



**Report 98-006**

**Fairchild Metro RLK 8611**

**fog/low fuel landing incident**

**Christchurch Airport**

**8 May 1998**

### **Abstract**

On Friday 8 May 1998 Air Nelson Metro ZK-NSJ, Airlink (RLK) 8611, was being operated on a scheduled service at night from Hokitika to Christchurch when the incident occurred. Unforecast fog occurred at the destination and alternate aerodromes. The aircraft made four ILS approaches before being able to land at the destination. No alternative course of action remained available to the crew at that stage because of the low amount of fuel remaining.

Safety issues identified are:

- the procedure for crews to release company agents from departure aerodromes
- the availability of current weather information from company agents at Timaru and Hokitika
- the CAA action to amend Rules to allow category 1 ILS minima to become normal
- the need for pilots to weigh and interpret weather information and not just take issued forecasts at face value.

Three safety recommendations were made to address these issues.

# Transport Accident Investigation Commission

## Aircraft Incident Report 98-006

<b>Aircraft type, flight number and registration:</b>	Fairchild SA 227 Metro, RLK 8611, ZK-NSJ
<b>Date and time:</b>	8 May 1998, 2001 hours <sup>1</sup>
<b>Location:</b>	Christchurch Airport
<b>Type of flight:</b>	Scheduled passenger transport
<b>Persons on board:</b>	Crew: 2 Passengers: 5
<b>Injuries:</b>	Nil
<b>Nature of damage:</b>	Nil
<b>Investigator-in-Charge:</b>	J J Goddard

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<sup>1</sup> All times in this report are in NZST (UTC + 12)

# 1. Factual information

## History of the flight

- 1.1 On Friday 8 May 1998 Air Nelson Metro ZK-NSJ, Airlink (RLK) 8611, was being operated on a scheduled service at night from Hokitika to Christchurch when the incident occurred. This was the return leg of the second round trip between Christchurch and Hokitika flown that afternoon and evening by the aircraft and crew.
- 1.2 The crew had started their duty at 1125 hours at the airline headquarters in Nelson, where they prepared and planned for their allocated flights. They then passengered to Christchurch where, after a meal break, they took over the aircraft. Fuel was loaded for the first round trip, and the crew reviewed the current weather information.
- 1.3 The first round trip to Hokitika and back to Christchurch, with the first officer as the pilot flying (PF), was without incident. They had departed from Christchurch at 1445 and returned at 1648 hours. The weather had been good, enabling visual approaches for each landing.
- 1.4 At Christchurch the crew reviewed the current weather information. The amended Christchurch aerodrome forecast (TAF) was for a temporary change after 1800 hours to broken low cloud, with fog temporarily forecast for the following morning. The unamended Timaru TAF was for scattered cloud at 4000 feet. Fuel was loaded for the round trip, allowing for Timaru as an alternate for Christchurch.
- 1.5 After a meal break for the crew, the aircraft departed at 1747 hours, with the captain as PF. The flight to Hokitika was routine, with the weather permitting a visual approach.
- 1.6 At Hokitika the crew reviewed the available weather information. The 1800 hours Christchurch weather report (METAR) reported scattered cloud at 300 feet, with the added TREND forecast of broken cloud at 300 feet, as expected. They noted the added remark "Extensive low cloud bank to NE, fog reported SE over Wigram airfield". The latest Timaru METAR, for 1700 hours, reported a visibility of 40 km and scattered cloud at 18000 feet. An additional 100 pounds of fuel was loaded, to ensure the fuel reserve was sufficient for the route, with Timaru as the nominated alternate.
- 1.7 The aircraft departed from Hokitika at 1848 hours, and the initial part of the flight was routine. At about their decision point on the route across the Southern Alps the crew advised the company agent at Hokitika that he was released. Shortly afterwards, as the aircraft approached top of descent at 1906 hours, Christchurch Air Traffic Control (ATC) advised the crew that the Christchurch weather had become 800 m visibility in fog.
- 1.8 As the descent was continued to Christchurch the first officer tried to contact the company agent at Timaru by radio for a weather report, without success. The crew however established from ATC that a Boeing 737 aircraft had just made a successful instrument landing system (ILS) approach and landing at Christchurch, its crew reporting that the weather was near the category 1 minima for the ILS. RLK 8611 was cleared for an ILS approach runway 20, which was flown to the normal decision altitude (DA) by the captain. No approach or runway lights were seen, so the missed approach procedure was followed, climbing to Burnham non-directional beacon (NDB).
- 1.9 During the ILS approach the first officer had asked Christchurch Tower for the current Timaru weather. After the missed approach Christchurch Tower advised that the Timaru weather was unavailable through them, but that company operations (Ops) may be able to help. The first officer called Ops who advised that Timaru was in fog.

