Report 96-011

Robinson R44

ZK-HJD

Near Gisborne

31 March 1996

Abstract

At 1306 hours on Sunday 31 March 1996, the pilot of Robinson R44 ZK-HJD called Gisborne Tower, reporting 20 miles south for joining instructions. Low cloud, poor visibility and gale-force winds prevailed at the time. When the helicopter failed to arrive at Gisborne, Search and Rescue action was initiated, and the pilot's body and some helicopter wreckage were found the next morning at Muriwai Beach, 5.5 nm south of Gisborne Airport. It was evident that the helicopter had flown into the sea, but no definitive cause was established.

Transport Accident Investigation Commission

Aircraft Accident Report 96-011

Aircraft type, serial number and registration:	Robinson R44, 0030, ZK-HJD
Number and type of engines:	1 Lycoming O-540-F1B5
Year of manufacture:	1993
Date and time:	31 March 1996, 1315 hours[1] (approx.)
Location:	5.5 nm south of Gisborne Airport Latitude: 38° 45.4'S Longitude: 177° 57.0'E
Type of flight:	Private
Persons on board:	Crew: 1
Injuries:	Crew: 1 fatal
Nature of damage:	Destroyed
Pilot-in-Command's Licence:	United States Airline Transport Pilot Certificate (Airplane & Helicopter) NZ Private Pilot Licence (Helicopter)
Pilot-in-Command's age:	49
Pilot-in-Command's total flying experience:	27 700 hours including 700 helicopter 15 (approx.) on type
Investigator in Charge:	A J Buckingham

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

1. Factual Information

1.1 The pilot, an overseas visitor to New Zealand, had hired privately-owned R44 ZK-HJD through a North Shore based operator for a North Island tour. A condition of the hire was a dual check under the auspices of an Ardmore training establishment, and he arranged to meet the instructor at the helicopter's Albany base on Tuesday 26 March 1996. They flew the helicopter to Ardmore, where the dual check flight took place, and on completion, the pilot proceeded on tour with a travelling companion as passenger.

1.2 The arrangement was for the pilot to return the helicopter to North Shore Aerodrome on Monday 1 April, as he was booked on an overseas flight either that night or the following morning. On the morning of Sunday 31 March, he visited the Hawkes Bay and East Coast Aero Club at Hastings Aerodrome, where he discussed the weather and possible flight routes with an instructor. The instructor obtained for him a faxed weather briefing from Napier Tower, and he suggested that the pilot not attempt to go anywhere because of the conditions; he himself had just turned down an ambulance flight to Wairoa because the weather was below IFR minima. The pilot left the Club and returned to the nearby private property where he had parked the helicopter. He took off from there just after midday, and proceeded to Napier Airport where he refuelled the helicopter. Fuel company records indicated that 63.60 litres of 100/130 Avgas were uplifted.

1.3 After refuelling, the pilot filed an abbreviated flight plan by radio with Napier Tower, took off at 1228 hours and vacated the control zone to the north, terminating his plan when clear of the zone. He did not indicate to the Napier controller what his intentions were after this point.

1.4 Between 1255 and 1305 hours, a helicopter fitting the description of ZK-HJD was seen at Waikokopu, 25 nm from Gisborne, on the western side of the isthmus connecting Mahia Peninsula to the mainland. The witness who reported the sighting described the helicopter as hugging the coast, about 150 feet above sea level and "pounding along". The weather conditions were described as "misty rain" with poor visibility out to sea.

1.5 At 1306 hours, the pilot of ZK-HJD called Gisborne Tower, advising that he was 20 miles south and requesting a clearance into the control zone. The Tower Controller cleared him into the zone Special VFR on a QNH of 995, and reported the actual weather conditions at Gisborne Airport as "surface wind 110 degrees (M), 26 knots gusting 33 knots, visibility 1500 metres, moderate rain, scattered (cloud) at 500 feet, broken at 800 feet, temperature 17 (°C), forecast 2000-foot wind 140 (degrees) magnetic, 40 knots". The Tower Controller had not been previously aware of the pilot's intended arrival at Gisborne.

