CIVIL AVIATION AUTHORITY
OF NEW ZEALAND
Te Mana Rererangi Tūmatanui o Aotearoa

SAFETY INVESTIGATION REPORT

CAA OCCURRENCE 18/6476

ALPI AVIATION SRL PIONEER 300

ZK-TNB

CONTROLLED FLIGHT INTO TERRAIN

TARINGATURA HILLS, SOUTHLAND

08 SEPTEMBER 2018

Foreword

New Zealand's legislative mandate to investigate an accident or incident is prescribed in the Transport Accident Investigation Commission Act 1990 (the TAIC Act) and Civil Aviation Act 1990 (the CA Act).

Following notification of an accident or incident, TAIC may conduct an investigation. CAA may also investigate subject to Section 72B(2)(d) of the CA Act which prescribes the following:

> **72B Functions of Authority**
>
> (2) The Authority has the following functions:
>
> (d) To investigate and review civil aviation accidents and incidents in its capacity as the responsible safety and security authority, subject to the limitations set out in section 14(3) of the Transport Accident Investigation Commission Act 1990

The purpose of a CAA safety investigation is to determine the circumstances and identify contributory factors, of an accident or incident with the purpose of minimising or reducing the risk to an acceptable level of a similar occurrence arising in the future. The safety investigation does not seek to ascribe responsibility to any person but to establish the contributory factors of the accident or incident based on the balance of probability.

A CAA safety investigation seeks to provide the Director of Civil Aviation with the information required to assess which, if any, risk-based regulatory intervention tools may be required to attain CAA safety objectives.

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Glossary of abbreviations:

AGL	above ground level
AMSL	above mean sea level
ARC	Aviation related concern
ATSB	Australian Transport Safety Bureau
C	Celsius
CAA	Civil Aviation Authority
CAR	Civil Aviation Rule(s)
CMV	Certificate and Membership Validation
E	east
EFB	Electronic flight bag
ft	foot or feet
GPS	Global Positioning System
km	kilometre(s)
m	metre(s)
METAR	Meteorological aerodrome report
MPC	Microlight Pilot Certificate
NZST	New Zealand standard time
RCCNZ	Rescue Coordination Centre New Zealand
S	south
UTC	Coordinated universal time
VHF	very high frequency

Data summary

Aircraft type, serial number and registration:	Alpi Aviation Srl Pioneer 300, s/n 74, ZK-TNB
Number and type of engines:	One, 100 HP Bombardier, Rotax Gmbh 912 S
Year of manufacture:	2002
Date and time of accident:	08 September 2018, 0912 hours[1] (approximately)
Location:	Taringatura Hills, Southland Latitude[2]: S 45° 57'11.21" Longitude: E 168° 16'32.23"
Type of flight:	Private
Persons on board:	Crew: 1
Injuries:	Crew: 1 fatal
Nature of damage:	Aircraft destroyed
Pilot-in-command's licence:	Advanced National Microlight Pilot Certificate
Pilot's age:	71 years
Pilot-in-command's total flying experience:	Approximately 1865 hours
Information sources:	Civil Aviation Authority field investigation
Investigator in charge:	Mrs S Mandich

[1] All times in this report are NZST (UTC + 12 hours) unless otherwise specified.

[2] World Geodetic System 1984 (WGS-84) coordinates

Executive summary

At approximately 1611 hours on 08 September 2018, the Civil Aviation Authority (CAA) was notified of an aircraft accident involving ZK-TNB.

The Transport Accident Investigation Commission (TAIC) was notified but declined to open an inquiry. A CAA field investigation commenced the following day.

The pilot departed from Alexandra aerodrome, Central Otago, on a flight to a private airstrip near Opio, Southland. The purpose of the flight was to join a group of microlight enthusiasts at a briefing for a 'group fly-in' to Stewart Island later that morning. When the pilot failed to arrive for the briefing and subsequent flight to Stewart Island, the Rescue Coordination Centre New Zealand (RCCNZ) was notified and a search initiated. The aircraft wreckage was located on the eastern slope of the Taringatura Hills, approximately seven nautical miles (NM) to the east of the airstrip.

It was determined that the accident occurred as a result of controlled flight into terrain (CFIT)[3] in poor weather conditions, below the required visual flight rules (VFR) minima.

The CAA safety investigation considers that the Civil Aviation Rules are appropriate. The New Zealand aviation system relies on people who actively participate in the system to understand and comply with Civil Aviation Rules. This accident serves as a timely reminder of the risks associated with flight into deteriorating weather conditions and the importance of thorough preflight planning.

1. Factual information

1.1 History of the flight

1.1.1 On the morning of Saturday 08 September 2018, the pilot of ZK-TNB (the pilot), with assistance from another pilot (the lead pilot), de-iced and refuelled ZK-TNB in preparation for departure from Alexandra aerodrome.

1.1.2 The purpose of the flight was to join several other microlight enthusiasts at the private airstrip near Opio (the airstrip), for a briefing on flight operations at Stewart Island at 0930 hours before continuing. The airstrip is on the western side of the Taringatura Hills, approximately 30 NM north-west of Invercargill.

1.1.3 The flight was to be conducted under visual flight rules (VFR).

1.1.4 Due to the pilot being unfamiliar with the area, it was agreed that the pilot would follow the lead pilot's aircraft to the airstrip. They subsequently discussed the route and heights to be flown.

1.1.5 Both aircraft departed Alexandra aerodrome at approximately 0836 hours (refer point A on Figure 1).

[3] A controlled flight into terrain (CFIT) is an accident in which an airworthy aircraft, under pilot control, is accidently flown into terrain.

