft type; or

(b) Five hours flight time as pilot-in-command under instrument flight rules on that aircraft type under the supervision of a pilot qualified to act as pilot-in-command under instrument flight rules on that aircraft type; or

(c) Any combination of (a) or (b) above.

1.5.3 Notwithstanding the provisions of . . . 1.5.2 . . . the Director, having regard to:

(a) The experience of the pilot;

(b) The complexity of the aircraft;

(c) The route to be flown;

may increase these minimum requirements." [Emphasis added]

INSTRUMENT RATING — DME ARC PROCEDURE

1.17.18 The following extracts were from CASO 12 Part 19, instrument Rating — Aeroplane:

"1.2 Requirements for issue

1.2.2 An applicant . . . shall demonstrate to an examiner . . . ability to perform . . . those . . . manoeuvres detailed in the flight test syllabus in Appendix II.

. . . (c) Radio aids on which an applicant has demonstrated competence . . . will be endorsed on the rating.

APPENDIX II

6 Flight Test Form

6.1 The flight test form to be used on . . . issue . . . flight tests shall be . . . the form set out in Appendix III. APPENDIX III — Notes:

1. Initial issue flight test: all items must be completed except . . . DME Arc . . . procedures."

[The Air Transport Division confirmed that it was not the practice to endorse DME arc procedures on the rating, notwithstanding paragraph 1.2.2 (c), because DME arc was not considered to be an approach procedure]

"1.3 Recent experience and competency requirements

1.3.1 The holder of an instrument rating — aeroplane shall not exercise the privileges of the rating:

. . . (d) to carry out an NDB/DME or VOR/DME arc approach under instrument flight rules unless the holder has successfully demonstrated, to a flight examiner, ability to perform competently a flight test on either of these procedures . . ."

REQUIREMENT FOR RECENT NIGHT FLYING EXPERIENCE

1.17.19 CASO 12 Part 3, Section 1 paragraph 3 stated:

"3. Recent experience requirements

3.1 The holder of a commercial pilot licence — aeroplane shall not exercise the privileges of his licence to act as pilot-in-command of an aeroplane carrying passengers. . . . :

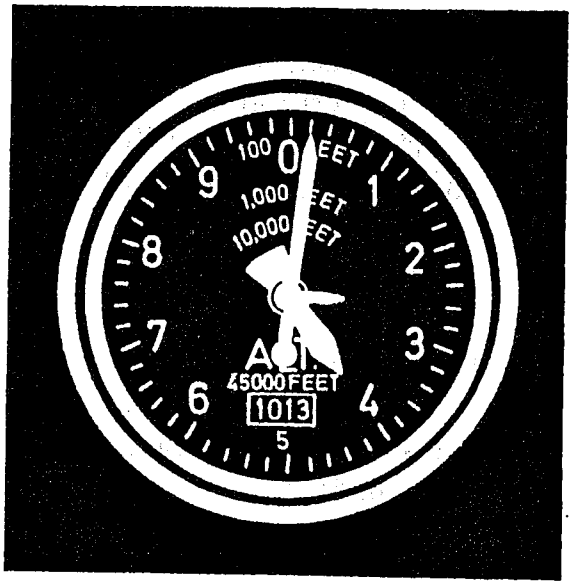
(b) By night, unless within the immediately preceding 90 days, he has; carried out as pilot-in-command of an aeroplane of the same type not less than three take-offs and three landings by night; or satisfactorily demonstrated his continued competency by night in an aeroplane of the same type".

INSTRUMENT FLYING COMPETENCE

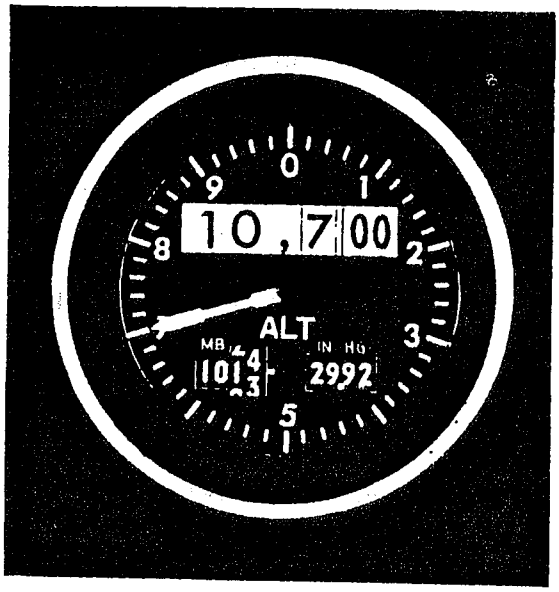
1.17.20 The Air Traffic Control Officer had to work on the premise that all pilots who filed an IFR flight plan were competent to fly the plan as filed and the approach procedures which they adopted and accepted.

PILOT WORKLOAD

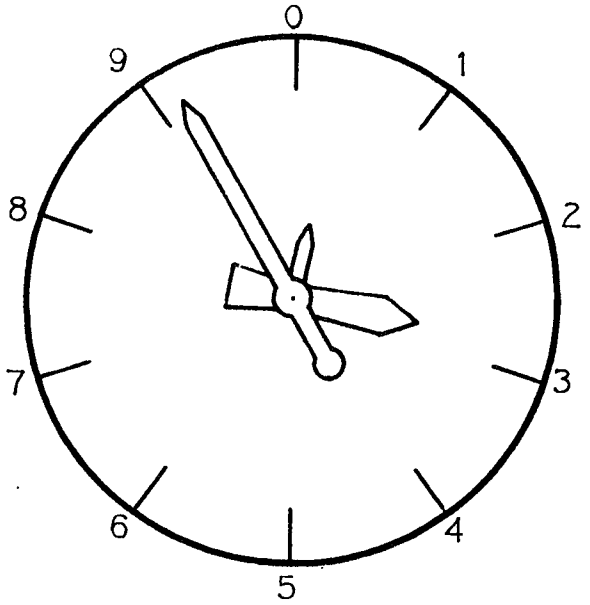
1.17.21 Two pilots one with an ATPL and the other an "A" category flying instructor with an SCPL, who were not operating routinely into Napier, were timed performing pre-descent checks and self-briefing appropriate to an



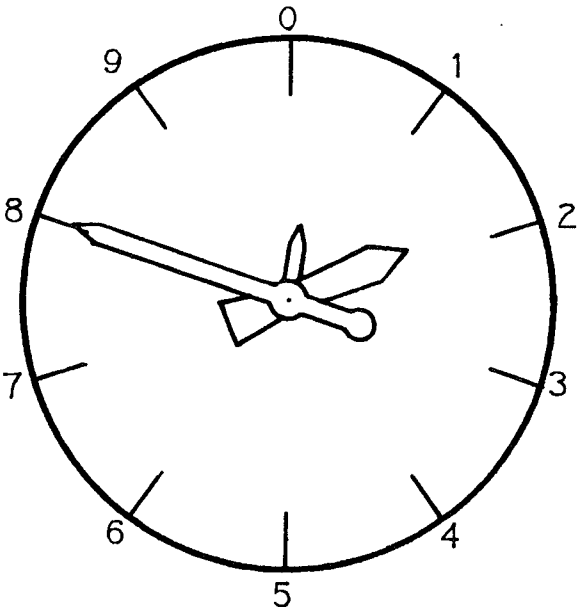
(a) 3 POINTER ALTIMETER



(b) DIGITAL ALTIMETER



(c) 2920 CAN BE READ AS 3920



(d) "APPROACHING 2500" IN DESCENT

ALTIMETERS

DIAGRAM 6

expected approach to runway 16 via the DME arc from the Taupo track and also re-briefing on the Alfa approach and missed approach procedure. Both events were timed with no extraneous workload or interruptions. The pre-descent checks and briefing took two minutes; the rebriefing for the Alfa approach (which included locating the appropriate approach plate) took two minutes thirty seconds.

THREE POINTER ALTIMETERS

1.17.22 Three pointer altimeters in which the pointers indicate hundreds, thousands and tens of thousands of feet (Diagram 6a) were still fitted to most light aircraft. They had been superseded in airline use for many years by the combined digital and pointer display shown in Diagram 6b.

1.17.23 Before being superseded for airline use, three-pointer altimeters were responsible for a number of accidents, because they were easy to misread. While most of the major accidents were caused by misreading the altitude by 10 000 feet (so that the aircraft was 10 000 feet lower than the crew believed to be the case), trials showed that it was even easier to misread the altitude shown by 1000 feet.

1.17.24 Diagrams 6c and 6d illustrate the way in which misreading by 1000 feet could occur. If an aircraft was climbing or descending and the pilot's attention had been diverted, he would have to make a conscious effort to read the instrument, rather than noting the changes as they occurred. There was a tendency to register the numerals nearest to the pointers, whereas if the lower hand was below the numeral, the next numeral was the correct reading.

1.17.25 If a pilot misread the altimeter by 1000 feet, the error might well escape his notice for a prolonged period because in general his attention would be directed primarily to the hundreds-of-feet pointer, during instrument flight.

1.17.26 Studies had shown that under high stress the probability of error in reading an instrument could rise by a factor of five to ten.

HUMAN INFORMATION PROCESSING

1.17.27 Research on human information processing shows that, at the level of conscious decision making, man functions as a single channel processor of limited capability. This fundamental characteristic places critical restrictions on man as a component of complex man-machine-environment systems, such as an aircraft. To some extent humans can perform parallel processing, provided the two tasks are different. For example, a pilot could fly the aircraft and make navigation calculations. However, as the workload builds up the pilot prioritises and reduces the attention he gives to things he perceives as less important.

1.17.28 For each item requiring a decision, a number of mental faculties have to be brought to bear:

Data monitoring
Memory recall
Cogitational work (e.g. correlation, comparison)
Arriving at a decision
Cross-checking and verification
Selecting a response
Taking action (e.g. physical effort)

Decision making and cogitational work are much more demanding of attention resources than monitoring or response selection.

As the number of separate items accumulates and overlaps, there is progressively less mental reserve remaining. The principal cognitive effects of stress due to increasing workload are:

(a) Involuntary effects:

(i) Narrowing of attentional focus, i.e. greater selectivity with less attention for secondary tasks,

(ii) Reduced working memory capacity: this limits the number of alternatives that can be held in mind simultaneously and is probably a key limit on decision-making ability,

(iii) Overall reduction in attentional capacity, as some is taken up with self-monitoring and self-assessment.

(b) Workload shedding techniques:

(i) Reducing the look-ahead time horizon and selecting the task with the highest immediate pay-off, (for example, the pilot may have perceived that flying the aircraft was the most important task and continued to do so at the expense of other tasks such as navigation),

(ii) Limiting anticipation of what might happen next; planning in shorter steps,

(iii) Spending less time on each task,

(iv) Increasing the speed of response at the expense of accuracy,

(v) Omitting some tasks, such as gathering feedback on expected responses (substituting expectation for checking).

(c) An increased likelihood of responding with previously overlearned patterns of responses.

(d) At extreme levels of stress, to follow, impulsively, the, first course of action which seems to offer some escape from the situation. Because of the effects noted above, this may not be the best course of action.

(e) A reversion to automaticity: people are more able to perform highly practised, automated sequences of actions even under high levels of stress; in contrast to a decreased ability to reason with new information under the same circumstances.

1.17.29 When confronted with a situation of overload, i.e. the time available is insufficient to complete the information processing demands of the situation, the human operator copes in one or more of the following ways:

Omission:	Ignoring some signals or responsibilities.
Error:	Processing information incorrectly.
Queueing:	Delaying response during peak loads and catching up during lulls.
Filtering:	Systematic omission of certain categories of information according to some priority scheme.

Approximation: Making a less precise response; pursuing possible explanations less thoroughly.

