**No 94-023**
**AEROSPATIALE AS 350B**
**ZK-HWV**
**WAIKUKUPA VALLEY, NEAR FOX GLACIER**
**WESTLAND NATIONAL PARK**
**29 OCTOBER 1994**


## ABSTRACT

On 29 October 1994 at about 1000 hours, Aerospatiale AS 350B ZK-HWV collided with a valley side during a local scenic flight, killing all seven occupants. While no cause was established positively, it is probable the aircraft was flown into cloud inadvertently. A safety issue which prompted a safety recommendation to the Civil Aviation Authority was the absence of standards to guide pilots in setting height margins beneath cloud.

## TRANSPORT ACCIDENT INVESTIGATION COMMISSION

# ACCIDENT REPORT NO. 94-023

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|---|---|
| **Aircraft Type, Serial Number and Registration:** | Aerospatiale AS 350B, 1813, ZK-HWV |
| **Number and Type of Engines:** | One Turbomeca Arriel 1B |
| **Year of Manufacture:** | 1984 |
| **Date and Time:** | 29 October 1994, about 1000 hours |
| **Location:** | Waikukupa Valley, near<br>Fox Glacier<br>Westland National Park<br>Latitude: 43° 27.2' south<br>Longitude: 170° 03.2' east |
| **Type of Flight:** | Air Transport, Scenic |
| **Persons on Board:** | Crew: 1<br>Passengers: 6 |
| **Injuries:** | Crew: 1 Fatal<br>Passengers: 6 Fatal |
| **Nature of Damage:** | Destroyed |
| **Pilot in Command's Licence:** | Commercial Pilot Licences (Helicopter and Aeroplane) |
| **Pilot in Command's Age:** | 34 |
| **Pilot in Command's Total Flying Experience:** | 5198 hours<br>4088 hours on Helicopters<br>2643 hours on Type |
| **Information Source:** | Transport Accident Investigation Commission field investigation |
| **Investigator in Charge:** | Mr J J Goddard |

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

# 1. NARRATIVE

1.1 During the morning of 29 October 1994, Aerospatiale Squirrel helicopter ZK-HWV was engaged on tourist scenic flying from Franz Josef and Fox Glacier townships to the glacier and high alpine areas of Westland National Park. The pilot, who was based in Fox Glacier, started his day's flying by positioning the helicopter to Franz Josef for a 40 minute flight with four passengers, which departed at 0900 hours.

1.2 This flight proceeded without incident, and ZK-HWV arrived back at Franz Josef at 0942 hours. During the flight the pilot had reported by RTF to the Company booking office that the top of Mount Cook was in cloud, thus precluding high mountain flights. No other difficulty was indicated.

1.3 After refuelling the helicopter to 50% capacity and loading two non-revenue passengers, who were parents of a local resident, for the next scenic flight, the pilot repositioned it back to Fox Glacier to pick up four overseas tourists for their 20 minute snow landing flight.

1.4 These passengers were loaded aboard the helicopter by the Company's Fox Glacier flight clerk, and it departed for the flight at 0955 hours.

1.5 The normal route for the Company's 20 minute snow landing flights from Fox Glacier was to depart to the north-east over the Cook Saddle, then to the east up the Waikukupa River valley to the Baumann Glacier at the head of the valley for the snow landing. This particular snow landing location was allocated to the Company by the Department of Conservation, who administered the National Park. The return to Fox Glacier was typically across the Victoria Range, then down the Fox Glacier valley. This route could be varied to suit weather and cloud conditions, but that described was the most common and expeditious.

1.6 Another helicopter pilot, one of several operating in the general area, heard an RTF call from the pilot of ZK-HWV on departure, that he was "lifting from Doctor's Pad for Cook Saddle". No further RTF calls were heard from ZK-HWV by any aircraft or ground stations.

1.7 At about 1025 hours the Fox Glacier flight clerk made RTF calls to ZK-HWV which produced no response, then telephoned the Franz Josef office to express concern that the helicopter had not returned at its ETA of 1015 hours. The Company's senior West Coast pilot responded promptly and initiated an aerial search in another helicopter, leaving Franz Josef at 1045 hours.

1.8 Shortly after he lifted off on his search he heard an ELT signal on his VHF radio, which he suspected was from the overdue helicopter, and which led to the formal initiation of Search and Rescue action. He made an initial search of the likely route of ZK-HWV but was unable to sight the aircraft or define its location from the intermittent ELT signal.