1.1.6 Flight data retrieved from the aircraft's AvPlan electronic flight bag (EFB) application showed that after taking off from Alexandra aerodrome, the aircraft travelled in a southerly direction in a shallow climb, towards Roxburgh Hydro. The aircraft then turned on a south-westerly heading en route toward Opio (refer Figure 1). During this portion of the flight, both aircraft climbed to an altitude of approximately 4700 feet (ft) above mean sea level (AMSL).

1.1.7 The lead pilot was in radio contact with the pilot during the duration of the flight.

1.1.8 The last visual contact the lead pilot had of ZK-TNB was when turning, abeam Roxburgh Hydro, onto the south-westerly heading towards the Old Man Range ridgeline (refer point B on Figure 1). The lead pilot stated that at this point he saw ZK-TNB slightly lower and approximately 200 m off the right wing tip of his aircraft.

1.1.9 Flight data indicates that after turning onto the south-westerly heading, the pilot climbed to an altitude of approximately 5600 ft AMSL, while the lead pilot climbed to an altitude of around 6500 ft AMSL.

1.1.10 When the lead aircraft was approximately 36 NM from Opio (refer point D on Figure 1) the pilot contacted the lead pilot via VHF radio asking for the location of Opio.

1.1.11 The lead pilot provided this information to which the pilot responded, "Thanks for that". The lead pilot stated that he assumed the pilot was loading the location into his AvPlan EFB application.

1.1.12 Flight data shows ZK-TNB's track changes slightly onto a more direct track toward Opio at point C on Figure 1. Then, the flight data shows that the pilot initiated a gradual descent just after point C on Figure 1.

1.1.13 The lead pilot stated that during the time between points C and D on Figure 1 the two pilots also discussed a "bank of cloud" and "hazy" conditions visible to the south, in the direction of their destination. The lead pilot stated that the pilot commented that, "It looks worse because we're looking at it from a distance".

1.1.14 Approximately 15 NM from Opio (refer point E on Figure 2) the lead pilot stated that he initiated a descent to 3500 ft; simultaneously altering his track in a westerly direction to 'skirt' around the northern side of the Taringatura Hills. The lead pilot stated that he assumed that ZK-TNB was still following.

1.1.15 At approximately point F on Figure 2, the lead pilot contacted a pilot who was on the ground at the airstrip. The lead pilot stated that the suggestion given was to "fly downstream on the right-hand bank of the Aparima River". He descended to 500 ft above ground level (AGL) to get under the bank of cloud and follow the river.

1.1.16 The lead pilot believed the pilot heard some of this conversation because the pilot asked, "where is the river?" The lead pilot replied, "I'm heading for it now". This was the last communication the lead pilot had with the pilot.