Regression: Responding with a previously overlearned habit pattern.

Escape: Giving up; abandoning any attempt to cope.

Not all of these effects may be consciously apparent to the human operator when they occur. For example, under stress a pilot may not realise that he has regressed to an emergency procedure appropriate to another aircraft type with which he is more familiar.

1.17.30 A traumatic event, such as knowledge of an aircraft accident, will be likely to cause psychological and physiological changes which could produce similar symptoms to those of task overload:

There is likely to be a marked deterioration in a person's ability to hold several alternatives in mind, or to reason with new information.

There may be a narrowing of attention, so that some sources of information fail to "register", and a tendency to stick to one hypothesis long after the facts contradict it (perseveration).

There is likely to be decrements in performance of a task, but again automaticity will result in less effect on a highly practiced series of actions.

2. ANALYSIS

2.1 The Pilot's Conversion Training to Fly ZK-SUN

2.1.1 ZK-SUN was an aircraft with higher performance than any type which the pilot had flown before. Therefore until his training and experience had reached the point where he could achieve the appropriate airspeeds readily, he would have needed to devote more of his attention to that task and thus his workload (especially in IMC) would have been increased. The workload would in any event have been increased somewhat by the higher speed of the Baron compared with that of the GA7 with which he was familiar and the fact that this was a night flight. These factors would have compressed events in time.

2.1.2 An autopilot was a mandatory item of equipment for single-pilot IFR flight because its use reduced the workload to a manageable level. Axiomatically it was essential that the pilot knew how to use it. The pilot had not previously used this type of autopilot and in the absence of understanding its pitch and altitude hold characteristics, it was likely that he would have used it in heading mode only, while he controlled the aircraft manually in pitch. However for private IFR flights an autopilot with "heading hold" mode only was the minimum requirement for this assistance and the pilot of ZK-SUN would probably have used it in this mode without undue difficulty.

2.1.3 The aircraft's reported sensitivity in pitch implied that, if he had been flying it manually, a pilot inexperienced on type would have needed to devote a significant proportion of his attention to the accurate maintenance of height, yet again increasing his workload.

2.1.4 In ZK-SUN, the placing of instruments and equipment on the instrument panel was not very systematic. In particular, the displays of the VOR and ADF were not only remote from the switches on the receivers which controlled them, but also it was not immediately obvious which receiver was supplying which display. In the case of the ADFs, for example, confusion could have arisen as to which beacon's relative bearing was being displayed on which indicator. This difficulty would have required practice to overcome.

2.1.5 The ADFs were of a type, which required manual (and aural) tuning: this took a significant time, even for a pilot accustomed to these ADFs. The pilot had no experience of them and would probably have required up to a minute to tune one to a beacon. A digital frequency counter had been installed but it is unlikely that the pilot, who had not been instructed in its use, would have known how to operate it.

2.1.6 When converting to any new aircraft it is essential for the pilot, particularly for single pilot IFR operations, to become familiar with the positions and functions of each switch and control. This could only be achieved with practice.

2.1.7 When the aircraft was to be flown at night it was even more important that the pilot should have been familiar with its operation due to the limitations of cockpit lighting.

2.1.8 It was essential that a pilot about to fly on single-pilot IFR operation at night had this familiarity, since searching for switches and controls would have added to his workload. With no second pilot to detect errors, confusion as to what was being displayed, or incorrect selection, could have led to errors with serious consequences.

2.1.9 The pilot's conversion training on the Beech Baron comprised 45 minutes of dual instruction and a solo circuit. The operation of the radios, navigation equipment and autopilot, all essential for IFR operations, was not taught. He had no further practice or familiarisation flying in the aircraft before departing on the accident flight. The pilot's type familiarisation training was thus inadequate for the flight he was about to undertake.

2.1.10 CASO 12 Part 18 Section 1 — Type Ratings, stipulated at paragraph 1.2.2 that a pilot type rated on an aeroplane forming part of a group (in this case Group E — twin piston engines, less than 5700 kg MCTOW and with tricycle retractable undercarriage and constant speed propellers) was deemed to be rated on all aeroplanes within that group. Therefore as the pilot of ZK-SUN was rated on the GA 7 and PA 34 he was deemed to be rated on the Baron.

2.1.11 Paragraph 1.4, of CASO 12 Part 18 Section 1, which specified a minimum of one hour's dual conversion training for each subsequent type of multi-engine aeroplane not exceeding 5700 kg MCTOW, was ambiguous, since this flying was said to be for the issue of a type rating - which paragraph 1.2 had stated was not required for subsequent types within that group. If it was intended to require a minimum of one hour's dual instruction, that level of experience for the pilot, proposing to make a single-pilot IFR flight at night, was inadequate. It would be appropriate in many cases for a pilot to accumulate experience during day VFR flight or IFR with an experienced second pilot prior to undertaking single pilot IFR flights at night on an aircraft type with which he was not familiar.

2.1.12 CASO 12 Part 18 recognised the need for more familiarisation with an aircraft type, where air transport flights were to be made under IFR, by prescribing an additional 5 hours of flying. In addition this minimum could have been increased, at the discretion of the Director of Civil Aviation, if the pilot was inexperienced and a more complex aircraft than he was used to was to be flown. However the provision for the additional five hours familiarisation flying or extra familiarisation at the Director's discretion did not apply to pilots carrying passengers on a private operation.

2.1.13 There was a requirement for any pilot to complete three night take-offs and landings in the particular type of aircraft prior to carrying passengers by night. This pilot had not flown in any multi-engined aircraft at night prior to this flight and this omission to meet the requirements deprived him of even this small amount of pre-flight night familiarisation.

2.2 The DME Arc Approach

2.2.1 The DME arc procedure required the pilot to adjust the aircraft's heading repeatedly, both to fly around the curved path and to allow for changing drift. At the same time he had to monitor his radial from the VOR since (in general) a series of height reductions would be commenced at various radials. In the course of flying the arc he would also be reducing speed and configuring the aircraft for the final approach.

2.2.2 Before flying a DME Arc approach, a pilot was required to have been tested in this procedure by an approved examiner. However, the arrangement of CASO 12 Part 19 was such that this requirement was not readily apparent. The pilot had not been tested in this procedure and according to his logbook he had flown it only twice before.

2.2.3 The DME arc approach procedure is widely used in New Zealand. Notwithstanding this, the DME arc approach procedure was not a mandatory item in the flight test for issue of an Instrument Rating.

2.2.4 Despite his lack of qualification in this procedure, the pilot accepted the DME arc procedure, first to runway 16 and subsequently to the Alfa approach. His unfamiliarity with the procedure would have exacerbated the workload he experienced.

2.3 Approach Sequence

2.3.1 When the pilot of ZK-SUN called Napier from Taupo East at 1831 hours his ETA for Napier, 39 nm distant, was 1845 hours. His subsequent position reports indicated this ETA would have been achieved.

2.3.2 At 1832 hours, NZ 846 advised "was Norsewood 35" and gave an estimated time of arrival at Napier of 1849. The standard flight plan time taken by this aircraft type from Norsewood to Napier was 14 minutes. 1849 hours was thus an appropriate ETA but as the message was timed at 1832 hours, the aircraft could not already have passed Norsewood at 1835. Analysis of the aircraft's subsequent DME reports showed his ATA was likely to have been 1844 hours. It seems likely therefore that his crossing time at Norsewood was 30 rather than 35. By 1837.20 comparative DME ranges established that NZ 846 would arrive first and the controller changed the arrival sequence before allocating approach procedures to the two aircraft. Because the sequence was

changed before the approach procedures were allocated the erroneous position report did not affect the outcome of events.

2.4 The Pilot's Response to the Changed Clearance

2.4.1 At 1843:57 hours the pilot reported that he was crossing the 330 Radial. Even if the report was contemporaneous with the radial crossing, there was only .85 nm, or 25 seconds, to go to the point at which the aircraft should have commenced its turn onto the final approach for which it was cleared. By this stage the pilot should have set the inbound track on both OBS.

2.4.2 The controller responded to the pilot's position report by instructing him to "continue on round the arc to turn inbound for the VOR Alfa circling 16 Approach not below 3000", instead of the 16 Approach as previously cleared. In the time taken by the RTF exchanges between the pilot and the controller (about 35 seconds) the aircraft would have reached, or passed, the normal turn-in point. The pilot responded with "continuing around the arc to the 16 Alfa Ap . . . not below 3000".

2.4.3 The revision of the clearance required the pilot to take several actions:

First he should have discontinued the turn if already commenced, turned back onto his original heading and continued to fly the aircraft around the arc. If he wished to use the autopilot for this purpose he would have had to re-set the heading bug (to which the autopilot was slaved).

While doing this he should have written down and read back the revised clearance. (It was not written down on the log).

Then he had to locate the approach chart for the revised approach, and rebrief himself on the new approach path, associated minima and the missed approach procedure.

He would have noted the check radials on the new approach, and their associated altitudes and revised his descent plan accordingly.

Finally, he would have had to set the first new check radial (or monitor his progress) on one OBS and set the new inbound track on the other.

For a two-pilot crew who were familiar with the approaches to Napier, the workload involved in responding to a change of approach clearance at this late stage would have been high. For a single pilot the workload had the potential to be excessive.

2.4.4 A pilot who considered that an ATC instruction imposed too high a workload on him should have stated that he was unable to comply, or requested an alternative clearance or offered to enter the holding pattern while the situation was resolved. However, the pilot of ZK-SUN, in the event, accepted the revised approach clearance.

2.5 Analysis of Flightpath after the Changed Clearance

2.5.1 The speed derived from the aircraft's reported positions on the arc up to the 330 radial was 125 knots. The time reported at the 330 radial corresponded well with the approximate time at which the aircraft was first heard by Witness "A" and the controller recalled seeing a VDF bearing which

agreed with the reported radial. This indicated the aircraft had followed the intended profile to this stage.

2.5.2 After 1835 hours there were no other piston-engined aircraft on IFR flights in the area at the relevant times, and VFR flight was impracticable in the meteorological conditions. The witnesses referred to in Section 1 of this report, who were familiar with the sound of turbine-powered aircraft, stated the aircraft which they heard was neither a F27 nor a Bandeirante. The aircraft seen and/or heard by them therefore was probably ZK-SUN.

2.5.3 The Police log showed that the accident was reported at 1900 hours. Witness A (Diagram 5), who saw the accident, considered that it had taken him two minutes to place the call, putting the time of the accident at about 1858 hours. This time was substantiated by the lack of response by the pilot when the controller called him at 1858:09 hours.

2.5.4 . VDF bearings, although uncalibrated, were likely to have been accurate. They were recorded at 1843.57, 1853:32, 1855:56 and 1856:17 hours.

2.5.5 The witnesses could not be certain about times. Some of the witnesses were indoors when they heard the aircraft so the direction in which they thought they heard it might have been misleading, and the distance at which the aircraft could be heard was uncertain. Some witnesses thought it remained in earshot for two minutes, suggesting a "sound footprint" of 2 nm radius, but the distance might have been affected by the aspect of the aircraft or the effects of the steeply undulating terrain. Others thought the aircraft was audible only for a short time.

2.5.6 The witness who was least certain of the time at which he heard the aircraft was witness "B" (1830-1900 hours) so it was uncertain whether he noticed the aircraft early or late in the sequence. While the Cookson aircraft would have been in the area at approximately 1835 hours it would have passed this witness on only one occasion. As the aircraft which was heard passed three times in a short period it is likely to have been ZK-SUN. Witness "G" saw the aircraft during the sequence, but was unable to give a time; she saw the aircraft flying directly towards her in the direction of Napier. This sighting provided a point on the flightpath with the associated direction of flight.