1.9 Three local helicopters continued the search in deteriorating weather conditions. They were joined by an RNZAF Iroquois helicopter from Christchurch at 1415 hours. This helicopter was able to locate the ELT at the accident site using its electronic homing equipment, and then winched personnel to the site on the steep bush clad valley side. They confirmed that all the occupants had been killed.

1.10 Bad weather prevented further access to the site until the morning of 31 October, when the victims were recovered and the site investigation began.

1.11 The helicopter had collided with the southern side of the Waikukupa Valley at an elevation of about 2750 feet amsl. The terrain had a local down slope of 36° to the north. The valley wall above the site rose to over 4000 feet amsl.

1.12 The helicopter had come to rest on a heading of 174° magnetic, which was probably similar to its track before impact. A main rotor swath through saplings suggested an attitude of 5 to 10° left bank and 10 to 15° nose up before impact. The swath was insufficient to confirm that the flight path was level, but the combination of pitch attitude, terrain slope and impact angle damage evidence suggested that it was not climbing or descending significantly.

1.13 The impact damage was consistent with a severe high speed collision with the terrain at an angle of about 45°. The main fuselage structure had collapsed down and forwards, intruding into the cabin area, while the underfloor structure had collapsed up to the floor. The transmission and mast remained in place but with the structural attachments broken. The tail boom had concertinaed forwards and down, but the tail rotor was virtually undamaged. Severe main rotor blade and hub damage was consistent with blade strikes on substantial trees and terrain at normal rotor speed, and probably under power.

1.14 The passengers' seats had collapsed, but the passengers had been restrained within the cabin area by their lap belts. Severe multiple injuries indicated that the impact acceleration had been of the order of 75G, and thus unsurvivable. The pilot had been ejected when the stitching of his lap belt failed. He had not been wearing his shoulder harness.

1.15 The complete aircraft was accounted for at the site, apart from two main rotor blade tips which had probably separated during the blade strike sequence, and were not found in the bush. The pre-impact integrity of all control system linkages and drive shafts was established. The completely separated instrument panel did not contain any significant evidence. The engine controls were in the normal operating positions.

1.16 The wreckage was lifted out by helicopter and recovered to workshop storage. Further examination disclosed no pre-impact defect in any control system. The filaments of light bulbs in the caption panel showed no evidence of any malfunction warnings being illuminated at impact. The engine fuel system had fuel throughout, and was intact apart from the ruptured tank. Both engine stages were free to turn. The module 5 input pinion matched markings showed that relative movement had occurred, indicating that engine power was being delivered when the main rotor strikes occurred. This was confirmed by a strip inspection of the overrun clutch the inner race of which showed typical evidence of impact overloading.

1.17 Summarising the technical investigation; no evidence was found of a mechanical defect with the helicopter and the engine was delivering power to the main rotor at impact. The impact attitude and flight path suggested that it was under the control of the pilot at the time.

1.18 The post-mortem and toxicological investigation of the pilot showed no abnormalities which may have affected his ability to conduct the flight.

1.19 The weight and balance of the helicopter were computed using the actual weights and locations of the occupants. At take-off the weight was 1896 kg, and the longitudinal C of G was 3.16 m AOD. The C of G would have moved forward with fuel burn-off, to 3.12 m AOD. The authorised maximum weight was 1950 kg, while the C of G envelope was between 3.17 m and 3.43 m at this weight. The computation was repeated using standard weights of 77 kg per person. This put the C of G at 3.15 m AOD, moving to 3.11 m AOD with fuel burn-off.

1.20 While the misloading, which put the C of G outside the forward limit, might not have had a serious effect on the helicopter's controllability on this flight, it could have become significant had the flight been prolonged. It was also evident that the front passenger seat modification to accommodate two people did make the helicopter susceptible to misloading.

1.21 An aftercast of the weather prepared by the Meteorological Service of New Zealand showed that a frontal system and associated depression to the north-west of Fiordland was moving onto South Island. On its eastern side an increasing northerly wind flow affected the area. Wind soundings at Hokitika, 60 nm north-east of Fox Glacier, recorded northerly winds up to 6000 feet amsl of 10 knots at 0600 hours, and 15 knots at 1200 hours. Above an inversion at 6000 feet the winds were markedly stronger.