- 1.10 After joining the Burnham holding pattern the crew checked that they had sufficient fuel endurance to return to Hokitika, and asked ATC if the agent could be contacted to return to Hokitika to operate the runway lights. They also requested an ILS approach for runway 02, rather than fly in the holding pattern.
- 1.11 An ATR 72 aircraft at this time made a successful ILS approach and landing on runway 20.
- 1.12 RLK 8611 was cleared for the runway 02 ILS approach, which was flown to the normal DA without success, followed by the missed approach procedure, towards Woodend NDB.
- 1.13 The crew asked ATC to check the weather at Wigram and Nelson aerodromes. ATC reported that Wigram had visibility of 150 m in fog, while Nelson was clear with good visibility.
- 1.14 At that stage the crew checked the flight time required to divert to Nelson, and found it to be marginal for their endurance. They advised Christchurch Tower that their endurance was 50 minutes, and that they were “fuel critical”.
- 1.15 The crew decided to make a further ILS approach for runway 20, and the captain briefed that he would continue the approach until they had visual contact, which was agreed by the first officer.
- 1.16 The third ILS approach, for runway 20, was flown to about the category 1 DA, where the first officer reported seeing the approach lights. The captain looked up, and called for landing flap as he saw the runway end lights. This resulted in the approach becoming destabilised slightly and misaligned with the runway, so a further missed approach was made.
- 1.17 As the aircraft was being repositioned for a further runway 20 approach, ATC reported that Hokitika was attended, with the runway lights on. The crew checked their remaining endurance, and concluded that it was insufficient to divert to Hokitika.
- 1.18 They briefed for another ILS approach for runway 20, again descending until visual, but that the flap setting would remain at half-flap, and when the first officer had sufficient visual cues he would take over control and land the aircraft.
- 1.19 After a BAe 146 aircraft had successfully landed from the ILS approach, the crew repositioned RLK 8611 for the approach. At that stage they reported to ATC that they had 30 minutes endurance remaining. ATC decided to declare a full emergency, and the airport rescue fire service was alerted and positioned appropriately about the aerodrome.
- 1.20 Christchurch Tower at this stage asked the crew of a Boeing 737 aircraft which was preparing to depart if they could make some taxi runs on the approach end of runway 20, to try to reduce the fog locally with the aircraft’s jet blast. This was done in co-ordination with RLK 8611’s approach to the runway.
- 1.21 RLK 8611 was flown on a fourth ILS approach, which proceeded as the crew had briefed. The first officer took control at about 150 feet above the runway, and a safe landing was made at 2001 hours.
- 1.22 The fuel remaining was estimated by the crew during refuelling the next day to have been 200 pounds, equivalent to about 20 minutes endurance.