2.5.7 The pilot may have turned inbound in accord with his initial clearance as discussed in Section 2.4 but there was no evidence to confirm this. However such a turn is not inconsistent with the witness reports which do indicate that the aircraft turned south at some position on the arc between the 330 and 360 radials. The timing of the VDF bearing of 360° confirmed that the aircraft had not flown directly round the 10nm DME arc to that bearing.

2.5.8 Since witness "H" did not hear the aircraft circling, he may have heard it on a different occasion from witness "B", who stated it passed his house three times.

2.5.9 The marine light close to witness "B" flashed green, white and red. The aerodrome beacon at Napier flashed green and white, and there was a green, white and red light shown on the approach plates for Napier, one nautical mile east of the aerodrome. There was a potential cause for confusion, therefore, which might explain the three passes described by the witness. The witness' location was consistent with the aircraft manoeuvring visually around the light.

2.5.10 The evidence of the witnesses establishes that ZK-SUN was manoeuvring for some 14 minutes, after the pilot acknowledged the amended clearance, in the area generally north of Napier between 5 and 10 nm from the aerodrome and was not following the 10 nm DME arc or the VOR Alfa approach.

2.5.11 The witness evidence as a whole did not provide an adequate basis for the reconstruction of a single definitive flight path as all but two of the witnesses only heard the aircraft and could not therefore be precise as to its height and position. However the pilot was heard to transmit advice on the Napier Tower frequency that he was "going around again to rejoin the arc at 2600", and shortly thereafter was sighted heading north-west at low altitude immediately prior to colliding with the terrain at a position in the vicinity of the 10 nm DME arc.

2.6 The Pilot's Actions

2.6.1 The available evidence indicated the aircraft was at the position given when he reported "330 radial". As discussed in paragraph 2.5.7 it appears the pilot turned the aircraft inbound before reaching the 360 radial.

2.6.2 Although the instruction to "continue round the arc" was explicit the pilot appears not to have attempted to remain on the arc. The three most probable reasons for not complying with the revised clearance appear to be:

He may, initially, have misunderstood the revised clearance as being similar to that for which he had already been cleared, or

He decided to continue the descent in contravention of the controller's instruction in the hope that he would encounter VMC and be able to make a visual approach to Napier Aerodrome or,

He may have continued with his preplanned course of action by turning onto the 16 final approach and continuing the descent before he assimilated the new clearance.

2.6.3 Some support for the first possibility is provided by the order in which he listed the components of the revised clearance in his incorrect read back to the controller. He read back ". . . the 16 Alfa (approach)" instead of "the VOR Alfa circling 16 approach" which was the description of the Alfa approach given him by the controller. His original clearance was for a "VOR/DME approach runway 16 . . ." While there was no 16 Alfa approach the pilot's response which omitted the word "circling" indicated that he may have believed initially that the reference was to another approach which was direct to runway 16. As he later gave radials to the controller indicating that he knew where he should have been on the arc for the "Alfa" approach it is apparent that any initial confusion was eventually resolved.

2.6.4 The "aural witnesses" who heard an aircraft within 5 nm of the aerodrome and in one case apparently manoeuvring in the vicinity of a marine beacon indicate that the aircraft did become visual for a time and lend some credance to the second alternative. In addition as one witness saw the aircraft proceeding towards Napier it is probable that the pilot did sight pinpoints of light from isolated houses.

2.6.5 The possibility that the pilot was attempting to fly by visual reference was explored. If the pilot had not obtained a weather briefing prior to his departure from Hamilton, he would have had no other information on the conditions than the ATIS weather which he had recorded on his log, and the RTF transmission that a preceding aircraft had become visual. This may have tempted him to endeavour to obtain visual contact and request a visual approach to avoid the necessity to comply with the revised clearance.

2.6.6 However the actual conditions to the north of Napier Aerodrome where the aircraft was manoeuvring and in the vicinity of the accident site were:

Near total darkness ($1^1/_2$ hours after the end of evening civil twilight)

General cloudbase 1400 feet with patches much lower

Visibility generally 8 km but much reduced in patches of heavy rain

With the exception of the powerful marine light at Whirinaki, the only sources of external light would have been the light from isolated houses.

2.6.7 The pilot's downward vision in the Baron was restricted, being almost nil forward due to the high coaming and long nose, while to the side large areas were obscured by the wings and engine nacelles. Even if he saw the individual house lights they could not have provided navigational information; and in the conditions it would not have been practicable to keep control of the aircraft by visual reference. The pilot had control of the aircraft at impact: it was flying essentially straight and level.

2.6.8 If the pilot did follow this course of action, the attempt to make a visual approach was evidently unsuccessful due to the actual weather conditions and the pilot would have had no option but to revert to instrument flight.

2.6.9 In the event that the pilot continued on the original approach path, his assimilation of the clearance may have been delayed while he sought a "16 Alfa" plate. No such plate existed and the controller did not pick the pilot up on his error in referring to such an approach in his readback of the clearance.

2.6.10 It is likely that while briefing himself for the revised clearance for the Alfa approach to formulate a new plan to comply with this instruction he became geographically disoriented or was orbitting in the vicinity of the witnesses who heard an aircraft overhead. During this period it appears that he continued the preplanned descent for some time as the final impact height was 1400 feet.

2.6.11 In either event during this process he responded to the controller's requests with information which indicated he was complying with the clearance for the Alfa approach. Although these reports were in a logical sequence they were inappropriate in timing. As the aircraft was not in the positions given they had the effect of misleading the controller. Nevertheless the reports indicated that the pilot had sufficient knowledge of the Alfa approach to know where he should have been.

2.6.12 Although the spurious RTF responses may have been just an attempt to "buy time" in a high workload situation, it was more likely they were intended to inject an appearance of normality: the pilot was trying to avoid embarrassment through exposure of his deviation from the prescribed approach pattern.

2.6.13 When at 1856 hours, the controller advised him that her VDF bearings disagreed with the reported radials the pilot appears to have decided to make an attempt to resolve his predicament by starting again as he then advised he was "going round again to rejoin the arc".

2.6.14 There remained an anomaly between the height at which the pilot reported he was going to rejoin the arc and that of the accident site at which he arrived within seconds of the transmission.

2.6.15 A high stress situation would predispose the pilot to misreading a 3-pointer altimeter, since he would tend to lose track of the movement of the "thousands of feet" pointer while scanning other instruments. A quick glance at the "hundreds of feet" pointer then had the potential to be misleading (See, for example Diagram 6).

2.6.16 Misreading of the 3-pointer altimeter thus may have been a factor in the accident.

2.6.17 In normal operations the spot heights and lights displayed on the approach plate were of no use to a pilot. Flying the aircraft in accordance with the published procedure ensured that the aircraft cleared the terrain by a safe margin and arrived at a point from which, in suitable weather, a visual landing could be accomplished. The sole purpose of the additional information was to assist the pilot in an abnormal situation when for some reason radio navigation was not producing the required results and the approach plate may have been the only chart readily available. However it was valueless for this purpose unless it was accurate and complete.

2.7 Pilot Overload

2.7.1 The pilot had no experience in night flying in multi-engined aircraft and he was unfamiliar with the aircraft type, its handling, performance, systems, instrumentation and avionics. He was flying a single pilot, IFR, night flight in IMC to an unfamiliar aerodrome with procedures and approaches which probably, he had not flown before. In addition he may have had to hand fly the aircraft continuously, at least in pitch, due to his unfamiliarity with its autopilot system.

2.7.2 These demands on his capability and experience would have generated a high workload and placed the pilot under stress. The pilot's use of an incorrect callsign on several occasions and his incorrect readback of instructions on his first contact with Napier ATC and on subsequent occasions were indicative of the pressure under which the pilot was operating. A deterioration in the pilot's RTF clarity was also evident in the latter stages of the flight.

2.7.3 The pilot was given a change of approach clearance just as he was about to turn onto the pre-planned final approach and the ingredients for an overload situation were then present.

2.7.4 During, or shortly after, receiving the changed clearance the pilot turned away from the DME arc toward Napier. Whatever the reason for the turn it delayed the need for him to respond to the new clearance until he had time to sort it out.

2.7.5 The pilot's subsequent actions were clearly ineffective. The evidence from the wreckage of the aircraft indicated that the ADFs were not tuned to

Napier NDB. The failure to select the Napier NDB on at least one ADF was a fundamental mistake by the pilot. Unlike the OBS, the information on which was not displayed directly, the ADF needle would have given a direct, continuous and unambiguous indication of the relative bearing of the beacon. The ADF would have been a considerable aid to flying the DME arc, since it was necessary only to maintain a heading which was approximately at right angles to the needle. With Napier NDB selected the pilot could have resolved any uncertainty as to geographic orientation by a glance at the ADF.

2.7.6 When the RTF exchanges were not directed to ZK-SUN it was still necessary for the pilot to listen to them so as to identify those which were: his prompt responses showed that he was doing so. Continuous monitoring of the RTF was a normal practice during IFR operation so that pilots could build up a picture of the air traffic situation. If this task had intruded on his other responsibilities he should have shed the task for the period it took to complete operations of greater priority.

2.7.7 If the pilot was flying the aircraft manually the flying workload would have been continuous and of the highest priority. No quantitative figure can be given for the amount of the pilot's mental capacity which would have been required for manual flight on instruments, since (even if measurable) the figure would vary with currency and experience. However a pilot who was inexperienced on a particular aircraft would find much of his mental capacity was required just to fly the aircraft. Therefore if the pilot was flying the aircraft manually he would have been more susceptible to overloading by extraneous factors.

2.7.8 The pilot probably became overloaded to the extent that he was forced to prioritise. His first priority was to fly the aeroplane and this he succeeded in doing to the end. However, the spare capacity needed to navigate around the approach pattern for which he was re-cleared would have been reduced. If he had a plan in mind, his thoughts were likely to have been directed to a progressively shorter period ahead. He may not have perceived the time or the need to tune an ADF to Napier, though this would have resolved any disorientation in azimuth readily.

2.7.9 A more experienced pilot would have reduced his workload in a number of ways, if he found it becoming excessive e.g.:

he could have refused to accept the revised ATC clearance and requested an alternative clearance or,

he could have engaged the autopilot and headed east to approximate the DME arc while sorting out the new clearance.

when he found himself in difficulty he could have turned onto a safe heading and climbed until clear of terrain or,

most important, he should have indicated to ATC that he was experiencing some difficulty.

2.7.10 A clearance which imposed an excessive workload could have been dealt with by a request for an alternative clearance. Regulation 37, which required pilots to comply with ATC instructions except in emergency, was misleading. The Manual of Air Traffic Services equated "instruction" with "clearance" and defined "clearance" as "authority to proceed". An ATC

clearance was in fact negotiable to enable pilots to retain their responsibility for the safe operation of their aircraft.

2.7.11 If the pilot found any query by ATC inconvenient, he could have postponed the need to reply at any time by the use of "standby" — meaning that he was attending to more urgent matters.

2.7.12 There appears to be a need for education of pilots about their interaction with controllers and in dealing with an excessive workload. Inexperienced pilots who had the greater potential to need an alternative clearance, lacked the background of experience which would have given them the confidence to reject a clearance as unsuitable.

2.8 INHIBITIONS TO SEEKING ASSISTANCE

2.8.1 When it became clear to the pilot that he was not following the prescribed clearance, he ought to have advised the controller of his situation and requested assistance or an alternative clearance. The controller, if alerted to his predicament in time, could have provided assistance which would have averted the accident. Instead, by his responses to the controller the pilot conveyed an impression of normality during the subsequent 14 minutes prior to the accident.

2.8.2 There were at least two possible reasons (apart from trying to avoid embarrassment) why the pilot might have felt inhibited from seeking assistance: he may have thought that his departure from the clearance would be held against him; alternatively he may have feared that any breaches of the Regulations he had made might be brought to light by subsequent investigation.