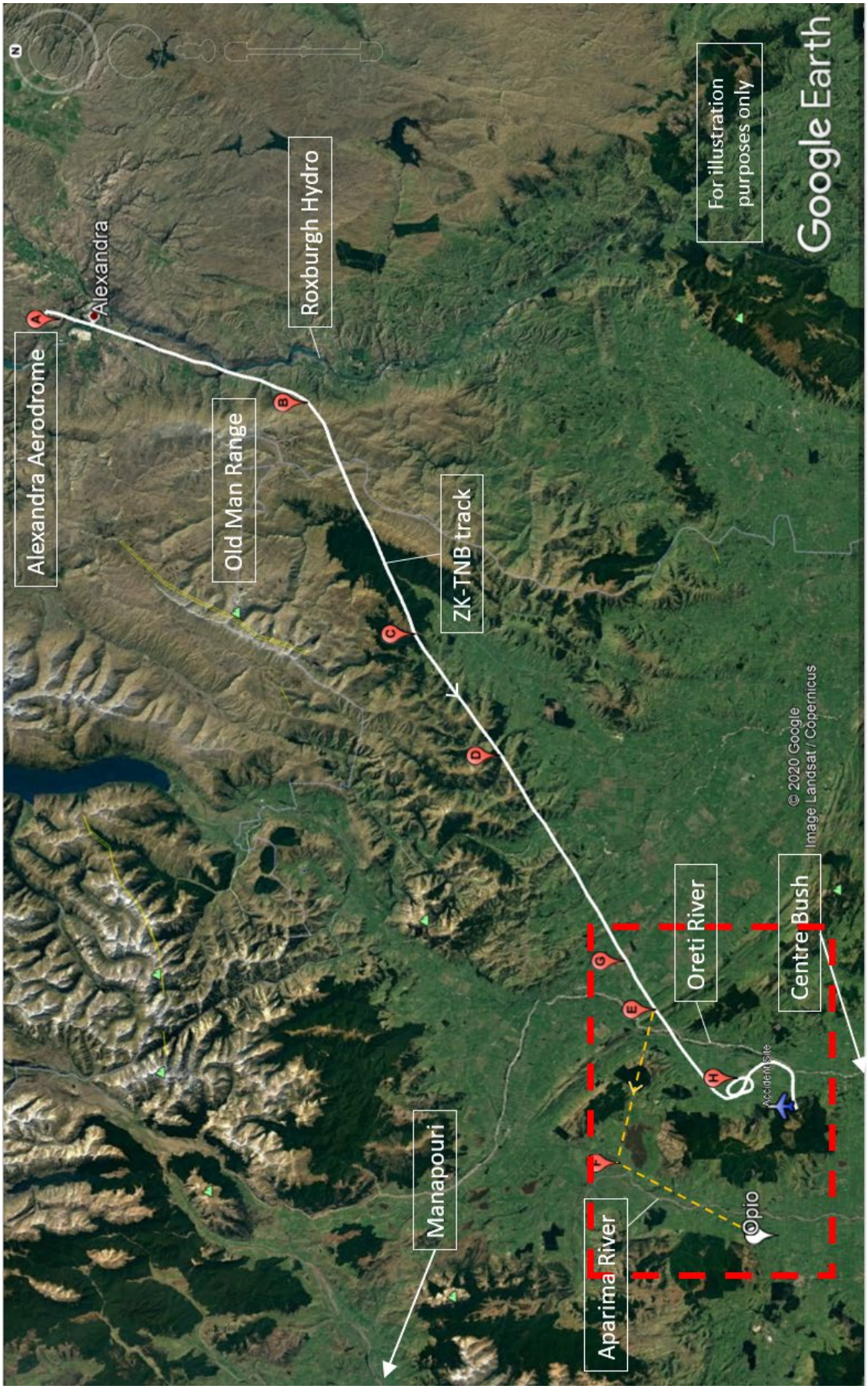

Figure 1: ZK-TNB flight track from AvPlan EFB application flight data

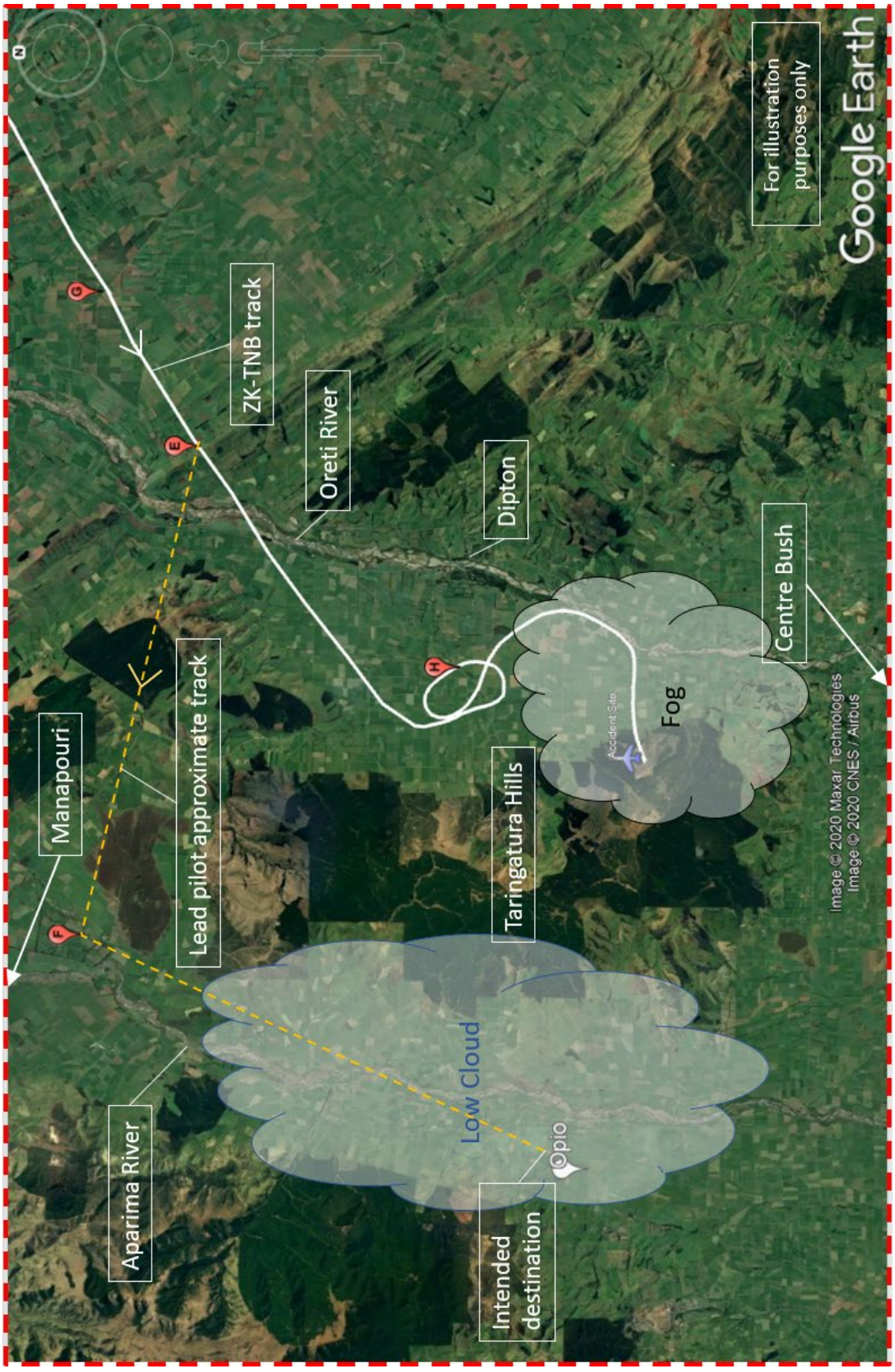

Figure 2: Inset from Figure 1
(For an accurate representation of the fog/low cloud refer Figure 4 on page 14)

1.1.17 The lead pilot descended to approximately 500 ft AGL to get under the cloud base. However due to fog and misty conditions he decided to turn back, making a radio call, “I am giving it away and turning back”. The lead pilot stated that he added, “I am turning left” as he believed ZK-TNB was still following.

1.1.18 After being informed, by a pilot on the ground at the airstrip, that the weather was clearing, the lead pilot turned back and subsequently landed at the airstrip.

1.1.19 At point E on Figure 2 the flight data shows ZK-TNB had descended to approximately 2300 ft AMSL. It then shows ZK-TNB crossed the Oreti River while remaining on track toward Opio, on the eastern side of the Taringatura Hills.

1.1.20 According to cellphone records the pilot made a call at 0908 hours to a pilot on the ground at the airstrip. The call lasted 35 seconds.

1.1.21 During the call the pilot said that he could see a bank of fog and asked if he should go over or under it. The pilot on the ground, unaware of ZK-TNB’s position, advised that “the other pilots went under and down the river beginning with ‘A’ [*Aparima*], not the Oreti”.