1.22 No formal weather observations of cloud were available on the West Coast between Hokitika and Milford Sound, 120 nm south-west of Fox Glacier, but local pilots reported complete cloud cover at about 11000 feet amsl, and areas of lower stratiform cloud with a base of about 2500 feet and tops at 5000 feet amsl. These areas were particularly in the Franz Josef (Waiho River), and the Omoeroa and Waikukupa Valleys which opened to the north. The Fox Valley, facing west, remained clear of cloud. The lower cloud increased and the weather deteriorated generally during the morning, with most operators ceasing scenic flights after 1000 hours.

1.23 Photographs taken at about 0915 hours by passengers on the earlier flight in ZK-HWV showed the overcast high cloud and flat lighting on the Baumann Glacier, and also the broken lower cloud in the Waikukupa Valley which they had evidently flown over at about 5000 feet amsl while en-route from Franz Josef to the upper Fox Glacier. The area of the accident site appeared to be under cloud at that time, with the upper Waikukupa Valley from about 1 nm above the accident site, clear of cloud.

1.24 No evidence was found to determine the exact time of the accident, nor whether the helicopter was heading up the Waikukupa Valley or returning after landing on the Baumann Glacier. It was probable, however, that it occurred on the way up, some 5 minutes after departure from Fox Glacier at about 1000 hours. This was because that was the most common route; because the other helicopter pilots in the area had heard no customary RTF calls from ZK-HWV on landing or departing from the Baumann Glacier, and also because the film from the passengers' cameras recovered from the wreckage produced only pre-departure photographs, rather than photographs taken on the snow which would have been very likely had they made the planned glacier landing.

1.25 If the accident in fact occurred when the helicopter was on the way up, then the pilot must have decided that the extent of the low cloud forming in the Waikukupa Valley did not preclude a visual climb above it, because the alternative of flying up the Fox Valley, which was evidently clear at that time, was only slightly less expeditious. He would have been able to assess the Waikukupa route on his earlier flight - at 0915 hours he would have seen the broken cloud as it was shown on the passenger's photograph; he also would have flown past the valley entrance while repositioning from Franz Josef to Fox Glacier at about 0950 hours, five minutes before take-off, but the high overcast would have precluded his observing sunshine on the ground to estimate the extent of the lower cloud further up the valley. Such a situation, where low cloud prevails near a valley mouth but further up the valley clear conditions allow space for a helicopter to climb above, is a common feature of local weather in the area. Whether this was in fact the situation at the time was not established because no other helicopter pilot had flown that route then. It was evident, however, that the low cloud layer had increased with the deterioration in the weather during the morning. The pilot of the first search helicopter was able to fly down the Waikukupa Valley from the Baumann Glacier area at about 1100 hours, but reported that conditions were fluctuating. Cloud was present at that time above 2500 feet in the vicinity of the subsequently found accident site.

1.26 The accident site was not far up the mountainous part of the Waikukupa Valley - less than 1 nm from State Highway 6 which runs past its mouth. The presence of cloud at the site at the time of the accident was likely as this area near the valley mouth was a common location for cloud to start to form; it appeared to be under cloud at 0915 hours, and was reported so at 1100 hours. Because of this, it is probable that cloud was a factor in the accident. There was no indication, however, that the cloud conditions in the valley at the time of the accident had deteriorated to make it impassable or even marginal. The pilot's decision to go that way may have been reasonable, based on his experience of the route and his observations that morning. The procedure which he may have adopted in flying up the valley was therefore examined.

1.27 A common tactic used by pilots flying up a valley under cloud towards an expected clear area further up would be to fly level, with a sufficient height margin beneath the cloud base to retain visibility, and along one side of the valley so that optimum space remained for manoeuvring if a turn back became necessary. In the case of ZK-HWV the logical side of the valley was the south side, because the route from Fox Glacier would naturally take it there; in the northerly wind conditions a left turn back through north would be advantageous, and the local rules in the major glacier valleys required keeping to the right, anyway. Such a procedure could have brought the helicopter to the vicinity of the accident site; it should not of itself have led to the helicopter flying on a southerly heading into the valley side.

1.28 One possible hypothesis is that as the helicopter entered the valley, an orographic updraught from the northerly wind may have caused an unanticipated climb towards cloud while transpiration from the dense bush on the valley side would have been likely to produce local lowering of the cloud base, with the result that the helicopter inadvertently entered cloud. An alternative cause of an accidental climb might have been a momentary distraction of the pilot by a passenger. Upon any such encounter with cloud, the pilot would have had to manoeuvre to fly clear of cloud while remaining clear of the terrain which he would know was close below on his right. He would have had to change immediately to flying by instruments rather than by visual reference, while looking to regain any sight of the outside world. One likely manoeuvre would have been to turn left towards the valley mouth, commence a descent, and possibly reduce airspeed. An alternative, since he would know that it was clear above the cloud tops at about 5000 feet amsl, might have been to climb the aircraft at maximum rate while turning onto a favourable heading to emerge clear above cloud and terrain.