2.8.3 In the past, senior controllers dealt with problems by post-flight discussion with pilots and the only record would have been an entry in the ATC log. However, the Airways Corporation was required by Civil Aviation Regulation 149E to report all incidents to the Air Transport Division and this may have changed pilots' perceptions of the likely consequences of a request for assistance. Although the Air Transport Division advised that it was highly unlikely that enforcement action would result from investigations made after a bona fide request for assistance such an assurance was not published.

2.9 AIR TRAFFIC CONTROL ASPECTS PRIOR TO THE ACCIDENT

2.9.1 The controller expected the pilot would have briefed himself on all of the approaches to Napier, before departure. She believed that for a pilot to brief himself on the new (Alfa) approach he "would only be required to flip over the page in his Instrument Chart Supplement Flight Guide". The controller's belief was not well founded.

2.9.2 While the pilot could be expected to have briefed himself on each of the approaches to an aerodrome before departure, there were four possible approaches, all different, for Napier. As the pilot would have been taught not to rely on his memory for the detail of each, he would have to review the approach plate for the cleared approach as soon as practicable after the expected approach or actual clearance was given. In issuing an "expected approach" to the pilot of ZK-SUN, the controller probably triggered the sequence of events

in the cockpit, in which the pilot would locate the correct approach plate and brief himself on the approach and missed approach procedures at an appropriate stage during the descent, when the workload was low.

2.9.3 Since a revised clearance to a different approach would require the pilot to rebrief himself on the new procedure, it was essential that whenever practicable the controller made any such revision at an early stage before the pilot's workload had built up to the high level to be expected during the final stages of an instrument approach. Timely changes to clearances were required by the Manual of Air Traffic Services.

2.9.4 The controller cleared the F27 to fly the DME arc for the VOR approach to runway 34, circling to land on runway 16, then cleared the pilot of the Baron to fly the DME arc approach for runway 16, as he expected. The alternative would have been a clearance direct to the VOR to fly the Alfa approach to runway 16. A height restriction, which was intended to ensure vertical separation from the F27, was imposed.

2.9.5 A clearance for the VOR/DME approach to 16 was issued to ZK-SUN, with a level restriction of 5000 feet initially. Some 2.5 minutes later the pilot was cleared to the commencement level of 3000 feet and instructed to report passing the 330 radial. This was so that the clearance could be amended, if necessary, to preserve separation from NZ 846.

2.9.6 The controller stated that she realised that there might be a potential conflict but if one developed she intended to extend the path of ZK-SUN around the DME arc to fly the Alfa approach thus restoring the spacing.

2.9.7 The clearance was incorrect because the pilot was cleared for the instrument approach and subsequently cleared to the commencement altitude. In the event of interruption of communications through RTF loading, jamming or any other factor, the pilot was entitled to make the approach without further clearance. Separation therefore became dependent upon the pilot being able to make the report passing the 330 radial before turning onto final approach.

2.9.8 A transmission advising the pilot of ZK-SUN to anticipate further descent when NZ 846 was assured of a landing was followed by the pilot of ZK-SUN reporting passing the 330 radial.

2.9.9 The Manual of Air Traffic Services referred controllers to the Communication and Navaid Failure procedures in Section 7 of the Instrument Flight Guide. These stated, in part:

"2.1 in IMC . . .

(a) Proceed in accordance with . . . acknowledged ATC clearance

(b) If clearance involved an altitude restriction and no clearance limit has been stated, maintain the restricted level . . . for five minutes, then proceed as cleared."

These instructions had the potential to mislead the controller, in this instance, and pilots in general. This part of Section 7 was intended to refer only to the en-route phase of flight: it had been found too cumbersome to write procedures which would have been valid for all circumstances where failure occurred on departure or approach. Such an intention might have been inferred from careful perusal of the layout of paragraph 2.1, but it was by no means self-evident, which a guide for use in stressful conditions should have been.

2.9.10 The report passing the 330 radial for the purposes of amending the clearance, if necessary, would have been made when the pilot had a maximum of 0.85 nm or 25 seconds to run before he was required to take action to establish the aircraft on the final approach radial.

2.9.11 The Manual of Air Traffic Services required that "clearances shall be issued sufficiently early to ensure they are transmitted to the aircraft in time for the aircraft to comply with them". In this instance, the amended clearance after the aircraft had passed the 330 radial did not meet this specification. However the pilot did accept the late clearance.

2.9.12 The combination of the late clearance and the pilot's acceptance of it was a causal factor in the accident, since had the clearance remained unchanged, the pilot could have been expected to follow a preplanned procedure to a successful conclusion and thus would not have become overloaded while rebriefing himself and replanning his approach. The late revision would have been unnecessary had the controller not given the previous improper clearance, so this too was a causal factor.

2.9.13 After the issuing the revised clearance the controller had no means of assessing the progress of the aircraft on the new procedure other than the pilot's position reports and the normal time lapse for each stage of the approach. She was entitled, however, to expect the aircraft to follow the approach procedure as acknowledged by the pilot.

2.9.14 RTF exchanges between ZK-SUN and the controller, initially at about one minute intervals, took place to establish the aircraft's altitude and to clear it for further descent. At 1847.16 the controller asked, "confirm you are inbound now" which obtained the response, "still on the arc at 2500". This call was about a minute before the aircraft could be expected to have traversed the 55° of arc and turned inbound.

2.9.15 After two further calls relating to altitude the controller asked at 1850.56 hours, "report radial passing". The pilot responded "through the 360 radial." This was about two minutes after the aircraft could have been expected to have reached the 025 radial, to turn inbound on the approach. Evidently the controller then realised that the aircraft's progress was unusually slow because at 1851.24 she cleared Eagle 225 to the holding pattern "due inbound traffic taking a bit longer than expected on the arc."

2.9.16 At 1853.29 her request "your radial passing" produced the immediate response "the 010 radial". Half a minute later when the pilot of ZK-SUN responded to confirm that he would report turning inbound, the controller oted the VDF indication of 354° This was 16° from the pilot's reported radial but the report had been made in a positive manner and she continued to accept it at face value. This was about five minutes after the aircraft should have reached the 025 radial, or approximately double the time the aircraft could have been expected to take to complete this stage of the procedure.

2.9.17 The controller's next request at 1855.47 "report radial passing" produced the response, "on the 32 . . ah . . 020 turning inbound soon." This transmission produced a VDF indication of 344°, 36° from that reported.

2.9.18 The magnitude of this discrepancy caused the controller to query it, "can you just confirm your radial passing, please, you've given me a bearing here of 344?". The pilot's prompt reply was "that's affirm, sorry, 344-345."

She noted the accompanying VDF indication was then 340°.

2.9.19 It was then about eight minutes after the aircraft could be expected to have reached the 025 radial turn in point for the approach, and the pilot's last transmission had confirmed, for the first time, that the aircraft was far from where it should have been. In addition, although the significance may not have been immediately apparent to the controller, the trend of the three VDF bearings indicated the aircraft was progressing westward not eastward as the DME arc procedure prescribed.

2.9.20 The pilot had not, in any of his RTF transmissions, indicated that he had any problem coping with his task of flying the revised approach or that he required any assistance. His reports of "radial passing", while evidently in error after his last acknowledgement, had occurred in a logical sequence with the effect that the controller's growing concern for the aircraft had been allayed until then.

2.9.21 At this stage, as soon as the controller was aware that the aircraft was seriously astray from the approach procedure, she needed to have found out, with urgency, its position, altitude and heading in order to reestablish safe and orderly control of traffic.

2.9.22 She replied to the pilot's last transmission, at 1856.28, with "roger, previous bearings were giving about 354. You are now showing about 340. Just confirm your radial passing please?"

2.9.23 While this request could have prompted some information, it fell short of relevant specific requests such as DME distance from Napier, altitude and heading which would have been needed to understand the situation. In any event, the controller allowed only four seconds for the pilot to reply before she initiated calls to other aircraft, thus effectively blocking any response from him.

2.9.24 It would have been in order for her to have postponed RTF contact with other aircraft while she resolved the matter, but the controller did not attempt to do so. Instead, for the next minute and a half, she first instructed an aircraft in the holding pattern to remain there and then allowed herself to become involved in an RTF exchange with an aircraft some 50 miles away. During that time the accident happened.

2.9.25 Despite the controller's growing concern for the aircraft's lack of progress round the arc, it is unlikely that a real opportunity existed for her to take any measures to avert the accident. It is evident that the time interval between her receiving confirmation that the aircraft was astray and the collision was short, probably between 30 and 90 seconds. The time needed to ask for and receive the vital information on the aircraft's position, altitude and heading, relate this to the terrain and traffic, formulate and transmit an instruction and for the pilot to achieve a manoeuvre in response was unlikely to have been available. Nevertheless, the controller should have given priority to keeping the frequency clear for any response which the pilot might have had.

2.9.26 It was evident that the pilot's erroneous "radial passing" reports had the effect of misleading and thus allaying the controller's uneasiness about the aircraft's lack of progress around the arc, with the result that she had not become convinced that the aircraft was not where it was supposed to be until a very late stage. If she had not received the inaccurate reports she would have

been better able to recover the situation, despite the lack of a request from the pilot for assistance. The pilot's misleading reports effectively denied the controller this opportunity.

2.9.27 The pilot's erroneous reports could have been deliberate attempts to mislead the controller into thinking his approach path was normal. The sequence of reports was logical, as though he knew where he should have been and this, with his final admission of the error when confronted with the VDF bearing did suggest that he had knowingly made misleading reports to the controller.

3. FINDINGS

3.1 The pilot held a valid Commercial Pilot Licence (Aeroplane) with instrument rating and was medically fit to make the flight.

3.2 The pilot had not been checked for, and was not therefore permitted to make, a DME Arc approach.

3.3 The requirement for the pilot to be checked on a DME Arc approach before using this procedure under IFR was not stated clearly in the relevant CASO.

3.4 The pilot held the appropriate rating for the aircraft type.

3.5 The pilot's conversion instruction and type experience was insufficient to enable him to make the flight safely in ZK-SUN.

3.6 The controller was rated for the appropriate air traffic control duties at Napier.

3.7 The controller was on sole watch on the night of the accident.

3.8 The aircraft had a valid Certificate of Airworthiness and Maintenance Release. Its weight and balance were within limits.

3.9 There was no evidence of any mechanical malfunction of the aircraft which might have been a causal factor in the accident.

3.10 The pilot was not familiar with the aircraft's radio navigation equipment or the autopilot and may have been confused by them.

3.11 The aircraft was equipped with 3-pointer altimeters which had the potential to be misread.

3.12 The controller issued clearances which did not comply with the requirements of the Manual of Air Traffic Services.

3.13 The controller gave the pilot of ZK-SUN an instruction to perform a different approach procedure just as he was about to commence the original approach.

3.14 The pilot read back the clearance for the new approach procedure incorrectly and this was not corrected by the controller.

3.15 The pilot may have misunderstood the revised clearance initially.

3.16 The pilot did not advise the controller that he was having any difficulty in understanding the new clearance.

3.17 The pilot did not advise the controller that he was leaving the arc or that he was descending below the assigned minimum altitude of 3000 feet.

3.18 The pilot made reports to the controller of being on certain radials and being on the arc when he was neither on the arc nor the radial given.

3.19 The pilot probably became overloaded mentally and either was unable to comply, or decided not to comply, with the new clearance.

3.20 The pilot became disoriented geographically.

3.21 While the pilot was geographically disoriented, the aircraft collided with a hill.

3.22 The pilot may have misread his altimeter and so believed that the aircraft's altitude was 1000 feet more than was the case.