## **Meteorological information**

- 1.23 A shallow depression was centred east of Christchurch with a deeper depression south of Stewart Island. A light south to south-west flow covered the area.
- 1.24 Satellite images taken during the afternoon showed mainly clear skies over the land east of the Southern Alps, and an extensive mass of low cloud or fog along the coast and out to sea south and east of Banks Peninsula.
- 1.25 The TAFs for Christchurch and Timaru were:
- Christchurch, issued at 1432 hours, valid from 1400 to 0700 hours: surface wind 050°/5 knots, visibility 30 km, cloud few 4000 feet. Temporarily between 0500 and 0700 hours visibility 800 m in fog.
  - Christchurch, amended at 1613 hours: surface wind 250°/5 knots, visibility 30 km, cloud few 4000 feet. Temporarily between 1800 and 2200 hours cloud broken 300 feet; temporarily between 0200 and 0700 hours visibility 800 m in fog.
  - Timaru, issued at 1432 hours, valid from 1400 to 0700 hours: surface wind 200°/8 knots, visibility 30 km, cloud few 4000 feet. Becoming between 1700 and 2000 hours wind variable/3 knots. Temporarily between 0400 and 0700 hours visibility 1200 m in haze.
- 1.26 The METARs for Christchurch were:
- 1600 hours: surface wind 250°/2 knots, visibility 30 km, cloud few 300 feet, temperature 19/dewpoint 11, QNH 1002. Remarks: low cloud bank extending to all areas approx. 30 km CH aerodrome.
  - 1700 hours: surface wind 210°/2 knots, visibility 30 km, cloud few 300 feet, temperature 18/dewpoint 11, QNH 1003. Temporarily from 1800 hours cloud broken 300 feet. Remarks: extensive low cloud bank east along coast to Port Hills.
  - 1800 hours: surface wind 180°/5 knots, visibility 30 km, cloud few 300 feet, temperature 13/dewpoint 11, QNH 1003. Temporarily cloud broken 300 feet. Remarks: extensive low cloud bank to north-east. Fog bank reported south-east over Wigram airfield.
  - 1900 hours: surface wind 200°/5 knots, visibility 1000m in fog, temperature 10/dewpoint 09, QNH 1004. Becoming visibility 30 km, no significant weather, temporarily cloud broken 300 feet.
- 1.27 The METARs for Timaru were:
- 1200 hours: surface wind 110°/6 knots, visibility 60 km, cloud few 15000 feet, temperature 18/no dewpoint, QNH 1001.
  - 1700 hours: surface wind 270°/3 knots, visibility 40 km, cloud scattered 18000 feet, temperature 13/no dewpoint, QNH 1003. Remarks: haze. (No other METAR report was made during this period.)

- 1.28 The Meteorological Standards Manager of MetService commented on the preparation of these TAFs. His report was:

The day shift is responsible for writing the overnight TAFs shortly before he finishes duty. In considering the TAFs the forecaster felt the midday analysis and the model guidance both indicated that the flow would be too westerly to allow the fog over the sea to advect over the two airfields. In addition the model guidance also indicated a drying trend in the low-level air during the evening and the night hours. He concluded that radiation fog was a possibility early the following morning and this was forecast to occur towards the end of the forecast period and with nothing occurring earlier.

The evening shift assumed responsibility for monitoring the TAFs from about 3pm. He received advice of an extensive bank of fog or low cloud from Air New Zealand at about 1600 and amended the Christchurch TAF to include a TEMPO BKN 003 from 1800 to 2200. It was felt that by 2200 the normal katabatic wind flow would disperse the low cloud. The Timaru TAF was not amended because the low cloud or fog bank was further away and successive satellite pictures showed it to be heading for Christchurch rather than Timaru. Both TAFs were amended once fog was established at Christchurch.

Both forecasters were handicapped by a lack of manual observations at Timaru. They had little information on which to base the initial TAF or any subsequent amendments. Pilots are warned in the AIP Planning Manual that TAFs that are not supported by observations will have a lower standard of accuracy than at times when observations are available and that amendments may not be made once three hours have elapsed since the last observation. The few observations that are received for Timaru are made close to the arrival times of Air Nelson flights. In addition the AWS (automatic weather station) is an older model and is not equipped with visibility and cloud sensors. The small number of scheduled flights does not justify the expense of up-grading the AWS.

Both forecasters followed the correct procedures and made their decisions based on an analysis of all the information they had available. The causes of the forecasts being incorrect stems from two decisions. The first in deciding that the fog/low cloud would miss Christchurch and the second in opting for low cloud instead of fog. In both cases it was a judgement call. It is possible that the first forecaster did not fully allow for the effect of Banks Peninsula on the model flow. A south-west airflow is deflected more southerly around the western side of the peninsula bringing any fog or low cloud into Christchurch. Most computer models have a mesh that is too coarse to be able to take into account the relatively small size of Banks Peninsula.