1.6 About 1315 hours, a resident at Muriwai, 5.5 nm to the south of Gisborne Airport, heard a helicopter fly over his house "so low it shook the house", and judged the speed to be high, as the noise came and went very quickly. He ran outside immediately and climbed onto his patio table to see if he could see the helicopter, but by this time it had "disappeared into the murk" and he heard the sound fade away. He described the weather as "blowing a gale, drizzly rain" and said that he could barely make out the shape of a nearby ridge, some 500 m from his house. The sound indicated that the helicopter was headed directly for Muriwai Beach, half a nautical mile to the north-east.

1.7 Nothing further was heard from the helicopter, and after it failed to arrive at Gisborne, Search and Rescue (SAR) action was initiated. Two locally-based helicopters conducted a search during the afternoon of 31 March, but no sign of ZK-HJD was found. Next morning, the crew of one of the search helicopters located a body and some helicopter wreckage on Muriwai Beach. The wreckage was identified as ZK-HJD, and the body as that of the pilot.

1.8 Beach searches at each low tide over the next three days and nights yielded a quantity of wreckage and other items from ZK-HJD. Most of the wreckage comprised small fragments of the airframe, including some heavy items such as a portion of the lower left tubular frame. Other items included one lifejacket which had not been inflated and showed no sign of having been worn, and the pilot's video camera, from which serviceable videotape was recovered. However, later investigation found that nothing had been recorded since Friday 29 March.

1.9 The entire main rotor and head washed ashore on the night of 4 April, and this was the last significant item of wreckage to do so, although small pieces continued to appear over the following few weeks.

1.10 Several attempts to locate the remaining wreckage by boat were unsuccessful, despite a water depth of only about three metres. In the area of the accident the water visibility was consistently no better than about 30 cm due to the suspension of papa clay particles from nearby cliffs. Wave action made depth finder readings unreliable in the target area (just outside the breaker line). The search for the remaining wreckage, comprising mainly the engine and transmission, was abandoned during the first week of May 1996.

Pilot Information

1.11 The pilot, male, aged 49, was a United States citizen and the holder of a US Airline Transport Pilot Certificate endorsed for aeroplanes and helicopters. He held Flight Instructor certification on both aircraft categories. He was an airline pilot in current flying practice on DC-8 aircraft.

1.12 He held a current Federal Aviation Administration Class 1 medical certificate, issued on 15 November 1995, and also held a New Zealand Private Pilot Licence (Helicopter), issued in 1994 and valid as long as his US licence and medical certificate were valid.

1.13 Helicopter type ratings endorsed on the pilot's licence were Robinson R22, Hughes 369, Bell 206 and Bell 212. In February 1996 he had completed type training on the Robinson R44 at the Robinson factory, and had also attended three safety awareness courses at the factory since 1988.

1.14 His total flight time was not able to be established at first hand, but details entered by the pilot on his training record at the Robinson Helicopter Company in February listed his experience as 27 000 hours aeroplane and 700 hours helicopter, including 400 on the Robinson R22 and 10 on the R44. His time on the R44 at the time of the accident was estimated at 15 hours. In the 90 days preceding the accident he had flown 160.7 hours in his airline role, plus his R44 time. The instructor who conducted the dual check flight on 26 March 1996 said that he had no reservations about the pilot's competence.

1.15 Post-mortem examination of the pilot revealed that he had died of multiple injuries consistent with a severe deceleration, with fractures to the right hip, right forearm, lower left leg, ribs and neck. No evidence of a pre-existing condition which could have affected his ability to control the helicopter or of sudden incapacitation was found, and toxicological tests disclosed no evidence of alcohol or other drugs.

Aircraft information

1.16 Robinson R44 serial number 0030 was constructed in 1993, and imported new into New Zealand, being issued with its New Zealand Certificate of Airworthiness in January 1994. At the time of the accident ZK-HJD had accrued approximately 150 hours on the airframe and engine (the notebook recording the operating hours since the last check was normally carried on the helicopter, and was not found).

1.17 Although no aircraft documents were recovered apart from an empty Flight Manual binder, maintenance and CAA records showed that ZK-HJD had a valid Certificate of Airworthiness and Maintenance Release, the latter having been issued on 1 March 1996 following a 100-hourly/annual check (at an engine/airframe time in service of 136.7 hours). Maintenance had been in accordance with the Robinson and Lycoming maintenance schedules, and perusal of the maintenance records revealed nothing unusual. All applicable ADs had been complied with.