3.23 Incomplete and inaccurate information on the Aerodrome Approach Chart had the potential to mislead the pilot.

3.24 The controller had become aware that the aircraft was experiencing navigational difficulty, but did not take appropriate action to endeavour to identify and rectify the problem.

3.25 At the time the controller became aware that the aircraft was not complying with its approach clearance there was insufficient time for her to have resolved the situation.

3.26 The pilot's erroneous reports prevented the controller becoming aware of the situation in time to resolve it.

3.27 The probable cause of this accident was that the pilot was overloaded mentally and as a result became geographically disoriented and misread the aircraft's altimeter. The causal factors were a combination of a pilot whose training and experience were insufficient for him to make the flight safely, a late change of approach clearance by the controller and the pilot's erroneous and misleading reports to the controller.

3.28 Contributory factors included the pilot's inadequate conversion on to the aircraft type before making an IFR flight, the pilot's unfamiliarity with DME Arc procedures, the pilot's failure to declare an emergency due to navigational difficulty, and the use of 3-pointer altimeters in an IFR operation.

4. OBSERVATIONS

4.1 If the pilot of ZK-SUN had been experienced in single-pilot flight at night in IMC and had been familiar with his aircraft, he would have had more reserve to cope with the late change of approach clearance.

4.2 At the time of the accident, the experience level of pilots flying single-pilot IFR operations was not high. This was unlikely to change as the situation was endemic. Unless action is taken to improve the training and supervision of pilots the potential for a recurrence of an accident of this type will continue to be present.

4.3 Single pilot IFR operation is one of the most demanding tasks in civil flying, combining as it does the workload normally handled by two pilots with

the absence of cross-checking between pilots which should detect errors, yet it is usually performed by the least experienced pilots. This is because, as pilots gain experience, they tend to progress to larger aircraft: these larger aircraft are more productive, in terms of passenger-to-crew ratio, so the pilots can be paid more. The least productive aircraft, which are too small to be operated profitably with a two-pilot crew, are operated by the least experienced pilots on their own. The situation has thus arisen that the least experienced pilots are performing the most demanding task, while they accumulate hours to qualify for airline positions.

4.4 If single-pilot IFR operations with inexperienced pilots are to be performed safely, adequate training and supervision is essential. Such supervision is needed to ensure experience is gained safely, e.g. the weather conditions into which a pilot ventures and the aerodromes into which he flies in IFR conditions will be related to his experience in instrument flight. More testing conditions and aerodromes can be explored with a more experienced pilot aboard, providing not only a back-up in case of difficulty, but also the possibility of work-sharing to reduce the workload should this become excessive. Such supervision requires, in turn, that the supervisor takes a detailed interest in the flights undertaken by his/her pilots, examining the forecasts and reviewing the terrain and approaches at destination and alternates.

4.5 It would be preferable for pilots to gain experience in a two-pilot crew before undertaking single-pilot IFR operations, so that the co-pilot learns from the more experienced captain. However, airlines recruit traditionally from the most experienced pilots available and stipulate instrument flying experience as a pre-requisite, so pilots seeking an airline career are forced to gain experience with small operators on single-pilot operations.

5. SAFETY RECOMMENDATIONS

5.1 As a result of the investigation into this accident it was recommended to the Airways Corporation that:

Steps be taken to ensure that a controller can be relieved promptly, if an accident or serious incident occurs to an aircraft for which they are responsible,

Last minute changes to an IFR approach clearance be limited to an instruction to enter the holding pattern,

Controllers be made aware of the need to make allowances for pilots who may be unfamiliar with the local procedures when issuing instructions which will increase pilot workload,

The VDF systems already installed be calibrated and procedures promulgated for their use, so they can be used by the controller in controlling IFR traffic,

Controllers be taught to issue immediate and imperative advisories if they become aware that an aircraft may be standing into danger,

Consideration be given to providing cockpit familiarisation flights for controllers to gain an appreciation of the workload imposed in single pilot IFR operations.

The General Manager replied as follows:

"The relief of controllers is a matter of standard procedure. The Corporation's position remains unchanged from that advised to you in July 1986. Particularly with small units, there will not always be personnel available to enable the policy to be implemented. Where circumstances permit the Corporation will seek to replace controllers faced with similar events.

Last minute changes to an IFR approach clearance. The Corporation does not accept that there is any necessity for this recommendation.

Making allowance for pilot's unfamiliarity with local procedures. The Corporation considers controllers are already aware of the need to make allowances for pilots unfamiliar with local procedures and when they are aware of this they do so. However controllers have to proceed on the assumption that pilots are competent unless advised otherwise. It would not be practicable to work on the alternative assumption.

Use of VDF for control of IFR traffic. Your (recommendation) suggests that VDF equipment could be a valuable aid in the control of air traffic. It is not intended to be used for control purposes. The Corporation has no plans to "clear" VDF equipment for use in controlling IFR traffic."

It was also recommended that the Corporation:

Harmonise the provisions relating to separation after loss of communications in the Manual of Air Traffic Services and the Flight Guide.

Take steps to ensure that all air traffic service units practice the action to be taken in the event of emergencies, routinely.

Promulgated in the Local Unit Orders at each aerodrome, specific procedures to be followed in the event of loss of communications.

Review the supervision of inexperienced controllers with a view to preventing the development of undesirable habits and unsatisfactory techniques.

Consider establishing a requirement for a minimum level of experience for controllers who perform solo duties.

5.2 It was recommended to the General Manager of the Air Transport Division of the Ministry of Transport that:

Action be taken to bring to the attention of all pilots, that the DME Arc procedure may not be used until the pilot has been tested on the procedure by an examiner,

"DME arc" should be endorsed on the licences of instrument rated pilots qualified to use it,

CASO 12 Part 19 should be amended to move the issue requirement for the DME Arc procedures from the Recent Experience section,

The Flight Test form should be amended to reflect the fact that the pilot may not use DME Arc procedures unless he has demonstrated competency in their use,

Consideration be given to making testing in the use of DME Arc procedures mandatory on initial issue flight test for an instrument rating,

The Director replied:

"The five recommendations were considered and have been adopted with one exception.

To bring the matter to the attention of all pilots, a highlighted item was inserted in the June 1990 issue of 'New Zealand Flight Safety' (which is mailed to all pilots other than student pilots).

Following consultation through CAIC GEN B35/90, the 30 May 1991 amendment to CASO 12 incorporates changes to the flight test forms which now make DME Arc procedures mandatory, not only for initial issue of instrument ratings, but also for renewals.

I do not accept the recommendation that the DME Arc should be endorsed on instrument ratings. The procedure is a positioning method rather than an instrument approach procedure and my decision is also in conformity with ICAO, who do not require such an endorsement."

5.3 It was also recommended to the General Manager of the Air Transport Division that he:

Promulgate as soon as practicable, by NOTAM or otherwise, a warning to pilots that the information on approach plates, which relates to spot heights and lights, may be incomplete and in particular the highest ground in the immediate area of the spot height may not be depicted,

Review the policy on the provision of information on instrument approach plates, relating to navigation lights visible to pilots and the depiction of spot heights,

If it is decided that these features will be depicted, amend all approach plates as soon as practicable to

—Delete spot heights from them, other than the boxed height for the highest ground

—Ensure all navigation lights are depicted or include a notice to pilots, on the chart, advising which categories of navigation lights are depicted

Require that the Airways Corporation put in place plans for the mandatory replacement of controllers after an accident, or alternatively to close aerodromes or declare them uncontrolled after an accident for which the controller was providing air traffic service, until such time as the controller can be replaced.

Devise regulatory requirements for air traffic service standards, incorporating such a requirement.

Consider introducing training on the limitations of human performance and methods of handling excessive workload, as part of the flying training syllabus.

Require aircraft used for IFR air transport operations to be fitted with digital altimeters.

Apply the requirements for additional familiarisation flying after gaining a type rating, prescribed for air transport flights under IFR, to the pilots of any IFR flight carrying passengers.

Amend Regulation 37, in the planned review of Civil Aviation Regulations, to reflect the responsibility of the Pilot in Command stated in Regulation 59(2) and the negotiability of an ATC clearance.

Stipulate a minimum number of hours of instrument flight for pilots flying single pilot IFR on air transport operations.

Introduce a requirement for a period of supervision, following a pilot's initial qualification for single pilot IFR flight.

Adopt a stated policy that a pilot will not be prosecuted as a result of investigations following a bona fide request for assistance.

Review Section 7 paragraph 2.1 of the Instrument Flight Guide and amend it so as to clarify which phase of flight is being referred to in the various parts and have an additional statement made in paragraph 2.1 to the effect that if communications are interrupted after approach clearance is received, the approach profile is to be flown irrespective of any previous height limitation.

GLOSSARY

ACC	ATS Area Control Centre
ANZ	Air New Zealand
APE	Taupo East (Reporting Point)
ADF	Automatic direction finding (equipment)
APP	ATS Approach Control
ATC	Air Traffic Control
ATIS	Automatic terminal information service
ATS	Air Traffic Service
B55	Beechcraft 95-A55 Baron aircraft
CASO	Civil Aviation Safety Order
CATS	Chief of ATS
CDI	Course deviation indicator
DME	Distance measuring equipment
EAG	Eagle Airways
ETA	Estimated time of arrival
F27	Fokker Friendship aircraft
GA7	Grumman Cougar aircraft
GS	Gisborne
hPa	Hecto pascals
ICAO	International Civil Aviation Organisation
IFR	Instrument flight rules
ILS	Instrument landing system
IMC	Instrument meteorological conditions
kg	Kilogrammes
MATS	Manual of Air Traffic Services
MCTOW	Maximum certificated take-off weight
MP	Manifold pressure
MSA	Minimum safe altitude
NDB	Non-directional beacon
NR	Napier
NZAIP	New Zealand Aeronautical Information Publication
NZST	New Zealand Standard Time
OBS	Omni bearing selector
OH	Ohakea
QNH	Altimeter subscale setting which will cause the altimeter to indicate height above mean sea level
REP	Reporting Point
RTF	Radio telephone
SAR	Search and rescue
SPAR	Special Aerodrome (weather) Report
TWR	ATS Aerodrome Control (Tower)
VFR	Visual Flight Rules
VHF	Very high frequency
VDF	VHF direction finding equipment
VOR	Very high frequency omnidirectional radio range