1.1.22 Corresponding flight data position points, at the time of the call, show ZK-TNB east of the Taringatura Hills, abeam Dipton, performing an orbit (refer point H on Figure 2). Once the call ended, ZK-TNB continued turning to the south, descending towards the Oreti River.

1.1.23 ZK-TNB then followed the Oreti River for a short distance before commencing a right turn on track toward Opio.

1.1.24 During the right turn, at 0911 hours, ZK-TNB was approximately 200 ft AGL following the Oreti River. On completion of the turn ZK-TNB had climbed to approximately 350 ft, heading directly towards the Taringatura Hills.

1.1.25 The flight data indicates ZK-TNB struck terrain at approximately 0912 hours.

1.1.26 No MAYDAY call was heard.

1.1.27 When ZK-TNB did not arrive at the airstrip, the other pilots continued with the Stewart Island briefing. It was assumed by the other pilots that the pilot had either returned to Alexandra aerodrome or continued to Stewart Island.

1.1.28 Numerous attempts were made to contact the pilot of ZK-TNB, from 0918 hours.

1.1.29 Once the group realised the pilot was not at Stewart Island, at approximately 1204 hours RCCNZ was notified of the missing aircraft, and a search was initiated.

1.1.30 With assistance from the AvPlan EFB flight data provided to the RCCNZ, the wreckage was located by a search and rescue team at approximately 1550 hours. However, the pilot was deceased.

1.1.31 The accident occurred in daylight, at approximately 0912 hours on 08 September 2018, approximately 28 NM north of Invercargill on the eastern slope of the Taringatura Hills, at a height of approximately 1085 ft AMSL. latitude S 45°57’10.8, longitude E 168°16'33.8.

1.2 Injuries to persons

Injuries	*Crew*	*Passengers*	*Other*
Fatal	1	0	0

Table 1: Injuries to persons

1.3 Damage to aircraft

1.3.1 The aircraft was destroyed.

1.4 Other damage

1.4.1 Nil.

1.5 Personnel information

1.5.1 The pilot held a valid Advanced Microlight Pilot Certificate (MPC) and current microlight medical certificate.

1.5.2 The last Certificate and Membership Validation (CMV) was carried out on 10 January 2017. The CMV recorded the pilot had accrued 1865 hours, with 118 hours being flown since the previous CMV.

1.5.3 The pilot’s total hours flown up to the time of the accident could not be established as his Pilot Logbook could not be located for assessment.

1.5.4 The pilot had been the subject of three aviation-related concern (ARC) investigations by the CAA relating to alleged unsafe flying:

- On 13 July 2009, for allegedly landing on a closed runway at Pauanui aerodrome,
- On 12 November 2013, for alleged unsafe flying,
- On 04 June 2016, for alleged unsafe flying.

1.5.5 On 24 August 2016, the CAA’s Deputy Director General Aviation authorised the suspension of the pilot’s MPC, in the interest of aviation safety, pending the outcome of a CAA Section 15 investigation into his alleged unsafe flying practices.

1.5.6 As a result of this investigation, several conditions were placed on the pilot, before the suspension could be withdrawn. These conditions were subsequently met by the pilot and the suspension was withdrawn on 25 January 2017.

1.5.7 A witness stated that the pilot had “gone IMC [instrument meteorological conditions]” within the last three months prior to the accident.

1.6 Aircraft information

1.6.1 Alpi Aviation Srl Pioneer 300, serial number 74, was manufactured in 2002 and registered as ZK-TNB, a Class 2 Microlight, in December 2004. The aircraft was powered by a 100 HP Bombardier Rotax 912 S driving a two-bladed Avtec Idrovario AIV (AVY2) in-flight variable-pitch composite propeller.

1.6.2 The aircraft was of wooden construction with composite material fairings. It was capable of carrying two people in a side-by-side arrangement and had a maximum all up weight of 499 kg.

1.6.3 A non-terminating Flight Permit was issued pursuant to the Civil Aviation Part 103, *Microlight Aircraft - Operating Rules*. The aircraft instruments and equipment supported VFR flight only.

1.6.4 An annual Microlight Aircraft Inspection and Flight Permit Validation was completed on 21 November 2017. No discrepancies or defects were noted.

1.6.5 The last maintenance was carried out on 07 September 2018. On completion of the maintenance, the aircraft was test flown with no faults found.

1.6.6 The safety investigation did not identify any evidence of mechanical issues which may have contributed to the accident.

1.7 Meteorological information

1.7.1 The CAA's Chief Meteorological Officer was commissioned to analyse the weather conditions on the day of the accident.

1.7.2 The information included automatic weather station (AWS) meteorological aerodrome reports (METAR) for Alexandra aerodrome. These mostly showed calm, frosty conditions on the morning of the accident.

1.7.3 While there are no visibility, ceiling or present weather sensors located at Alexandra aerodrome, satellite imagery at the time indicated clear skies.

1.7.4 AWS METARs for Te Anau/Manapouri aerodrome, at 0600 and 0630 respectively, fog and overcast low cloud conditions were observed. The visibility recorded by the AWS for those times were 750 m and 800 m.

1.7.5 After that time, fog was no longer reported by the AWS. However, the overcast low cloud base was reported by the Manapouri AWS to have remained between 300 and 500 ft AGL up to and beyond the time of the accident.

1.7.6 The Graphical aviation forecast[4] issued the previous evening indicated that the prevailing weather (i.e. most areas) over the lower South Island as expected to consist of nil significant cloud (NSC), with 30 km visibility and nil significant weather

4 Describes expected weather (cloud cover and type, visibility, precipitation) over New Zealand, from the surface to FL100 (10,000ft).

(NSW), with localised (LCA) areas of fog with visibility reduced to 200 m, expected to lift to form broken cloud[5] cover with a base of 800 ft AMSL by 1100 hours. The cloud was then forecast to completely clear by 1300 hours.