1.18 One AD, DCA/R44/3A, repeated FAA AD 95-26-05, which called for the insertion of additional material in the Approved Flight Manual, specifically in the Limitations, Normal Procedures and Emergency Procedures sections. Compliance with the Limitations section was mandatory, but the material in the other two sections was by way of information only.

1.19 The CAA addition to the Limitations section read:

> a) The following limitations (1-3) are to be observed when the Pilot manipulating the controls has not taken the awareness training specified in AIC/GEN A113/95, and has logged less than 200 hours of helicopter flight time and less than 50 hours of flight time in the RHC Model R44 helicopter.
>
> 1) Flight when surface winds exceed 25 knots, including gusts, is prohibited.
>
> 2) Flight when surface wind gust spreads exceed 15 knots is prohibited.
>
> 3) Continued flight in severe or extreme turbulence is prohibited.
>
> b) Adjust forward airspeed to between 60 knots indicated airspeed (KIAS) and 0.7 Vne[2] but no lower than 60 KIAS upon inadvertently encountering moderate, severe or extreme turbulence.
>
> Note: Moderate turbulence is turbulence that causes: (1) changes in altitude or attitude; (2) variations in indicated airspeed; and (3) aircraft occupants to feel definite strains against seat belts.

1.20 The Normal Procedures section additional material read:

> Until the FAA completes its research into the conditions and aircraft characteristics that lead to main rotor blade/fuselage contact accidents, and corrective type design changes and operating limitations are identified, pilots are strongly urged to become familiar with the following information and comply with the recommended procedures.
> **Main Rotor Stall:** Many factors may contribute to main rotor stall and pilots should be familiar with them. Any flight condition that creates excessive angle of attack on the main rotor blades can produce a stall. Low main-rotor RPM, aggressive manoeuvring, high collective angle (often the result of high density altitude, over-pitching [exceeding power available] during climb, or high forward airspeed) and slow response to the low main rotor RPM warning horn and light may result in rotor stall. The effect of these conditions can be amplified in turbulence. Main rotor stall can ultimately result in contact between the main rotor and airframe. Additional information on main rotor stall is provided in the Robinson helicopter Company Safety Notices SN-10, SN-15, SN-20, SN-27 and SN-29.
> **Mast Bumping:** Mast bumping may occur with a teetering rotor system when excessive main rotor flapping results from low "G" (load factor below 1.0) or abrupt control input. A low "G" flight condition can result from an abrupt cyclic pushover in forward flight. High forward airspeed, turbulence , and excessive sideslip can accentuate the adverse effects of these control movements. The excessive flapping

[2] Never-exceed speed

results in the main rotor hub assembly striking the main rotor mast with subsequent main rotor system separation from the helicopter.
To avoid these conditions, pilots are strongly urged to follow these recommendations:
(1) Maintain cruise airspeeds greater than 60 KIAS and less than 0.9 Vne.
(2) Use maximum "power-on" RPM at all times during powered flight.
(3) Avoid sideslip during flight. Maintain in-trim flight at all times.
(4) Avoid large, rapid forward cyclic inputs in forward flight, and abrupt control inputs in turbulence.

1.21 Weight and balance calculations, based on an assumed baggage weight of 20 kg and full fuel ex Napier, showed that ZK-HJD was unlikely to have exceeded 855 kg AUW (MAUW is 1088 kg) at the time of the accident, with the centre of gravity within limits, regardless of the placement of the baggage.

1.22 ZK-HJD was equipped with a VHF transceiver, a transponder with Mode C, but no other radio aids to navigation. In addition to altimeter, airspeed indicator and vertical speed indicator, it was equipped with an attitude indicator and directional gyro.

Meteorological information

1.23 At the time of the accident, ex-tropical cyclone "Beti" lay to the east of East Cape, moving slowly south-eastwards. A strong moist south-easterly airflow prevailed over the Gisborne region. Gale-force winds and heavy rain caused damage, extensive surface flooding and road closures in the area over the weekend of 30/31 March.

1.24 The SPECI[3] for Gisborne Airport at 1300 hours read (in plain language): "surface wind 140(°T)/28 knots gusting 38, visibility 1200 m in rain, cloud: 3 to 4 okta at 500 feet, overcast at 800 feet, temperature and dewpoint 17° C, QNH 996 hPa". A SPAR[4] issued at 0955 hours reported the wind as gusting to 42 knots.