TIME	FROM	TO	MODE	TRANSMISSION
1820:00				TRANSCRIPT STARTS
1821:26	COOKSON 102	NR APP	124.8	NAPIER GOOD EVENING AGAIN COOKSON ONE ZERO TWO
1821:29	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO GOOD EVENING NAPIER GO AHEAD
1821:32	COOKSON	NR APP	124.8	ONE ZERO TWO WE HAVE JUST CROSSED WAIROA SIX THOUSAND FEET UH TOP OF DESCENT TWO ON BOARD AND RECEIVED FOXTROT ONE ZERO ONE FOUR
1821:40	NR APP	COOKSON	124.8	COOKSON ONE ZERO TWO CONFIRMING FOXTROT ONE ZERO ONE FOUR AND TOP OF DESCENT CLEARED TO THREE THOUSAND ANTICIPATE THE FINAL OF THE VOR ALPHA APPROACH CIRCLING ONE SIX
1821:49	COOKSON 102	NR APP	124.8	COOKSON ONE ZERO TWO CLEARED UH THREE THOUSAND LEFT SIX
1821:53	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO THANKS REPORT AGAIN ONE FIVE NAPIER DME FOR APPROACH CLEARANCE
1821:57	COOKSON 102	NR APP	124.8	COOKSON ONE ZERO TWO REPORTING ONE FIVE DME
1822:01	NR APP	OH APP	PHONE	NAPIER
1822:02	OH APP	NR APP	PHONE	HULLO
1822:03	NR APP	OH APP	PHONE	YA
1822:04	OH APP	NR APP	PHONE	O SORRY TRANSFER NEW ZEALAND EIGHT THREE NINE
1822:07	NR APP	OH APP	PHONE	HECK NEW ZEALAND EIGHT THREE NINE GO AHEAD
1822:09	OH APP	NR APP	PHONE	NAPIER ONE SIX FLIGHT LEVEL ONE FOUR ZERO DESCENDING ONE ZERO THOUSAND FEET RELEASED ON THE HOUR NIL
1822:14	NR APP	OH APP	PHONE	HE'S EARLY
1822:15	OH APP	NR APP	PHONE	OH DON'T COMPLAIN
1822:16	NR APP	OH APP	PHONE	NO I'M NOT NEW ZEALAND EIGHT THREE NINE NAPIER ONE SIX ONE FOUR ZERO DESCENDING ONE ZERO THOUSAND RELEASED ON THE HOUR NIL
1822:22	OH APP	NR APP	PHONE	THAT'S CORRECT
1822:23	NR APP	OH APP	PHONE	THANKS
1827:59	NR APP	GS APP	PHONE	NAPIER
1828:01	GS APP	NR APP	PHONE	TRANSFER EAGLE TWO TWO FIVE
1828:02	NR APP	GS APP	PHONE	EAGLE TWO TWO FIVE GO AHEAD
1828:03	GS APP	NR APP	PHONE	WAIROA EAST AT FOUR SEVEN SIX THOUSAND NIL
1828:06	NR APP	GS APP	PHONE	EAGLE TWO TWO FIVE WAIROA EAST AT FOUR SEVEN SIX THOUSAND NIL
1828:09	GS APP	NR APP	PHONE	CONFIRM THAT'S WAIROA EAST

TIME	FROM	TO	MODE	TRANSMISSION
1828:11	NR APP	GS APP	PHONE	WAIROA EAST AFFIRM
1828:12	GS APP	NR APP	PHONE	AFFIRM
1828:13	NR APP	GS APP	PHONE	TA
1828:51	COOKSON 102	NR APP	124.8	COOKSON ONE ZERO TWO IS ONE FIVE MILES APPROACHING THREE THOUSAND
1828:55	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO CLEARED VOR ALPHA APPROACH CIRCLING RUNWAY ONE SIX
1828:59	COOKSON 102	NR APP	124.8	COOKSON ONE ZERO TWO CLEARED VOR ALPHA CIRCLING ONE SIX
1829:02	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO AND TO REPORT PASSING TWO THOUSAND
1829:06	COOKSON 102	NR APP	124.8	ONE ZERO TWO WILCO
1830:27	COOKSON 102	NR APP	124.8	ONE ZERO TWO IS ESTABLISHED ON THE APPROACH
1830:30	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO
1830:57	ZK SUN	NR APP	124.8	NAPIER THIS IS SIERRA UNIFORM NOVEMBER GOOD EVENING
1831:00	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER GOOD EVENING NAPIER GO AHEAD
1831:03	ZK SUN	NR APP	124.8	WE ARE TAUPO EAST THIS TIME LEVEL EIGHT THOUSAND WE HAVE FOXTROT ONE ZERO ONE FOUR WE WILL BE WITH YOU AT UH FOUR FIVE WITH THREE POB
1831:14	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER COPIED NAPIER FOUR FIVE WITH THREE ON BOARD UH RECLEARED NOW DME STEPS FOUR THOUSAND TO BE FIVE THOUSAND BY ONE ONE NAPIER DME ANTICIPATE THE VOR/DME APPROACH RUNWAY 16 VIA THE ARC CONFIRMING FOXTROT ONE ZERO ONE FOUR
1831:30	ZK SUN	NR APP	124.8	UNIFORM FOXTROT SIERRA IS UH CLEARED DME STEPS TO FOUR THOUSAND TO BE FIVE THOUSAND BY ONE ONE DME NAPIER AND CLEARED FOR THE ARC APPROACH ONE SIX
1831:41	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER UH JUST CONFIRMING YOU ARE NOT YET CLEARED FOR THE VOR/DME APPROACH ONE SIX REPORT AGAIN ONE FIVE MILES FOR AN APPROACH CLEARANCE
1831:49	ZK SUN	NR APP	124.8	CONFIRMING ONE FIVE MILES FOR APPROACH CLEARANCE
1831:53	ANZ 846	NR APP	124.8	NAPIER TOWER GOOD EVENING NEW ZEALAND EIGHT FOUR SIX
1831:56	UNKNOWN	NR APP	124.8	NOW PASSING ONE SEVEN ZERO ZERO

TIME	FROM	TO	MODE	TRANSMISSION
1832:01	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX GOOD EVENING NAPIER GO AHEAD
1832:04	ANZ 846	NR APP	124.8	NEW ZEALAND UH EIGHT FOUR SIX WAS NORSEWOOD THREE FIVE WE'VE UH LEFT FLIGHT LEVEL ONE THREE ZERO IN DESCENT ONE ZERO THOUSAND ESTIMATE UH NAPIER FOUR NINE
1832:13	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX COPIED NAPIER AT FOUR NINE AND UH RECLEARED NOW DME STEPS TO SEVEN THOUSAND FEET FOXTROT CONFIRMED ONE ZERO ONE FOUR AND REPORT POB
1832:26	ANZ 846	NR APP	124.8	NEW ZEALAND EIGHT FOUR SIX ROGER DME DESCENT TO SEVEN THOUSAND FEET AND WE'VE COPIED FOXTROT ONE ZERO ONE FOUR
1832:34	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX CORRECT YOUR POB PLEASE
1832:36	ANZ 846	NR APP	124.8	THREE ZERO ON BOARD EIGHT FOUR SIX
1832:39	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX COPIED THREE ZERO POB
1832:42	NR APP	GS APP	PHONE	NAPIER
1832:43	GS APP	NR APP	PHONE	REVISION EAGLE TWO TWO FIVE WAIROA EAST FOUR SIX
TIME	FROM	TO	MODE	TRANSMISSION
1832:47	NR APP	GS APP	PHONE	WAIROA EAST FOUR SIX EAGLE TWO TWO FIVE
1832:49	GS APP	NR APP	PHONE	CORRECT
1832:50	NR APP	GS APP	PHONE	TA
1834:05	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO REPORT DME AND ALTITUDE PASSING
1834:09	COOKSON 102	NR APP	124.8	UH ONE ZERO TWO IS UH THREE DECIMAL FOUR AT MINIMUMS AND CAN MAKE A VISUAL APPROACH
1834:16	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO ROGER CLEARED FOR THE VISUAL APPROACH TO JOIN LEFT BASE RUNWAY ONE SIX SURFACE WIND ONE EIGHT ZERO FIVE KNOTS REPORT ALTITUDE PASSING
1834:25	COOKSON 102	NR APP	124.8	JOINING UH LEFT BASE ONE SIX AND WE'RE AT MINIMUMS
1834:29	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO SORRY THANKS
1834:32	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER RECLEARED OW DME STEPS THREE THOUSAND STILL THE REQUIREMENT TO BE FIVE THOUSAND BY ONE ONE NAPIER DME
1834:39	ZK SUN	NR APP	124.8	UNIFORM SIERRA UNIFORM NOVEMBER IS RECLEARED TO THREE THOUSAND BY THE DME STEPS WITH THE REQUIREMENT TO BE FIVE THOUSAND BY ONE ONE DME

TIME	FROM	TO	MODE	TRANSMISSION
1834:47	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER CORRECT
1834:51	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX REPORT DME
1834:53	ANZ 846	NR APP	124.8	EIGHT FOUR SIX TWENTY SEVEN MILES
1834:56	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX THANKS
1834:59	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER YOUR DME AND ALTITUDE PASSING
1835:04	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS TWO EIGHT MILES AT EIGHT THOUSAND
1835:25	COOKSON 102	NR APP	124.8	ONE ZERO TWO IS TURNING BASE FOR ONE SIX
1835:28	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO ROGER THE SURFACE WIND ONE EIGHT ZERO FIVE KNOTS CLEARED TO LAND
1835:32	COOKSON 102	NR APP	124.8	COOKSON ONE ZERO TWO
1835:35	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX YOU'RE NUMBER TWO UH IN THE APPROACH SEQUENCE FOLLOWING UH LIGHT AIRCRAFT INBOUND ON THE TAUPO EAST TRACK ESTIMATING NAPIER FOUR FIVE HE HAS JUST CALLED TWENTY EIGHT MILES EIGHT THOUSAND AND WILL BE FOR THE VOR/DME APPROACH RUNWAY ONE SIX
1835:49	ANZ 846	NR APP	124.8	NEW ZEALAND UH EIGHT FOUR SIX ROGER THAT'S UNDERSTOOD
1835:57	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT FIVE THOUSAND
1836:01	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER WILCO
1836:08	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX YOU CAN ANTICIPATE OVERHEADING NAPIER AND UH THE VOR ALPHA APPROACH CIRCLING FOR ONE SIX
1836:18	ANZ 846	NR APP	124.8	EIGHT FOUR SIX ROGER COPIES UH VOR ALPHA FOR ONE SIX AND WE'RE APPROACHING SEVEN THOUSAND
1836:24	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX
1836:47	ANZ 846	NR APP	124.8	NAPIER EIGHT FOUR SIX UH JUST CONFIRM THE TRAFFIC AFFECTING US IS ON THE TAUPO NAPIER UH TRACK AND SAY AGAIN THE ALTITUDE
1836:58	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX AFFIRM INBOUND ON TAUPO EAST UH NAPIER DESCENDING DME STEPS THREE THOUSAND
1837:04	ANZ 846	NR APP	124.8	ROGER THAT'S UNDERSTOOD WE'RE UH ONE EIGHT MILES LEVEL SEVEN THOUSAND NOW
1837:10	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX THANKS BREAK SIERRA UNIFORM NOVEMBER YOUR ALTITUDE PASSING AND DME NAPIER

TIME	FROM	TO	MODE	TRANSMISSION
1837:15	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS TWO TWO MILES NAPIER AT EIGHT THOUSAND
1837:20	NR APP	ZK SUN ANZ 846	124.8	SIERRA UNIFORM NOVEMBER ROGER MAINTAIN EIGHT THOUSAND CANCEL YOUR PREVIOUS DESCENT CLEARANCE BREAK NEW ZEALAND EIGHT FOUR SIX IS RECLEARED NOW DME STEPS THREE THOUSAND TO ANTICIPATE THE VOR RUNWAY THREE FOUR APPROACH VIA THE ARC
1837:32	ANZ 846	NR APP	124.8	EIGHT FOUR SIX ROGER DESCENT TO DME DESCENT THREE THOUSAND FEET ANTICIPATING THE DME ARC APPROACH RUNWAY THREE FOUR
1837:37	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX CORRECT REPORT PASSING EACH THOUSAND FOOT LEVEL
1837:40	ANZ 846	NR APP	124.8	WILCO
1837:43	ZK SUN	NR APP	124.8	AND SIERRA UNIFORM NOVEMBER IS MAINTAINING EIGHT THOUSAND
1837:45	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER ROGER YOU'RE NOW NUMBER TWO FOLLOWING FRIENDSHIP TRAFFIC INBOUND OFF NORSEWOOD YOURS WILL BE A STEPPED DESCENT ON TOP OF THAT TRAFFIC
1837:50	ZK SUN	NR APP	124.8	UH COPIED SIERRA UNIFORM NOVEMBER
1837:55	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO BACK TRACK AND TAXI APRON
1837:57	COOKSON 102	NR APP	124.8	COOKSON ONE ZERO TWO
1838:02	ANZ 846	NR APP	124.8	FOUR SIX PASSES SIX THOUSAND
1838:04	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX THANKS
1838:11	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER IS RECLEARED NOW SEVEN THOUSAND
1838:16	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS RECLEARED TO SEVEN THOUSAND AND LEAVING EIGHT THOUSAND FOR SEVEN THOUSAND
1838:20	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER
1838:27	COOKSON 102	NR APP	124.8	AND COOKSON ONE ZERO TWO WILL BE UH WAIROA VIA WAIROA EAST THIS EVENING AT THREE THOUSAND FEET AND WITH NAPIER ALTERNATE
1838:36	NR APP	COOKSON 102	124.8	COOKSON ONE ZERO TWO COPIED THANKS
1838:50	ANZ 846	NR APP	124.8	NEW ZEALAND EIGHT FOUR SIX IS NOW PASSING FOUR THOUSAND FEET
1838:54	NR APP	ANZ 846 ZK SUN	124.8	NEW ZEALAND EIGHT FOUR SIX THANKS BREAK SIERRA UNIFORM NOVEMBER ARE YOU ABLE TO REACH FIVE THOUSAND BY ONE ONE NAPIER DME