1.29 If a pilot was well versed in instrument flying and in current practice, he might be expected to execute either manoeuvre without too much difficulty. An uncurrent pilot, or one without instrument flying experience, would probably become disoriented, leading to some loss of control of the aircraft. Typically such a loss of control would involve a spiral descent; its result might range from flying in an undesired direction at increasing speed to exceeding the limits of speed, load and attitude of the aircraft, perhaps with catastrophic results.

1.30 The accident site evidence indicated that a gross loss of control had not occurred, but if the pilot had, for example, started a climbing left turn on encountering cloud and had been unable to control the helicopter accurately on instruments, this could have developed into a spiralling left descent through perhaps 270° onto the southerly heading which led to the collision with the hillside. The attitude at impact could have resulted from the pilot sighting the terrain ahead when too close to avoid it, but attempting to flare the helicopter's flightpath to cushion its arrival.

1.31 Such a hypothesis is not supported other than by the circumstantial evidence of the wreckage, the weather and the route, but it probably represents the most likely sequence of events leading to the accident.

1.32 The pilot had last logged instrument flying time in April 1983, when he completed his aeroplane licence. He had logged no instrument flying time in helicopters. He had completed an Australian Class IV Instrument Rating in 1986 with 11.2 hours of aeroplane night flying, but this had not resulted in any instrument time being logged.

1.33 The type of flying he was engaged in was of an essentially visual, daytime nature and did not require any instrument or night flying qualification.

1.34 His Commercial Pilot Licence (Helicopter), which included the AS 350 Type Rating, was endorsed "restricted to student pilot privileges by night". It contained a waiver for hearing. His Class 1 Medical Certificate was valid to October 1995. His last Biennial Flight Review and flight check in accordance with Civil Aviation Regulation 76 was completed satisfactorily on the AS350 type on 23 June 1994.

1.35 His Company training records showed that training and checking had been completed satisfactorily on an annual basis since 1989. As well as assessing handling skills, it had included training modules on pilot judgement and decision making. This had been carried out by an independent consultant training organisation.

1.36 He had been employed full-time by the Company from December 1987 to September 1989 and from October 1992 to March 1994. At other times his employment was on a part-time seasonal basis, interspersed with periods of overseas employment on other types of helicopter operations. His current employment at Fox Glacier was as a relieving pilot for a two week period, while his previous period with the Company had been for six weeks on heliskiing operations to September 1994. He had spent a total of about 36 months and 1275 flying hours at Franz Josef or Fox Glacier since 1987 on scenic flying operations around the glacier area, and had thus acquired appreciable experience of the task and the local environment. The majority of his helicopter flying had been on operations in mountainous areas.

1.37 The day of the accident was the last day of his relieving period of employment at Fox Glacier, and with the deterioration in the weather he was probably aware that the flight would be his last of the period. There were no particular pressures, other than normal commercial competition with the other operators, to complete the flight should he have had any reservations about it. It was reported that he was keen to return to his recently acquired high-country farm, and his anticipation of, and perhaps some preoccupation with doing this could have had a subtle effect upon his in-flight judgement and decision making. He was reported to have been in good health and in his normal cheerful frame of mind on that day.

1.38 One inference which might logically devolve from the hypothetical sequence of events is that for an experienced pilot to be caught in cloud in this way, he may have been flying the helicopter below the cloud with a height margin which was insufficient to allow him to anticipate and avoid it. This, in turn, raised the question of whether he may have habitually flown with a small height margin beneath cloud, and whether any training and checking system could have set and monitored suitable standards of height margins below cloud for pilots to follow.

1.39 Civil Aviation Safety Order Number 1, Section 2 "Visual Flight Rules" only required helicopters to fly "clear of cloud and in sight of ground or water" when "below 3000 feet amsl or 1000 feet above terrain whichever is higher". The Company Operations Manual contained the same requirement and in addition required pilots to maintain a flight visibility of 5000 m. No other written guidance was given to assist in setting a standard of height margins below cloud for pilots to follow.