- 1.29 The Christchurch Tower controller reported that the fog rolled in quite quickly from the south, with a southerly wind picking up to about 8 knots. The pilot of a light aircraft on a local VFR flight which landed on runway 20 at 1903 hours reported that the fog had covered the southern two-thirds of the runway at that time.
- 1.30 The crew of RLK 8611 had observed the low cloud bank towards the coast east of Christchurch during their arrivals and departures that afternoon, and expected it to move over the aerodrome as a broken cloud layer after 1800 hours, as indicated by the forecast.

### **Personnel information**

- 1.31 The captain had been with Air Nelson for four years, and had been a Metro captain for two years. He had previously served 20 months as a first officer on the Saab 340, and 5 months as a first officer on the Metro. He had flown the Christchurch-Hokitika and -Timaru routes numerous times over 2½ years.
- 1.32 The first officer had been with Air Nelson for three months as a first officer on the Metro, with some 130 hours on type. He had flown the route about 30 times. His previous experience was on single-pilot and two-pilot operations on a PA 31 Chieftain.
- 1.33 Both crew reported good mutual communication, co-operation and support during the incident, and that their crew resource management worked well in their decision-making.

### **ILS approach information**

- 1.34 The Metro aircraft in the airline fleet were equipped with appropriate navigation aids for two-pilot IFR operations, including ILS approaches, but this equipment did not include an autopilot or flight director system. As a result, the operation had been limited to normal ILS minima rather than category 1 minima, in accordance with Civil Aviation Safety Order (CASO) 1, section 6. This essentially resulted in a decision height (DH) of 300 feet rather than the category 1 minimum of 200 feet.
- 1.35 The other aircraft which landed at Christchurch during the period of this incident had used category 1 minima for their ILS approaches.
- 1.36 Civil Aviation Rules (CAR) part 91 came into effect on 1 April 1997. This removed all reference to category 1 minima, with the intention of making the previous category 1 minima the normal minima for ILS approaches. CASO 1 had been revoked on 1 April 1997, with the prescriptions of some sections and appendices being assumed by CAR part 19, Transition Rules. CASO 1, section 6 was not included.
- 1.37 Supplementary regulatory documents issued by the Director of Civil Aviation, including Operations Specifications, and NZAIP instrument approach charts, had not been amended in concert with CAR part 91. The result of this was that the intended regulatory change, of making the category 1 minima the normal minima, did not take effect.
- 1.38 The normal ILS minima adopted by most other States were essentially similar to the New Zealand category 1 minima.

### **Alternate aerodrome information**

- 1.39 The Air Nelson Route Guide, page 4-2-1, included:

#### **Unattended Aerodromes**

A flight under IFR shall not be planned to an unattended aerodrome as a destination or as an alternate aerodrome unless:

... the following information is available to the pilot in command throughout the flight:

- the local weather conditions at the aerodrome
- any significant change in the state of the manoeuvring area or facilities at the aerodrome which may constitute a hazard to the operation of the aircraft.

All reports shall be originated by an approved person to make such observations at the aerodrome and shall be forwarded to the appropriate ATS unit as soon as possible.

The information specified in the above paragraph shall be available to the pilot in command, through the ATS unit providing service to the flight, before the flight is commenced and while the aircraft is in flight.

- 1.40 An approved company agent was located at Timaru, whose duties included making such reports. When the crew of RLK 8611 tried unsuccessfully to contact him by radio, he was probably on the apron at Timaru attending to another Air Nelson aircraft which had arrived just before the fog had closed the aerodrome, and was thus out of earshot of the base radio.

## 2. Analysis

- 2.1 This incident stemmed from three principal sources:

- the aerodrome weather forecasts for Christchurch and Timaru which were incorrect,
- the crew of RLK 8611 largely taking these forecasts at face value and planning accordingly,
- the timing of the onset of fog at Christchurch and Timaru in relation to the progress of the flight.

- 2.2 There were two supplementary events which probably precipitated the incident, however. In chronological order these were:

- the crew releasing the company agent at Hokitika before they had current weather information on their destination and alternate aerodromes. This action effectively precluded the option of a return to Hokitika because the agent was not then available to switch on the runway lights.
- the unavailability of a report of the weather at Timaru, their alternate aerodrome, at a critical time in their descent to Christchurch.