TIME	FROM	TO	MODE	TRANSMISSION
1839:01	ZK SUN	NR APP	124.8	THAT'S AFFIRMATIVE WE CAN MAKE FIVE THOUSAND BY ONE ONE
1839:04	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER ROGER RECLEARED NOW FIVE THOUSAND TO BE FIVE THOUSAND BY ONE ONE NAPIER DME
1839:11	ZK SUN	NR APP	124.8	UNIFORM FOXTROT SIERRA IS CLEARED TO FIVE THOUSAND TO FIVE THOUSAND BY ONE ONE DME
1839:18	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER
1839:21	ANZ 846	NR APP	124.8	NEW ZEALAND EIGHT FOUR SIX NOW TEN MILES CONFIRM CLEARED TO AH JOIN THE ARC FOR THREE FOUR APPROACH
1839:25	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX AFFIRM CLEARED VOR RWY THREE FOUR APPROACH VIA THE ARC CIRCLING FOR ONE SIX
	ANZ 846	NR APP	124.8	NEW ZEALAND EIGHT FOUR SIX ROGER IS CLEARED FOR VOR RUNWAY ARC APPROACH RUNWAY THREE FOUR CIRCLING ONE SIX
1839:37	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX
1839:40	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT DME
1839:42	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS ONE SIX DME
1839:46	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER ROGER CLEARED FOR THE VOR/DME APPROACH RUNWAY ONE SIX VIA THE ARC NOT BELOW FIVE THOUSAND FEET INITIALLY
1839:57	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS CLEARED FOR THE VOR APPROACH ONE SIX VIA THE ARC NOT AH — TO BE FIVE THOUSAND FEET INITIALLY
1839:59	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER
1840:09	NR APP	OH APP	PHONE	NAPIER
1840:10	OH APP	NR APP	PHONE	TRANSFER NEW ZEALAND EIGHT FIVE FOUR
	NR APP	OH APP	PHONE	NEW ZEALAND EIGHT FIVE FOUR GO AHEAD
	OH APP	NR APP	PHONE	NAPIER RELEASED ONE ZERO FLIGHT LEVEL ONE FIVE ZERO NIL
1840:17	NR APP	OH APP	PHONE	NEW ZEALAND EIGHT FIVE FOUR NAPIER AND RELEASED ONE ZERO ONE FIVE ZERO NIL
	OH APP	NR APP	PHONE	CORRECT
	NR APP	OH APP	PHONE	TAH
	NR APP	GS APP	PHONE	TRANSFER NEW ZEALAND EIGHT FIVE FOUR
	GS APP	NR APP	PHONE	NEW ZEALAND EIGHT FIVE FOUR GO AHEAD
	NR APP	GS APP	PHONE	WAIROA TWO ZERO FLIGHT LEVEL ONE FIVE ZERO NIL
	GS APP	NR APP	PHONE	NEW ZEALAND EIGHT FIVE FOUR WAIROA TWO ZERO FLIGHT LEVEL ONE FIVE ZERO NIL
	NR APP	GS APP	PHONE	CORRECT CAN I HAVE SOME AHH

TIME	FROM	TO	MODE	TRANSMISSION
1840:37	NR APP	GS APP	PHONE	INITIAL DESCENT FOR HIM
	GS APP	NR APP	PHONE	AHH ONE ZERO THOUSAND
	NR APP	GS APP	PHONE	ROGER REVISED DESCENDING ONE ZERO THOUSAND
	GS APP	NR APP	PHONE	CORRECT AHH WILL YOU ACCEPT MIKE SIERRA LIMA NON STANDARD FIVE THOUSAND WITH PALMERSTON
1840:50	NR APP	GS APP	PHONE	MIKE SIERRA LIMA AHH IS ACCEPTED NON STANDARD FIVE THOUSAND WITH PALMERSTON
	GS APP	NR APP	PHONE	MIKE SIERRA LIMA IS ACCEPTED NON STANDARD FIVE THOUSAND WITH PALMERSTON
1841:00	NR APP	GS APP	PHONE	AFFIRM THANKS
	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX YOUR ALTITUDE PASSING
1841:05	ANZ 846	NR APP	124.8	NEW ZEALAND EIGHT FOUR SIX JUST PASSING TWO THOUSAND FEET ABOUT TO TURN INBOUND
	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX THANKS
1841:13	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER RECLEARED ON THE APPROACH TO THREE THOUSAND
1841:19	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS RECLEARED ON THE APPROACH TO THREE THOUSAND AND JOINING ARC THIS TIME
1841:27	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER
1842:18	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT PASSING THE NAPIER, THREE THREE ZERO RADIAL
1842:22	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER WILCO
1842:24	NR APP	ZK SUN	124.8	AND YOUR ALTITUDE PASSING NOW
1842:26	ZK SUN	NR APP	124.8	AH THROUGH FIVE THOUSAND
	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER
1842.31	EAG 225	NR APP	124.8	NAPIER GOOD EVENING EAGLE TWO TWO FIVE
1842:35	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE GOOD EVENING NAPIER GO AHEAD
1842:40	EAG 225	NR APP	124.8	AH JUST CROSSED WAIROA EAST THIS TIME LEVEL SIX THOUSAND BE TOP OF DESCENT YOUR VOR AT TIME FIVE SEVEN IN RECEIPT OF FOXTROT ONE ZERO ONE FOUR WITH NINE POB
1842:53	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE COPIED NINE ON BOARD NAPIER FIVE SEVEN MAINTAIN SIX THOUSAND AND FOXTROT CONFIRMED ONE ZERO ONE FOUR YOU CAN ANTICIPATE THE VOR ALPHA APPROACH CIRCLING FOR ONE SIX YOU ARE NUMBER THREE IN THE APPROACH SEQUENCE FOLLOWING AH FRIENDSHIP TRAFFIC AND THEN AH A LIGHT AIRCRAFT INBOUND OFF TAUPO EAST TRACK FOR THE VOR DME ONE SIX ESTIMATING NAPIER FOUR FIVE

TIME	FROM	TO	MODE	TRANSMISSION
1843:15	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE COPIED MAINTAINING SIX THOUSAND
1843:25	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX YOUR DME AND ALTITUDE PASSING
1843:31	ANZ 846	NR APP	124.8	EIGHT FOUR SIX SEVEN MILES AT FIFTEEN HUNDRED FEET
1843:37	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX
1843:45	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER YOU CAN ANTICIPATE FURTHER DESCENT ONCE THE FRIENDSHIP TRAFFIC INBOUND OFF THE THREE FOUR APPROACH IS ASSURED OF A LANDING
1843:57	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER COPIED AND PASSING THE THREE THREE ZERO RADIAL THIS TIME
1844:02	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER ROGER CONTINUE ON ROUND THE ARC TO TURN INBOUND FOR THE VOR ALPHA CIRCLING ONE SIX APPROACH NOT BELOW THREE THOUSAND
1844:15	ZK SUN	NR APP	124.8	CONTINUING AROUND THE ARC TO AH FOR THE ONE SIX ALPHA APP. . . NOT BELOW THREE THOUSAND
1844:18	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER YOUR ALTITUDE NOW
1844:22	ZK SUN	NR APP	124.8	FOUR THOUSAND
1844:24	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER CONFIRM FOUR THOUSAND
1844:27	ZK SUN	NR APP	124.8	THAT'S FOUR THOUSAND
1844:29	NR APP	ZK SUN/	124.8	SIERRA UNIFORM NOVEMBER THANKS BREAK EAGLE
		EAG 225		TWO TWO FIVE AT TOP OF DESCENT CLEARED FIVE THOUSAND
1844:32	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE AT TOP OF DESCENT CLEARED TO FIVE THOUSAND WE ARE LEAVING SIX THIS TIME
1844:38	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE THANKS
1844:40	ANZ 846	NR APP	124.8	NEW ZEALAND EIGHT FOUR SIX IS VISUAL AND CIRCLING LEFT HAND
1844:46	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX ROGER CIRCLE LEFT HAND RUNWAY ONE SIX SURFACE WIND TWO ONE ZERO FIVE KNOTS CLEARED TO LAND
1844:58	ANZ 846	NR APP/TWR	124.8	EIGHT FOUR SIX
1845:28	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT APPROACHING THREE THOUSAND OR TURNING INBOUND WHICHEVER'S SOONER
1845:32	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER
1845:56	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE APPROACHING FIVE THOUSAND

TIME	FROM	TO	MODE	TRANSMISSION
1846:00	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE AH ROGER MAINTAIN FIVE THOUSAND YOUR DME NAPIER
1846:04	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE MAINTAINING FIVE THOUSAND AND WE ARE TWENTY MILES
1846:10	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE THANKS ROGER REPORT AGAIN AH ONE FIVE NAPIER DME
1846:14	EAG 225	NR APP	124.8	TWO TWO FIVE WILCO
1846:15	ZK SUN	NR APP	124.8	UNIFORM FOXTROT SIERRA IS APPROACHING TWO (INDISTINCT) THOUSAND
1846:20	NR APP	ZK SUN	124.8	UNIFORM FOXTROT CORRECTION SIERRA UNIFORM NOVEMBER
1846:21	ZK SUN	NR APP	124.8	(UNINTELLIGIBLE WORD) . . . CORRECTION
1846:30	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER IS RECLEARED TO TWO THOUSAND FEET ON THE APPROACH
1846:34	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS RECLEARED TWO THOUSAND ON THE APPROACH
1846:37	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER BREAK EAGLE TWO
		EAG 225		TWO FIVE RECLEARED FOUR THOUSAND
1846:41	EAG 225	NR APP	124.8	TWO TWO FIVE RECLEARED TO FOUR THOUSAND OUT OF FIVE THIS TIME
1847:16	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER ER CONFIRM YOU ARE INBOUND NOW
1847:21	ZK SUN	NR APP	124.8	AH STILL ON THE ARC . . .AT TWO FIVE HUNDRED
1847:31	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER
1847:38	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE REPORT DME
1847:41	EAG 225	NR APP	124.8	TWO TWO FIVE IS JUST COMING UP ON FIFTEEN NOW
1847:51	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE ROGER CONTINUE AH ON TRACK TO THE VOR ANTICIPATE THE VOR RUNWAY THREE FOUR APPROACH COMMENCING OVERHEAD
1848:02	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE TO MAINTAIN FOUR THOUSAND TO THE AH VOR ANTICIPATING VOR THREE FOUR
1848:09	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE
1848:13	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER UNRESTRICTED ON THE APPROACH
1848:15	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS UNRESTRICTED ON THE APPROACH
1848:48	NR APP	ANZ 846	124.8	NEW ZEALAND EIGHT FOUR SIX BACKTRACK AND TAXI APRON
1848:53	ANZ 846	NR APP/TWR	124.8	NEW ZEALAND EIGHT FOUR SIX ONE FIVE ZERO NIL THANKS