1.25 The METAR for Napier Airport at 1200 hours read (in plain language): "surface wind 170(°T)/19 knots, visibility 2000 m in rain, cloud 3 to 4 okta at 500 feet, 5 to 7 okta at 800 feet, temperature 15, dewpoint 14, QNH 1004."

1.26 The beach from where the helicopter wreckage was recovered was, in south-easterly conditions, directly in the lee of the ridge delineating the southern boundary of Poverty Bay, and the seaward extremity of which is Young Nicks Head. The ridge is a "razorback" feature, 2.5 km in length and one kilometre at maximum width, tapering to a point at each end. Its height exceeds 400 feet over most of its length, and the highest elevation is 580 feet. The northern aspect of the ridge consists of steep, eroding, papa cliffs, which are the source of the sea cloudiness referred to in paragraph 1.10.

1.27 Assuming a free-stream flow of 40 knots over the ridge, the magnitude of updraughts and downdraughts could be expected to equal at least half that of the horizontal speed, i.e. 20 knots or about 2000 feet per minute. With such a steep feature, the transition between updraughts and downdraughts was likely to be sharply demarcated. The pilot of one of the search helicopters, a Hughes 369D, described the conditions in the area on the afternoon of the accident as "wild".

1.28 A local fisherman reported to the police that there were four-metre waves, by his estimate, breaking on Muriwai Beach around the time of the accident.

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[3] Special aerodrome report (in METAR code)
[4] Special aerodrome report issued by Air Traffic Services (in abbreviated plain language)

Wreckage information

1.29 The wreckage recovered from Muriwai Beach over the few weeks following the accident comprised the complete main rotor assembly and a large number of fragments of the severely disintegrated airframe. The aftermost section of the tail boom was also recovered, complete with the horizontal and vertical stabilisers and the tail rotor and gearbox. Part of one tail rotor blade was missing.

1.30 The main rotor bore evidence of having flapped to extreme, resulting in mast bumping severe enough to cause mast failure. The blades themselves showed no sign of having struck any part of the airframe, but one blade had a significant sweepback over the outer 2 m of its length together with compression wrinkles on the trailing edge, consistent with a water strike. It was the root end of this blade which had struck the rotor mast and caused the mast failure. The droop stop "tusk" at the root of the other blade had been driven with great force into the upper portion of the rotor head itself, as that blade flapped down in relation to the other, before the tusk failed. The "tusks" normally engaged static stops on the rotor mast, preventing mast contact by the rotor head at low or zero rpm.

1.31 The tail rotor driveshaft was found to have failed in torsion at the flex plate coupling at its tail rotor gearbox end. The failure was in a "driven" sense, consistent with either a sudden stoppage of the tail rotor or a sudden surge in engine RPM which would be experienced in a main rotor separation. One tail rotor blade had fractured 452 mm in from the tip, and the tail boom had a clear imprint of a tail rotor blade strike. The remaining blade appeared not to have struck, or have been struck by, any object.

1.32 Damage to the vertical fin suggested that the tail boom (which in turn would have to be attached to the airframe to obtain the necessary leverage) was still intact at the time it struck the sea surface. The tail boom had fractured at the first riveted joint forward of the empennage, all rivets in the joint having failed in shear. The inside of the tail boom, forward of the flex plate coupling, showed flail damage inflicted by the failed tail rotor drive shaft, indicating that it was rotating as the rear of the tail boom separated.

1.33 Many of the airframe fragments were unidentifiable at first, but some were found to have part numbers stamped on them. These did not appear in the Parts Catalogue, but submission of the list of part numbers to the manufacturer resulted in the positive identification of most fragments. This confirmed that the airframe break-up had been more severe than first thought. One crumpled panel, thought initially to be from the aft fuselage, was identified as part of the second section of the tail boom.

2. Analysis

2.1 It was clear that the pilot's ultimate intention was to return the helicopter to the North Shore operator through whom he had arranged its hire. It is not known what his intentions were on reaching Gisborne, but his options would have been restricted to waiting for an improvement in the weather, securing the helicopter and continuing by other means, or refuelling and continuing to track via the coast in worsening weather to East Cape and thence to the Bay of Plenty. Tracking overland via Matawai was not an option because of the weather conditions.