- 2.3 If these two events had not occurred, the crew would have been aware in good time that their destination weather was marginal at best, and also that their planned alternate was unavailable, due fog. A return to Hokitika would have remained available at that stage, and would have been a simple and prudent course of action to take.

- 2.4 The action taken by the crew of releasing the company agent at about their decision point on the route across the Southern Alps was probably routine, but when taken at night committed them to continue before they had obtained current weather information on the destination and alternate aerodromes.

- 2.5 The company route guide had required that an aerodrome such as Timaru not be used as an alternate unless information on the local aerodrome weather was available to the pilot-in-command throughout the flight. This requirement was not met in these circumstances.

- 2.6 Safety recommendations were made to Air Nelson to adopt a more appropriate procedure for releasing a company agent, in circumstances where this could prejudice a return to the departure aerodrome, and to ensure where aerodromes such as Timaru or Hokitika are being used as a destination or alternate, that current weather information is available as required by the company route guide.



- 2.7 Given the circumstances created by these supplementary events, the crew's decision to continue to Christchurch after learning of the onset of fog there, to make an ILS approach to runway 20, was reasonable because they knew that another aircraft had just landed from an ILS approach. Their expectation of being able to do the same, however, probably did not take into account that they were limited to a higher DH than the other aircraft, which could use category 1 minima on the approach, and had reported the conditions to be near those minima.
- 2.8 If the crew of RLK 8611 had been able to use the category 1 DH of 200 feet on this first approach, it is likely that they would also have made visual contact with the approach and runway lights, and have been able to land without further ado. In that case, the incident would not have occurred, and the only circumstance of note would have been the unexpected onset of fog at both destination and alternate aerodromes. In addition, the real hazard and alarm created by the continued flight to a low fuel state would have been averted.
- 2.9 The intention of the Civil Aviation Authority in this regard, in the new rule-making process was that the old category 1 ILS minima would replace the "normal minima", making the normal DH for an ILS in New Zealand 200 feet. This would bring the New Zealand legislation into line with common practice elsewhere. The ILS had been designed and developed over some 50 years, to provide a precision approach to a DH of 200 feet above the runway, in normal circumstances. The adoption, by New Zealand, of a higher DH of 300 feet, with the 200 foot DH only available under more stringent criteria, stemmed from a time when a more paternalistic civil aviation regulatory authority existed. The acceptance by CAA that these criteria were dated and no longer relevant was timely, and the intended rule change was appropriate.
- 2.10 The administrative action taken by CAA, when CAR part 91 came into effect on 1 April 1997, did not extend sufficiently into other supplementary regulatory documents to allow the intended rule change to take effect. Had it done so, the hazard demonstrated by this incident might have been averted.
- 2.11 A recommendation was made to the Director of Civil Aviation that he promulgates to operators the lower ILS minima, and how to obtain approval to operate them.
- 2.12 The subsequent action of the crew, in making further ILS approaches to Christchurch, was probably the only realistic course of action left to them after the first missed approach. Their evaluation and rejection of alternatives while repositioning the aircraft between approaches was properly done, and the decision to descend below the normal DH as far as was necessary to make visual contact was competently managed between them.
- 2.13 The shortcomings in the aerodrome weather forecasts (TAF), while a reflection that weather forecasting is not an exact science, did fall short of the standard expected and normally achieved in aviation forecasts. The explanation by the Meteorological Standards Manager of MetService that the forecaster may not have allowed sufficiently for the effect of Banks Peninsula on the airflow which brought the advection fog to Christchurch is understood. The shortcomings may, however, be a symptom of centralised forecasting, where a forecaster in Wellington is unlikely to evaluate such local small scale effects as well as a locally based forecaster might. Such small scale effects can have a critical effect on the weather at an aerodrome, as in this case. The ability of MetService to provide accurate TAFs may have decreased since the withdrawal of local forecast units some years ago.