1.40 CASO 20 Part 3 and Civil Aviation Regulations 62 and 84 specified meteorological minima in terms of cloud ceiling and visibility, flight planning requirements in terms of meteorological conditions anticipated, and conduct of flights in accordance with meteorological conditions, but did not include any requirements concerning height margins below cloud.

1.41 There are several independent parameters which affect how big a height margin should be beneath cloud to achieve an acceptably low risk of entering cloud inadvertently. These include the speed and manoeuvrability of the aircraft, the field of view available to the pilot, his other work load, the general flight visibility and lighting, the decrease of visibility approaching the cloud, how level the cloud base is, whether the base is well defined or diffuse and whether precipitation is falling. In addition, the only way for a pilot to quantify his height margin is to actually fly right up to the cloud base, note the altitude, and then descend to a specific indicated altitude. The risk inherent in doing this may be unacceptable compared with the risk of not doing so.

1.42 These factors make the task of setting specific height margins difficult at best, and it is commonly perceived as an intangible and subjective topic by pilots, operators and flight training organisations. Basic training has mostly been confined to a ground briefing, and flight training has generally occurred, if at all, on an opportunity basis, where an instructor had been able to demonstrate a suitable technique on a dual flight with a convenient cloud layer. In industry operational practice pilots have been left to develop their own height margins beneath cloud, guided mostly by common sense, intuition, or what they feel comfortable with. This has two drawbacks; that height margins are likely to vary widely within an organisation, and where a pilot is often exposed to this situation he may become habituated to it so that his margin progressively decreases without his being aware of it. The company involved in this accident was essentially in line with industry practice in this matter.

1.43 The impracticability of setting discrete, objective standards for height margins beneath cloud, in terms of a specified distance, is acknowledged. Operational supervision, however, could be implemented by making this a topic for routine flight checks to address, both as discussion topic and as a flight exercise where weather conditions allow. This has the potential to set subjective standards at least within an operator's organisation, and to raise awareness of the topic and its attendant hazards. A recommendation to this effect was made to the Director of Civil Aviation.

1.44 No other factors were identified within the Company's operational management and supervision structure which might have affected the particular conduct of this flight. While the Company had in earlier years been involved principally in higher risk types of helicopter operations such as deer hunting, since becoming a major tourist operator it had developed an active policy to ensure that pilot decision-making training and appropriate risk management was pursued, and employed a specialist consultant to this end.

The spread of operating bases within the country meant that pilots might often be supervised only remotely, but this is common to much of the helicopter industry worldwide, which deploys pilots remotely and thus requires them to be independent and self-reliant.

## 2. FINDINGS

2.1 The pilot was appropriately licensed and experienced for the flight.

2.2 The helicopter was maintained properly and had a valid Certificate of Airworthiness and Maintenance Release.

2.3 The helicopter was loaded within the maximum weight, but the centre of gravity was outside the forward limit by a small amount.

2.4 This misloading was probably not significant on the accident flight.

2.5 The helicopter was on a visual scenic flight up a valley to a snow landing on a glacier.

2.6 While the weather was deteriorating, it may have been suitable on the route at the time.

2.7 The helicopter collided with the side of the valley while flying across its intended route.

2.8 The collision was unsurvivable.

2.9 The helicopter was probably functioning normally and under the control of the pilot at the time of the collision.

2.10 It is probable that the pilot flew the helicopter into cloud inadvertently while intending to fly beneath it towards clear conditions further up the valley.

2.11 The loss of visibility and resulting disorientation in cloud probably caused the pilot to fly the helicopter into the side of the valley.

2.12 The pilot may have been flying the helicopter with insufficient height margin beneath the cloud.

2.13 There were no Company nor industry standards to guide pilots in setting height margins from cloud while flying below 3000 feet amsl or 1000 feet above terrain.

2.14 The cause or causes of this accident were not positively determined.

## 3. SAFETY RECOMMENDATIONS

3.1 It was recommended to the Director of Civil Aviation that:

He require training and checking organisations to adopt height margins beneath cloud as a topic for flight checks, such as those carried out in accordance with CA Regulation 76, where it is relevant and appropriate to the operation involved. (001/95)

He promote awareness to pilots and flight training organisations of the hazards associated with flying with only a small height margin beneath cloud, and of the parameters which may affect a safe height margin, by the development of educational material in his flight safety publications. (002/95)