2.2 He had successfully followed the Hawke Bay coast as far as the base of the Mahia Peninsula, and it was probably soon after the helicopter was sighted there that the pilot made his initial call to Gisborne Tower. Tracking north from that location by any route other than coastal was unlikely, as both the main road and railway line traverse high ground which would have been

cloud-covered at the time. Not until about 2 nm south of Muriwai would the terrain and weather have permitted following either of these line features.

2.3 To have flown over the witness's house at Muriwai, ZK-HJD had to have left the coast at some stage, and in view of the weather conditions, this was most likely to have been in the vicinity of the Maraetaha River mouth, 2 nm south of Muriwai. Possible reasons for the helicopter heading towards Muriwai Beach include unsuitable conditions inland, despite flat, low-lying country (reduced visibility and/or turbulence in the lee of the coastal ridges south of Young Nicks Head), or merely "cutting the corner", avoiding the longer route around Young Nicks Head itself while still endeavouring to follow the coastline. Following the railway line from Muriwai would have led directly to Gisborne Airport (the line crosses the runway) over flat country, but either the pilot was unaware of this or the weather precluded following the line.

2.4 Arriving over the shoreline at Muriwai Beach, the pilot would have encountered severe turbulence directly downwind of Young Nicks Head as well as poor visibility due to rain and sea spray. Additionally, there was likely to have been poor definition due to lack of contrast between sea and sky. His altitude is unlikely to have been more than about 400 feet in order to maintain visual contact with the surface. The pilot's probable intention was to follow the beach northwards to the airport.

2.5 The distribution of the wreckage suggested that the accident occurred close to the beach, probably just outside the breaker line. The extent of structural disintegration of the helicopter and the injuries to the pilot indicated that the helicopter had struck the sea surface while in forward flight. Possible reasons for striking the sea include:

- Flying into a downdraught exceeding the helicopter's climb capability;
- Loss of visual reference;
- Loss of control in turbulence;
- Malfunction, such as an engine failure.

2.6 The magnitude of the downdraughts in the lee of Young Nicks Head was likely to have been in the vicinity of 2000 feet/minute with localised higher and lower values. At low altitude, in conditions of poor visibility, the pilot would have little time to recognise and correct the situation on encountering a downdraught, before colliding with the sea.

2.7 Although ZK-HJD was equipped sufficiently for the pilot to have flown solely by reference to instruments, it is unlikely that he was doing so, as it was essential for him to maintain visual surface contact for navigation and terrain avoidance reasons. Thus his attention was probably directed outside of the cockpit for most of the time, with attention to the instrument panel limited to an occasional glance. It is possible that, in conditions of poor visibility and surface definition, he descended inadvertently and struck the water.

2.8 In the turbulence in the accident area, the pilot would have found the control workload demanding, although, given the nature of the damage to the main rotor, it is unlikely that control was lost sufficiently to result in mast bumping in flight. The main rotor blades had not struck the airframe at all, whereas airframe strikes were the rule rather than the exception in cases of mast bumping and rotor separation in flight[5]. Rather, the damage suggested that the main rotor separation had occurred as a result of the collision with the sea surface.

2.9 Continued rotation of the tail rotor driveshaft after failure at the aft flex plate required some driving force - either the engine or the inertia of the main rotor. At the time the tail assembly hit the sea surface, the main rotor was likely to have already separated - this event would have

[5] Referring to teetering rotor systems, as on the R44

taken place within one quarter to one third of a revolution of the main rotor after it first struck the water, and it would stop abruptly on doing so. Thus the source of the tail rotor driveshaft rotation is more likely to have been the engine, possibly its last few revolutions before it stopped on entering the water. However, despite these scenarios, the exact sequence and mechanism of the helicopter's collision with the sea remain unknown.

2.10 At the time of the accident, the helicopter was being operated outside the Flight Manual limitations promulgated by AD, in that the surface wind conditions exceeded 25 knots. The pilot's experience exceeded the total flight time which would have made the limitation inapplicable, but he had less than the 50 hours on type required to override the limitation. He did however have some 400 hours on the R22 type, which is similarly configured and subject to similar limitations. Additionally, he had completed the prescribed safety awareness training on three separate occasions, the most recent in February 1996.