1.7.7 This forecast was reissued shortly before 0600 hours on the morning of the accident, with no significant change made (refer to Figure 3).

1.7.8 The elevation at Opio is approximately 600 ft AMSL and the area east of the Taringatura Hills is approximately 350 ft AMSL.

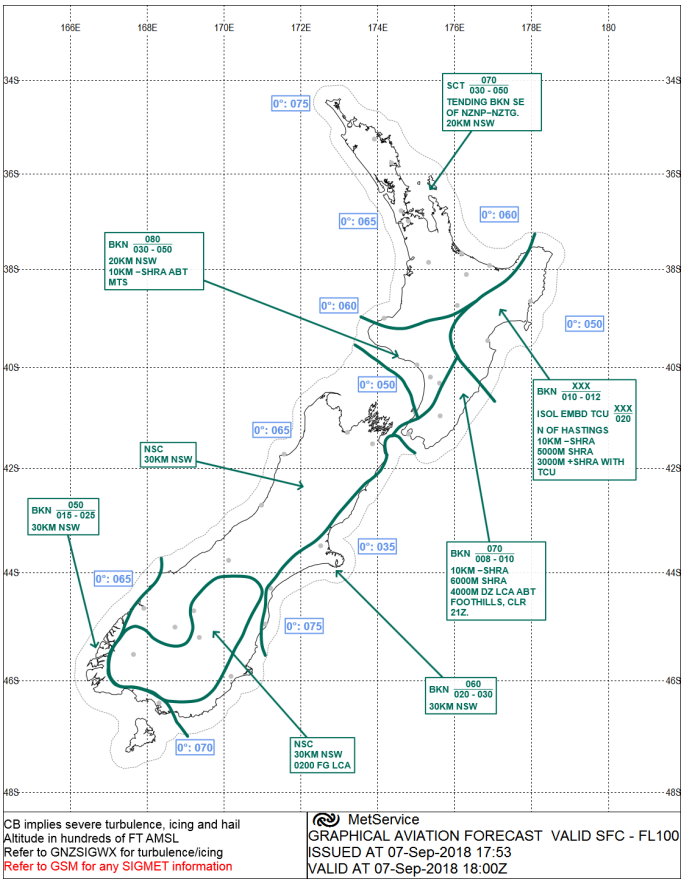

Figure 3: Graphical aviation forecast for New Zealand, valid at 1800Z 7 September 2018 (0600 hours 8 September 2018 NZST) and issued at 1753Z 7 September 2018 (0553 hours 8 September 2018 NZST)

1.7.10 Satellite imagery for the same day and time showed extensive areas of fog over the lower South Island, particularly in the valleys and basins. The location of the accident site is coincident with a large area of fog or low cloud depicted in the satellite image (refer to Figure 4).

5 Broken cloud (5 to 7 octas), where more than half the sky is covered and is represented by the term octas (eighths of the sky) in meteorological reports.

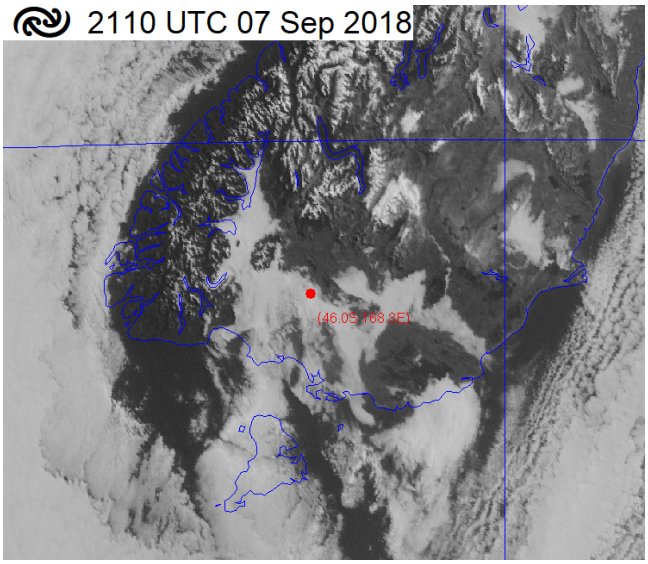

Figure 4: Himawari-8 visible satellite imagery at 21:10Z 7 September 2018 (0910 hours 8 September 2018 NZST), with the accident location marked by the red dot.

1.7.11 Several witnesses described the meteorological conditions in the area at the time of the accident. One in particular, a pilot, stated that he was driving from Centre Bush to Manapouri and recalled that between Centre Bush and approximately 4 km north of Dipton there was, "very heavy grey fog to the ground with no wind, and visibility of 140 m". He also stated that the "fog bank was solid from ground level up above the Taringatura Hills and believed that the fog would be there for a while".

1.7.12 There was no record the pilot had accessed Internet Flight Information Services (IFIS) or the MetService for weather information before his departure from Alexandra aerodrome.

1.8 Aids to navigation

1.8.1 The pilot used an iPad® which contained an AvPlan EFB application.

1.8.2 The AvPlan EFB application is designed to aid pilots by integrating information sources required to prepare, plan and execute a flight. This information includes, but is not limited to, aeronautical charts, IFIS access, MetFlight linkage, terrain map overlay with obstacle-alerting function and a GPS moving map.

1.8.3 To assist the pilot en route, the AvPlan EFB application has a plan/fly selector switch which allows the pilot to change from planning mode to flight mode. The AvPlan EFB has several features, including a selectable terrain alerting function. This function provides an audible warning when in close proximity to terrain.

1.8.4 The pilot's iPad® was recovered and the AvPlan EFB application accessed. There was no evidence of an active flight plan, or that the pilot conducted preflight planning. It was noted that the terrain and altitude-alerting function had not been selected on by the pilot. However, the waypoint for Opio had been entered into the AvPlan EFB application.