- 2.14 A further valid point made by the Meteorological Standards Manager was that the few observations made at Timaru provide little information for a forecaster to base a TAF or amendments on. This paucity of observations is common around New Zealand compared with a few years ago, and pilots should be aware that TAF information needs to be supplemented by whatever recent local reports may be available to best evaluate the forecast weather.
- 2.15 Pilots have a responsibility to weigh and interpret weather information in the light of their experience, training and observations, and not just take issued forecasts at face value. In this case the crew had considered the available TAFs and METARs, but their assessment of the likely weather was not as conservative as it should have been.
- 2.16 The weather in Christchurch that afternoon had been clear and sunny with light winds, with particularly warm temperatures for late autumn. The low bank of cloud towards the coast had been observed by the crew; it had been remarked upon in the METAR reports originated by Christchurch Tower, as had the fog at Wigram aerodrome (6 km south of Christchurch) at 1800 hours. The temperature had fallen rapidly during the late afternoon from 18° at 1700 to 13° at 1800 hours, and was rapidly approaching the dewpoint. The dewpoint of 11° indicated a humid air mass, confirmed by the persistent low bank of cloud towards the coast. The conditions were conducive to the formation or arrival of fog as the day cooled further, and this possibility should have been recognisable by an observant airline pilot with some local experience, regardless of what the Christchurch TAF predicted.
- 2.17 The weather in Timaru was less well documented, and not able to be observed at first hand by the crew. The location of Timaru on the Canterbury Plains does mean that its weather may often be similar to Christchurch, apart from local effects from Banks Peninsula, especially in a settled synoptic situation. It may be prudent for crews to consider whether Timaru is the most suitable weather alternate for Christchurch aerodrome when a possibility of fog is being considered.
- 2.18 If the crew had been alerted to the possibility of fog at Christchurch and Timaru, one suitable course of action before departure from Hokitika would have been to select a different alternate aerodrome, perhaps Hokitika or Nelson, and load extra fuel to accommodate this. Although a weight analysis was not done, the light passenger load out of Hokitika indicated that the extra fuel load would not have incurred any significant operational penalty.
- 2.19 The local effect on the fog of the Boeing 737 taxi runs on the approach end of runway 20 could not be evaluated in this case, so it is not known if this was a help to the crew of RLK 8611 on their successful final approach. However, the technique has been previously observed to be effective in circumstances of radiation fog, with light or calm wind conditions. Christchurch ATC showed initiative in arranging for the Boeing to make the taxi runs in the time available.

### **3. Findings**

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

- 3.1 Incorrect weather forecasts which did not predict fog misled the crew into planning the flight with an unsuitable alternate aerodrome and insufficient fuel reserves.
- 3.2 The crew should have been able to anticipate the possibility of fog, in spite of the incorrect forecasts.
- 3.3 The crew should not have released their company agent at Hokitika until they had the latest weather information on their destination and alternate aerodromes.

- 3.4 The airline company's system for their agent at Timaru to provide current aerodrome weather information failed at a critical time for this flight.
- 3.5 If the crew had been approved to use category 1 ILS approach minima the hazard involved in this incident might have been averted.
- 3.6 CAA had made rule changes intended to allow category 1 ILS minima to become normal, but had not taken further steps to cause the change to take effect.
- 3.7 The crew's action of flying the ILS approach below approved minima was appropriate and competently done, and resulted in the safe arrival of the aircraft.

#### **4. Safety Recommendations**

- 4.1 On 13 October 1998 it was recommended to the Chief Executive of Air Nelson that he:
  - 4.1.1 adopts and promulgates to crews a procedure that, where the release of a company agent after departure would preclude the use of the departure aerodrome for the return of the aircraft, this action is not taken until current weather and other operational information on the destination and alternate aerodromes has been received by the crew, (061/98): and
  - 4.1.2 ensures, when an aerodrome such as Timaru or Hokitika is being used as a destination or alternate, that current weather and other operational information on the aerodrome is available to the crew throughout the flight, by the company agent either passing the information to ATC, or ensuring radio communications are available with the aircraft. (062/98)
- 4.2 On 13 October 1998 it was recommended to the Director of Civil Aviation that he:
  - 4.2.1 promulgates to operators the availability of the lower ILS minima intended and generally implemented by the rulemaking process, advising action to amend ILS approach charts, and what steps air transport operators may take to obtain approval to use lower minima prior to obtaining recertification under rule part 119. (070/98)

Approved for publication 30 September 1998

Hon. W P Jeffries  
**Chief Commissioner**