2.11 The weather at Napier was suitable for him to have attempted the flight, but deteriorated as the flight progressed. The surface wind was only 19 knots from the south at Napier, but gusting to 33 at Gisborne at the time of initial radio contact. The pilot had not discussed weather conditions directly with either the Napier or the Gisborne Tower Controllers prior to leaving Napier, but would have been aware of the conditions likely to be encountered at and en route to Gisborne. Neither tower controller had been aware of the pilot's intention to proceed to Gisborne.

3. Findings

3.1 The pilot was suitably qualified and experienced for the flight, except that his time on type limited the operation of ZK-HJD to surface wind conditions of 25 knots or less.

3.2 Despite receiving a weather briefing, the pilot elected to proceed to Gisborne where the wind strength exceeded 25 knots.

3.3 ZK-HJD had a valid Certificate of Airworthiness and Maintenance Release, and had been maintained in accordance with the airframe and engine manufacturers' schedules.

3.4 The helicopter collided with the sea surface in an area where poor visibility, poor surface definition, strong winds and turbulence prevailed.

3.5 Some or all of the weather components were probable contributing factors.

3.6 No definite cause was established as to why the helicopter collided with the sea.

3.7 Main rotor separation prior to colliding with the sea probably did not occur, but could not be entirely ruled out.

23 October 1996

M F Dunphy
Chief Commissioner

Glossary of Aviation Abbreviations

AD	Airworthiness Directive
ADF	Automatic direction-finding equipment
agl	Above ground level
AI	Attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
amsl	Above mean sea level
AOD	Aft of datum
ASI	Airspeed indicator
ATA	Actual time of arrival
ATC	Air Traffic Control
ATD	Actual time of departure
ATPL (A *or* H)	Airline Transport Pilot Licence (Aeroplane *or* Helicopter)
AUW	All-up weight
°C	Degrees Celsius
CAA	Civil Aviation Authority
CASO	Civil Aviation Safety Order
CDI	Course Deviation Indicator
CFI	Chief Flying Instructor
C of A	Certificate of Airworthiness
C of G (*or* CG)	Centre of gravity
CPL (A *or* H)	Commercial Pilot Licence (Aeroplane *or* Helicopter)
DME	Distance measuring equipment
E	East
ELT	Emergency location transmitter
ERC	Enroute chart
ETA	Estimated time of arrival
ETD	Estimated time of departure
°F	Degrees Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	Flight level
ft	Foot/feet
g	Acceleration due to gravity
GPS	Global Positioning System
h	Hour
HF	High frequency
hPa	Hectopascals
hrs	Hours
HSI	Horizontal Situation Indicator
IAS	Indicated airspeed
IFR	Instrument Flight Rules
IGE	In ground effect
ILS	Instrument landing system
IMC	Instrument meteorological conditions

in	Inch(es)
ins Hg	Inches of mercury
kg	Kilogram(s)
kHz	Kilohertz
KIAS	Knots indicated airspeed
km	Kilometre(s)
kt	Knot(s)
LAME	Licenced Aircraft Maintenance Engineer
lb	Pounds
LF	Low frequency
LLZ	Localiser
Ltd	Limited
m	Metre(s)
M	Mach number (e.g. M1.2)
°M	Degrees Magnetic
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	Megahertz
mm	Millimetre(s)
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)
OGE	Out of ground effect
okta	Eighths of sky cloud cover (e.g. 4 oktas = 4/8 of cloud cover)
PAR	Precision approach radar
PIC	Pilot in command
PPL (A *or* H)	Private Pilot Licence (Aeroplane *or* Helicopter)
psi	Pounds per square inch
QFE	An altimeter subscale setting to obtain height above 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	Second(s)
S	South
SAR	Search and Rescue
SSR	Secondary surveillance radar
°T	Degrees True
TACAN	Tactical Air Navigation aid
TAF	Aerodrome forecast
TAS	True airspeed
UHF	Ultra high frequency
UTC	Coordinated Universal Time
VASIS	Visual approach slope indicator system
VFG	Visual Flight Guide
VFR	Visual flight rules
VHF	Very high frequency
VMC	Visual meteorological conditions
VOR	VHF omnidirectional radio range
VORTAC	VOR and TACAN combined
VTC	Visual terminal chart
W	West