1.9 Communications

1.9.1 The aircraft was equipped with a VHF radio.

1.9.2 The pilot also had the capability to use his cellphone via Bluetooth through his headset.

1.9.3 Communications between the lead pilot and the pilot were via VHF radio and cellphone.

1.9.4 The last known communication from the pilot was a cellphone call at 0908 hours to a pilot on the ground at the airstrip.

1.9.5 On the day of the accident the pilot had been operating in uncontrolled airspace and no radio calls were recorded by Air Traffic Services. It is not known whether the pilot made any position reports during the flight.

1.9.6 Radar surveillance data supports the flight data recovered. However, ZK-TNB disappears from radar surveillance coverage below 4000 ft AMSL prior to the accident due to lack of radar coverage at low levels in the area.

1.10 Aerodrome information

1.10.1 Not applicable.

1.11 Flight recorders

1.11.1 The aircraft was not fitted with a dedicated flight data recorder, nor is it required to be. However, video recordings of previous flights were retrieved from the pilot's cellphone and iPad® that were used to assist the safety investigation.

1.11.2 AvPlan EFB software used by the pilot records the GPS flight parameters and stores them remotely. This information was obtained by RCCNZ, and assisted with locating the aircraft wreckage.

1.12 Wreckage and impact information

1.12.1 The aircraft wreckage was found on the eastern side of the Taringatura Hills, approximately 750 ft below the ridgeline. The distance from the initial point of impact to where the aircraft came to rest was approximately 28m, on a 45° incline.

1.12.2 All the aircraft components were accounted for, on site.

1.12.3 The site examination indicated the aircraft struck the slope while in straight and level flight, tracking in a westerly direction towards Opio.

1.12.4 After the initial impact, the aircraft continued up the slope, coming to rest facing approximately 180° to the direction of travel. The aircraft was severely disrupted, and largely consumed by a post-impact fuel-fed fire.

1.12.5 Although flight control runs were disrupted by the impact and ensuing fire, pre-accident control integrity was established as far as possible.

1.13 Medical and pathological information

1.13.1 Post-mortem examination determined the pilot died of injuries consistent with a high energy impact.

1.13.2 No contributory disabling disease was evident.

1.13.3 Toxicology results showed the pilot had 0.3mg of Citalopram[6] per litre of blood present in his blood. The report states that "this level appears to be consistent with normal use".

1.13.4 The CAA has published medical information on its website, specific to Citalopram[7]. This information states, "*Some anti-depressant drugs are viewed by the CAA as being safer for aviation than others. The CAA considers Sertraline, Citalopram, and Fluoxetine to be the safest of the anti-depressant medications from an aviation safety perspective,…".* It also states, *"Our view is also that well treated cases of depression, in established remission, or / and taking reliably safe medication without problems,* [a pilot] *may be eligible to return to aviation".*

1.13.5 The pilot's general practitioner (GP) was aware that the pilot had been prescribed Citalopram and was listed as a "current and long-term medication". The GP also signed the pilot's current Medical Declaration and Certificate as being fit to fly with a passenger.

1.13.6 Based on this, the safety investigation concluded that, although the pilot had been taking the medication Citalopram, this was not considered to be a contributing factor in the accident.

1.14 Fire

1.14.1 Following the impact with terrain, an intense post-crash fire consumed most of the aircraft. The ignition source was likely from impact-related damage to the aircraft electrical components. The fire was then fed by fuel from the disrupted fuel tanks.

1.15 Survival aspects

1.15.1 The impact forces were not survivable.

1.15.2 The aircraft was not equipped with an emergency locator transmitter, nor is it required to be. However, the pilot had a personal locator beacon but the circumstances of the accident would not have enabled the pilot to activate it.

1.15.3 Although the impact forces were not survivable, it is noted there was no flight plan filed with Airways Corporation of New Zealand or active flight following for this flight. This led to a significant delay in identifying that the aircraft was missing and subsequent initiation of a search.

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[6] Citalopram is used in the treatment of depressive illness in the initial phase and maintenance against potential relapse or recurrence. https://www.medsafe.govt.nz/profs/datasheet/c/citalopramtab.pdf

[7] https://www.aviation.govt.nz/assets/publications/medical-information-sheets/mis016-depression.pdf

1.15.4 On 05 August 2019, as a result of a previous accident and this accident, the CAA formally requested the Part 149 AROs communicate to their members the importance of flight following services and the management and oversight of group flyaways. Additionally, in the Summer 2019 edition of *Vector*, an article was published reminding pilots of the importance of flight following.

1.16 Tests and research

1.16.1 The engine was dismantled and inspected by a specialist facility under CAA supervision.

1.16.2 The inspection found the propeller spinner back plate was folded backwards on both sides of the propeller hub, indicating the engine was turning at the time of impact.

1.16.3 No fault was found indicating the engine was not operating as expected at the time of the accident.

1.16.4 Situational awareness is a commonly used term in aviation. In simple terms it means appreciating all you need to know about current tasks and being able to anticipate future changes and/or developments.[8] The way a pilot achieves situational awareness is considered, by many human factors researchers, to be a process of 'pattern-matching'. A pilot compares their appreciation (mental model) of a situation, with the actual environment in which they find themselves, to gain an understanding of the current evolving situation.[9]

1.16.5 Human factors research describes mental models as representations of the world based on the individual's knowledge. These representations are built on, and continuously updated by, an individual's ability to detect or determine changes picked up by sensory channels (visual, auditory, etc.) and the meanings assigned.

1.16.6 Studies of people's judgement under conditions of uncertainty led researchers to a focus on understanding heuristics and biases.[10] Heuristics and biases can be considered subconscious strategies, shortcuts or 'rules of thumb' for making decisions or judgements. In certain situations, however, they can lead to systematic errors or flaws in the way people process information and make decisions.