TIME	FROM	TO	MODE	TRANSMISSION
1848:59	NR APP/TWR	ANZ 846 124.8	COPIED ONE FIVE ZERO NIL	
1849:05	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT AH PASSING TWO THOUSAND
1849:08	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER WILCO
1849:28	COOKSON 102	NR APP/TWR	124.8	NAPIER COOKSON ONE ZERO TWO
1849:32	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE IS LEVEL FOUR THOUSAND
1849:35	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE ROGER YOUR DME
1849:38	EAG 225	NR APP	124.8	ER WE ARE TEN MILES
1849:40	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE REPORT AGAIN FIVE MILES
1849:44	EAG 225	NR APP	124.8	TWO TWO FIVE WILCO
1849:45	NR APP/TWR	COOKSON 102	124.8	COOKSON ONE ZERO TWO NAPIER
1849:48	COOKSON 102	NR APP/TWR	124.8	ONE ZERO TWO IS READY TO START WE HAVE THREE ON BOARD FOXTROT ONE ZERO ONE FOUR
1849:53	NR APP/TWR	COOKSON 102	124.8	COOKSON ONE ZERO TWO CONFIRMING FOXTROT ONE ZERO ONE FOUR COPIED THREE ON BOARD YOU CAN ANTICIPATE ABOUT A AH FIVE TO SIX MINUTE DELAY DUE TO INBOUND TRAFFIC CALL BACK AT TIME FIVE SEVEN FOR A START
1850:32	NR APP	GS APP	PHONE	NAPIER
1850:33	GS APP	NR APP	PHONE	TRANSFER MIKE SIERRA LIMA
1850:34	NR APP	GS APP	PHONE	MIKE SIERRA LIMA GO AHEAD
1850:36	GS APP	NR APP	PHONE	WAIROA ONE ONE NON STANDARD FIVE THOUSAND WITH PALMERSTON
1850:41	NR APP	GS APP	PHONE	MIKE SIERRA LIMA WAIROA ONE ONE NON STANDARD
	FIVE THOUSAND PALMERSTON			
	GS APP	NR APP	PHONE	CORRECT
	NR APP	GS APP	PHONE	TA
1850:56	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT RADIAL PASSING
1851:01	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS THROUGH THE AH THREE SIX ZERO RADIAL
1851:20	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE IS FIVE MILES
1851:24	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE ROGER DUE INBOUND TRAFFIC AH TAKING A BIT LONGER THAN EXPECTED ON THE ARC UM MAKE ONE LAP OF THE NAPIER HOLD FOUR THOUSAND REPORT INBOUND IN THE HOLD FOR APPROACH CLEARANCE
1851:35	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE TO DO ONE LAP OF THE HOLD NAPIER FOUR THOUSAND AND WILCO

TIME	FROM	TO	MODE	TRANSMISSION
1851:43	NR APP	EAG 225/ ZK SUN	124.8	EAGLE TWO TWO FIVE BREAK SIERRA UNIFORM NOVEMBER YOUR ALTITUDE PASSING
1851:46	ZK SUN	NR APP	124.8	TWO THOUSAND
1851:49	NR APP	ZK SUN	124.8	SORRY WAS THAT TWO THOUSAND
1851:53	ZK SUN	NR APP	124.8	THAT'S AFFIRMATIVE TWO THOUSAND
1851:57	NR APP	ZK SUN/ EAG 225	124.8	SIERRA UNIFORM NOVEMBER THANKS BREAK EAGLE TWO TWO FIVE IS RECLEARED THREE THOUSAND TO HOLD NAPIER THREE THOUSAND
1852:07	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE DO YOU COPY
1852:09	EAG 225	NR APP	124.8	TWO TWO FIVE NEGATIVE
1852:11	NR APP	EAG 225	124.8	ROGER RECLEARED THREE THOUSAND TO HOLD NAPIER THREE THOUSAND
1852:16	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE RECLEARED THREE THOUSAND TO HOLD NAPIER THREE THOUSAND
1853:18	NR APP	GS APP	PHONE	NAPIER
	GS APP	NR APP	PHONE	REVISION MIKE SIERRA LIMA WAIROA AT ONE TWO
1853:22	NR APP	GS APP	PHONE	MIKE SIERRA LIMA WAIROA ONE TWO
1853:22	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE CROSSED THE VOR
1853:27	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE
1853:29	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER YOUR RADIAL PASSING
1853:32	ZK SUN	NR APP	124.8	THE AH ZERO ONE ZERO RADIAL
1854:00	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT TURNING INBOUND
1854:02	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER WILCO
1854:27	NR APP	GS APP	PHONE	NAPIER
	GS APP	NR APP	PHONE	REVISION MIKE SIERRA LIMA ALTERNATE NOW NAPIER
1854:29	NR APP	GS APP	PHONE	ALTERNATE NOW NAPIER . . . TA
1854:34	NR APP	OH APP	PHONE	NAPIER
	OH APP	NR APP	PHONE	REVISION NEW ZEALAND EIGHT AH FIVE . . . FOUR NAPIER RELEASED (UNINTELLIGIBLE) EIGHT
	NR APP	OH APP	PHONE	NEW ZEALAND EIGHT FIVE FOUR NAPIER AND RELEASED ONE EIGHT
	OH APP	NR APP	PHONE	CORRECT
	NR APP	OH APP	PHONE	TA
1854:43	NR APP	D MORGAN	PHONE	HULLO
	D MORGAN	NR APP	PHONE	HI, ITS DAVE MORGAN FROM THE FRIENDSHIP JUST WANT TO GET THE ACTUALS ON AUCKLAND AND HAMILTON IF I COULD
	NR APP	D MORGAN	PHONE	YEAH COME ON UP
	D MORGAN	NR APP	PHONE	THANKS

TIME	FROM	TO	MODE	TRANSMISSION
1855:39	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE IS LEVEL THREE THOUSAND
1855:42	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE
1855:44	EAG 225	NR APP	124.8	AND WE'RE ESTABLISHED INBOUND IN THE HOLDING PATTERN
1855:47	NR APP	EAG 225/ ZK SUN	124.8	EAGLE TWO TWO FIVE ROGER BREAK SIERRA UNIFORM NOVEMBER REPORT RADIAL PASSING
1855:56	ZK SUN	NR APP	124.8	SIERRA UNIFORM NOVEMBER IS . . . AH ON THE THREE TWO AH ZERO TWO ZERO TURNING INBOUND SOON
1856:07	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER CAN YOU JUST CONFIRM YOUR RADIAL PASSING PLEASE YOU'VE GIVEN ME A BEARING HERE OF THREE FOUR FOUR
1856:17	ZK SUN	NR APP	124.8	AH THAT'S AFFIRM SORRY THREE FOUR FOUR THREE FOUR FIVE
1856:28	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER ROGER PREVIOUS BEARINGS WERE GIVING ABOUT THREE FIVE FOUR YOU ARE NOW SHOWING ABOUT THREE FOUR ZERO JUST CONFIRM YOUR RADIAL PASSING PLEASE
1856:36	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE DUE TO THE INBOUND AIRCRAFT ON THE ARC I AM UNABLE TO GIVE YOU FURTHER DESCENT AH HOLD NAPIER FOR ANOTHER LAP
1856:49	EAG 225	NR APP	124.8	TWO TWO FIVE WILCO
1856:53	ANZ 839	NR APP	124.8	NAPIER GOOD EVENING NEW ZEALAND EIGHT THREE NINE
1856:56	NR APP	ANZ 839	124.8	NEW ZEALAND EIGHT THREE NINE GOOD EVENING NAPIER GO AHEAD
1857:00	ANZ 839	NR APP	124.8	NEW ZEALAND EIGHT THREE NINE MAINTAINING FLIGHT LEVEL ONE FOUR ZERO FIVE ZERO DME NAPIER COPIED FOXTROT ONE ZERO ONE FOUR
1857:09	NR APP	ANZ 839	124.8	NEW ZEALAND EIGHT THREE NINE COPIED AH FIVE ZERO NAPIER DME FOXTROT CONFIRMED ONE ZERO ONE FOUR STANDBY FOR DESCENT
1857:14	ANZ 839	NR APP	124.8	NEW ZEALAND EIGHT THREE NINE
1857:36	NR APP	ANZ 839	124.8	NEW ZEALAND EIGHT THREE NINE AT TOP OF DESCENT RECLEARED DME STEPS TO FOUR THOUSAND TO BE FOUR THOUSAND BY EIGHT NAPIER DME
1857:47	ANZ 839	NR APP	124.8	NEW ZEALAND EIGHT THREE NINE AT TOP OF DESCENT CLEARED DME STEPS FOUR THOUSAND TO BE FOUR THOUSAND BY EIGHT NAPIER DME. TWO ONE POB
1857:55	NR APP	ANZ 839	124.8	NEW ZEALAND EIGHT THREE NINE COPIED TWO ONE ON BOARD. YOU CAN ANTICIPATE THE VOR DME APPROACH RUNWAY ONE SIX VIA THE ARC REPORT ONE FIVE MILES

TIME	FROM	TO	MODE	TRANSMISSION
1858:02	ANZ 839	NR APP	124.8	NEW ZEALAND EIGHT THREE NINE WILCO LEAVING FLIGHT LEVEL ONE FOUR ZERO DESCENDING DME STEPS FOUR THOUSAND
1858:06	NR APP	ANZ 839	124.8	NEW ZEALAND EIGHT THREE NINE THANKS
1858:09	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER REPORT RADIAL PASSING PLEASE
1858:26	NR APP	ZK SUN	124.8	SIERRA UNIFORM NAPIER
1858:39	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER NAPIER
1858:57	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER SIERRA UNIFORM NOVEMBER NAPIER DO YOU READ
1859:21	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER NAPIER
1859:26	WAIROA	NR APP	124.8	NAPIER THIS IS WAIROA
	NR APP	WAIROA	124.8	WAIROA NAPIER GO AHEAD
	WAIROA	NR APP	124.8	ROGER IS ONE ZERO TWO ON THE WAY YET
1859:48	NR APP	WAIROA	124.8	AH THERE IS A SLIGHT DELAY AT NAPIER DUE TRAFFIC AND PROBABLY WONT BE AIRBORNE FOR ANOTHER TEN MINUTES OR SO
1859:51	WAIROA	NR APP	124.8	OH HAPPY DAYS ROGER THANKS
1859:54	NR APP	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER NAPIER
1900:00	NR APP	EAG 225	124.8	EAGLE TWO TWO FIVE NAPIER
	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE WE ARE JUST TURNING INBOUND IN THE HOLDING PATTERN THIS TIME
1900:07	NR APP	EAG 225	124.8	ROGER COULD YOU TRY GIVING SIERRA UNIFORM NOVEMBER A CALL PLEASE HE SHOULD BE LISTENING OUT ONE TWO FOUR EIGHT AND AH I'M NOT SURE OF HIS DIRECTION OF TRAVEL AT THE MOMENT HE SHOULD BE ABOUT TEN MILES OUT ON THE ARC SOMEWHERE NOT RESPONDING
1900:21	EAG 225	NR APP	124.8	EAGLE TWO TWO FIVE UNDERSTAND IT WAS SIERRA NOVEMBER UNIFORM
1900:25	NR APP	EAG 225	124.8	NO SIERRA UNIFORM NOVEMBER
1900:31	EAG 225	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER THIS IS EAGLE TWO TWO FIVE DO YOU READ?
1900:44	EAG 225	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER EAGLE TWO TWO FIVE
1901:04	EAG 225	ZK SUN	124.8	SIERRA UNIFORM NOVEMBER EAGLE TWO TWO FIVE