19 April 1995

M F Dunphy
Chief Commissioner

## ABBREVIATIONS COMMONLY USED IN TAIC REPORTS

| | |
|---|---|
| AD | Airworthiness Directive |
| ADF | Automatic direction-finding equipment |
| agl | Above ground level |
| AI | Attitude indicator |
| AIC | Aeronautical Information Circular |
| AIP | Aeronatical Information Publication |
| amsl | Above mean sea level |
| AOD | Aft of datum |
| ASI | Airspeed indicator |
| ATA | Actual time of arrival |
| ATC | Air Traffic Control |
| ATD | Actual time of departure |
| ATPL (A *or* H) | Airline Transport Pilot Licence (Aeroplane or Helicopter) |
| AUW | ll-up weight |
| | |
| C | Celsius (normally preceded by °) |
| CAA | Civil Aviation Authority |
| CASO | Civil Aviation Safety Order |
| CFI | Chief Flying Instructor |
| C of G | Centre of Gravity |
| CPL (A *or* H) | Commercial Pilot Licence (Aeroplane or Helicopter) |
| | |
| DME | Distance measuring equipment |
| | |
| E | East |
| ELT | Emergency location transmitter |
| ERC | En route chart |
| ETA | Estimated time of arrival |
| ETD | Estimated time of departure |
| | |
| F | Fahrenheit (normally preceded by °) |
| FAA | Federal Aviation Administration (United States) |
| FL | Flight level |
| | |
| g | Acceleration due to gravity |
| GPS | Global Positioning System |
| | |
| HF | High frequency |
| hPa | Hectopascals |
| | |
| IAS | Indicated airspeed |
| IFR | Instrument Flight Rules |
| IGE | In ground effect |
| ILS | Instrument landing system |
| IMC | Instrument meteorological conditions |
| ins Hg | Inches of mercury |
| | |
| kgs | Kilograms |
| kHz | Kilohertz |

| | |
|---|---|
| KIAS | Knots indicated airspeed |
| kt | Knot(s) |
| | |
| LF | Low frequency |
| LLZ | Localiser |
| | |
| M | Mach number (e.g. M1.2) |
| M | Magnetic (normally preceded by °) |
| MAANZ | Microlight Aircraft Association of New Zealand |
| MAP | Manifold absolute pressure (measured in inches of mercury) |
| MAUW | Maximum all-up weight |
| METAR | Aviation routine weather report (in aeronautical meteorological code) |
| MF | Medium frequency |
| MHz/Mhz | Megahertz |
| mph | Miles per hour |
| | |
| N | North |
| NDB | Non-directional radio beacon |
| nm | Nautical mile |
| NOTAM | Notice to Airmen |
| NTSB | National Transportation Safety Board (United States) |
| NZAACA | New Zealand Amateur Aircraft Constructors Association |
| NZDT | New Zealand daylight time (UTC + 13 hours) |
| NZGA | New Zealand Gliding Association |
| NZHGPA | New Zealand Hang Gliding and Paragliding Association |
| NZMS | New Zealand Mapping Service map series number |
| NZST | New Zealand standard time (UTC + 12 hours) |
| | |
| octa | Eighth's of sky cloud cover, (e.g. 4 octas = 4/8 of cloud cover) |
| OGE | Out of ground effect |
| | |
| PAR | Precision approach radar |
| PIC | Pilot in command |
| PPL (A or H) | Private Pilot Licence (Aeroplane or Helicopter) |
| psi | Pounds per square inch |
| | |
| QFE | An altimeter subscale setting to obtain height above aerodrome |
| QNH | An altimeter subscale setting to obtain elevation above mean sea level |
| | |
| RNZAC | Royal New Zealand Aero Club |
| RNZAF | Royal New Zealand Air Force |
| rpm | revolutions per minute |
| RTF | Radio telephone or radio telephony |
| | |
| S | South |
| SAR | Search and Rescue |
| SSR | Secondary surveillance radar |
| | |
| T | True (normally preceded by °) |

| | |
|---|---|
| TACAN | Tactical Air Navigation aid |
| TAF | Terminal aerodrome forecast |
| TAS | True airspeed |
| | |
| UHF | Ultra high frequency |
| UTC | Coordinated Universal Time |
| VASIS | Visual approach slope indicator system |
| VFG | Visual Flight Guide |
| VFR | Visual flight rules |
| VHF | Very high frequency |
| VMC | Visual meteorological conditions |
| VOR | VHF omnidirectional radio range |
| VORTAC | VOR and TACAN combined |
| VTC | Visual terminal chart |
| | |
| W | West |