1.16.7 In aviation, the generally accepted definition of expectation bias is that of having a strong belief or mind set toward a particular outcome, or 'you hear what you want to hear'.

8 https://www.skybrary.aero/index.php/Situational_Awareness_(OGHFA_BN), section 4, Issues and Factors Involved. Accessed 01/08/2020

9 Endsley, M. R.(2015). Situation Awareness Misconceptions and Misunderstandings. *Journal of cognitive engineering and decision making 9*(1), 4-32.

10 Tversky, A. & Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *Science, New Series, 185*(4157), 1124-1131.

1.16.8 Confirmation bias is another common example. It can be described as the tendency to search for evidence, or interpret information, consistent with a presently held view or understanding of the current situation, even in light of contradictory information.[11]

1.16.9 The continuation of a VFR flight into IMC is widely regarded as a significant and continuing factor in many aviation accidents.

1.16.10 Research conducted by the Australian Transport Safety Bureau (ATSB) shows that although the dangers of flying VFR into IMC are well-known, pilots still fly into deteriorating weather. An ATSB research investigation report, *General Aviation Pilot Behaviours in the Face of Adverse Weather* concluded that*:*

> *'The chances of a VFR into IMC encounter increased as the flight progressed until they reached a maximum during the final 20 [percent] of the flight distance. This result highlights the danger of pilots 'pressing on' to reach their destination.'*

1.17 Organisational and management information

1.17.1 Microlight activities in New Zealand are administered by an aviation recreation organisation (ARO). The Director of Civil Aviation delegates authority for the issue of Pilot Certificates and authorisation of microlight inspections to a nominated senior person in a Part 149 ARO.

1.17.2 Civil Aviation Rule (CAR) 149.63 *Internal Quality Assurance* requires that each ARO has procedures in place to ensure that any safety problems are identified, and appropriate actions are agreed on to correct the deficiencies.

1.17.3 The pilot's ARO provided documentation relating to the pilot's CMV and Microlight Aircraft Inspection and Flight Permit Validation. Although the pilot had a number of ARCs investigated by the CAA, no safety-related information was available from the ARO.

1.17.4 CARs require microlight pilots to report accidents but only a limited scope of incidents. The CARs do not require AROs to report safety concerns or incidents to the CAA, unless associated with CAR Part 115 *Adventure Aviation - Certification and Operations*.

1.17.5 Although CARs require a limited scope of reporting within the microlight community, the CAA encourages all aviation participants to actively report any safety-related concern.

11 Walmsley, S. & Gilbey, A. (2017) Debiasing visual pilots' weather-related decision making*. Applied Ergonomics,* Vol.65, pp.200-208

1.18 Additional information

1.18.1 Pilots operating on an MPC must comply with CAR 103.155 *Flight criteria* which states that:

(a) A pilot shall only operate a microlight aircraft –
(1) by day, and
(2) in VFR meteorological minima equal to or better than those prescribed in 91.301.

1.18.2 The accident flight was conducted in Class G airspace (general airspace) and the pilot was required to comply with CAR 91.301 *VFR meteorological minima* which requires:

> *Aircraft operating at or below 3000 feet AMSL or 1000 feet above terrain, whichever is higher, must remain clear of cloud and in sight of the surface. A minimum flight visibility of five kilometres is also required.*

1.18.3 CAR 91.311 *Minimum heights for VFR flights* requires a minimum altitude of 500 ft AGL for the area in which ZK-TNB was flying.

1.18.4 Prior to commencing a flight, a pilot is required to obtain and become familiar with current available meteorological forecasts for the area and alternatives available if the planned flight cannot be completed, as required by CAR 91.217 *Preflight action.*

1.19 Useful or effective investigation techniques

1.19.1 The CAA acknowledges the assistance provided by AvSoft Australia, the developer of the AvPlan EFB application, and the New Zealand Police.

2. Analysis

2.1 It is evident the accident occurred as a result of the aircraft having flown into the eastern slope of the Taringatura Hills in controlled flight, during poor weather conditions.

2.2 Satellite imagery at the time of the accident showed extensive areas of fog over the lower South Island, particularly in the valleys and basins. During the flight, the lead pilot and the pilot discussed a “bank of cloud” in the direction of their destination. The time and location of the accident site corresponds with a large area of fog or low cloud depicted in the satellite image, Figure 2.

2.3 A pilot, who was driving in the vicinity of the accident site and later interviewed, stated that between Centre Bush and approximately 4 km north of Dipton there was “very heavy grey fog to the ground with no wind and visibility of 140 m”. He also stated that “the fog bank was solid from ground level up above the Taringatura Hills and believed that the fog would be there for a while”.

2.4 The reason the pilot chose to continue into weather below VFR meteorological minima, described by witnesses as “thick fog”, could not be conclusively

determined. However, research shows there are many factors that may compel a pilot's decision to 'press on'. These may be a desire to reach the destination by a certain time, the fear of 'losing face'[12] with peers, or not accurately assessing the risk of the situation[13].

2.5 Analysis of the flight data determined that, after departing Alexandra aerodrome, point A on Figure 1, and reaching Roxburgh Hydro, point B on Figure 1, the pilot was following the lead aircraft. It is considered likely that at some stage between point B and point G on Figure 1 the pilot became separated from the lead aircraft.

2.6 After passing point B on Figure 1, the pilot requested the location of Opio from the lead pilot. Evidence shows that the waypoint for Opio had been entered into the AvPlan EFB, and at point C on Figure 1 it can be seen that the aircraft heading changes to a more direct track toward Opio. Although it could not be conclusively determined when the waypoint was entered, evidence supports the lead pilot's belief that the pilot did so en route.

2.7 When the conversation took place between the lead pilot and the pilot who was on the ground at the airstrip, ZK-TNB would have been at approximately point G on Figure 1. During the conversation the pilot asked, "where is the river?", with the lead pilot replying, "I'm heading for it now". The next river the pilot encountered on the flight route was the Oreti River.

2.8 It is most likely that due to the pilot being unfamiliar with the area, when he saw the Oreti River he, in error, determined that this was the river that the lead pilot was heading for. Having received information indicating the river was ahead, and then a short time later encountering a river as expected, it is considered likely that expectation bias led the pilot to think this was the correct river.

2.9 The flight data shows that approximately 3 NM to the east of Dipton the aircraft commenced an orbit, during which time the pilot made a cellphone call to a pilot on the ground at the airstrip. During this call the pilot of ZK-TNB advised that he could see a bank of fog and asked if he should go over or under the fog. The response he received was that "the other pilots went under and down the river beginning with 'A' [*Aparima*], not the Oreti". As described by witnesses and as depicted on Figure 1, the other pilots, including the lead pilot, were to the west of the Taringatura Hills when encountering the weather under which they 'went', which was a low cloud bank.

2.10 Hearing that the other pilots had encountered weather and had gone 'down and under', it is likely confirmation bias led the pilot to think he was indeed following the correct river and 'following' the other's route, even though he was on the eastern side of the Taringatura Hills.

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[12] Losing face can be described as: to become less respected by others.

[13] Madhavan, P. & Lacson, F. C. (2006) Psychological Factors Affecting Pilots Decision to Navigate in Deteriorating Weather. *North American Journal of Psychology* 8(1), 47-62

2.11 It is likely the information the pilot received during the flight led him to form a mental picture of the route ahead, and the physical features encountered matched those expected by the pilot. Given that the pilot was unfamiliar with the area, it is also considered likely that confirmation bias led the pilot to believe that it was possible to fly under the fog, as the other pilots 'had'.

2.12 Although VFR flight into IMC is well-known by pilots to be hazardous, considering the aircraft's flight path, the destination had nearly been reached. Therefore, according to the ATSB research, the pilot was nearing the highest chance of a VFR into an IMC encounter.

2.13 Human factors research has found that VFR pilots who deliberately entered IMC tended to have experienced the conditions previously and possessed a comparatively greater tolerance of risk. When recounting the event as part of the study, they experienced less anxiety and perceived the risks associated with the transition into instrument conditions as relatively lower than those pilots whose entry into instrument conditions was inadvertent.[14] According to a witness, the pilot had within the three months prior to the accident, experienced a VFR into IMC encounter.

2.14 The pilot had been investigated several times by the CAA for alleged unsafe flying, ultimately resulting in the suspension of his MPC pending the outcome of a CAA Section 15 investigation. Video recordings retrieved from the pilot's cellphone and iPad® demonstrated unsafe flying practices, including low flying over water and aerobatics in ZK-TNB. The pilot was not aerobatics rated, nor was the aircraft approved for aerobatic flight. The conduct of these activities, which are in breach of the CARs, is considered to demonstrate poor airmanship and reflects a propensity for risk-taking behaviour.

2.15 Although the route and heights to be flown were discussed with the lead pilot, this discussion did not adequately meet the standard expected for flight planning. Additionally, no evidence was found that the pilot had accessed weather information on the day of the accident. This accident serves as a timely reminder of the importance of conducting thorough flight planning, including acquiring the most up-to-date weather, identifying minimum safe altitudes for the terrain you are flying over and having a 'Plan B' should things not go as expected. It is also important to adhere to all CARs.

2.16 The CAA has provided several educational publications to raise awareness of the risks associated with flying into deteriorating conditions. One example is the "Fly to the Conditions" article published in the March / April 2013 issue of *Vector*. In the spring 2020 issue of *Vector* the article "Flight Planning not a quick once-over" was published, which highlights and informs pilots of the importance of conducting appropriate flight planning.

[14] Mark W. Wiggins, David R. Hunter, David O'Hare, Monica Martinussen. (2012). Characteristics of pilots who report deliberate versus inadvertent visual flight into Instrument Meteorological Conditions. *Safety Science 50*(1), 472–477

3. Conclusions

3.1 It was determined the accident occurred due to controlled flight into terrain (CFIT) in poor weather conditions below the required VFR minima.

3.2 It was likely that a combination of confirmation and expectation bias influenced the pilot's belief that he was following the route the other pilots had taken.

3.3 The pilot descended below 500 ft AGL and entered weather conditions below the required VFR meteorological minima, in non-compliance with CAR 91.311 *Minimum heights for VFR flights* and CAR 91.301 *VFR meteorological minima*.

3.4 The pilot did not adequately meet the standard expected for flight planning, including obtaining weather information, prior to the flight, in non-compliance with CAR 91.217 *Preflight action*.

3.5 The actual weather conditions reflected the weather forecast for the area to be flown.

3.6 The pilot was appropriately qualified.

3.7 The aircraft had a valid Microlight Aircraft Inspection and Flight Permit Validation.

3.8 No pre-accident aircraft defects were found.

3.9 The pilot was not instrument-rated nor was the aircraft equipped for flight into IMC. According to Human Factors research, having previously experienced an IMC encounter likely influenced the pilot's decision to enter the fog.

3.10 While there was a delay in locating the aircraft wreckage and the pilot, the accident was not survivable.

3.11 It is the responsibility of the pilot to ensure they are appropriately prepared to conduct the flight. This includes conducting thorough preflight planning, which will provide the pilot with the most accurate mental model of the route to be flown.

4. Safety actions/Recommendations

4.1 A *Vector* Article – "Flight planning not a quick once-over" was published in the Spring 2020 issue. The article aims to raise awareness of the importance of proper preflight preparation to minimise the risks of the flight going awry.

https://www.aviation.govt.nz/assets/publications/vector/Vector-Magazine-Spring-2020.pdf

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