Australian Government
Australian Transport Safety Bureau

VFR into IMC and loss of control involving Cessna 172, VH-FYN

13 km NNW of Ballina, New South Wales | 16 June 2017

Investigation

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Safety summary

What happened

On 16 June 2017, a Cessna Aircraft Company C172M, registered VH-FYN, was being operated on a private flight from Southport Mason Field, Queensland to Ballina Airport, New South Wales. The purpose of the flight was to ferry the aircraft to Ballina for scheduled maintenance. En route, near the town of Bangalow NSW, the aircraft entered an area of reduced visibility, including low cloud, fog and drizzle. The aircraft diverted off the initial track and was last seen disappearing into cloud heading inland. A short time later the aircraft collided with terrain and the pilot was fatally injured.

What the ATSB found

The ATSB found that the decision to depart Southport for Ballina on the morning of 16 June placed the pilot at risk of encountering conditions of reduced visibility. En route to Ballina, the aircraft entered an area of reduced visibility and the pilot likely became spatially disorientated resulting in a loss of control and collision with terrain. It was also found that after re-scheduling his maintenance booking twice, and with the aircraft's maintenance release due to expire, the pilot was likely under some degree of self-imposed pressure to continue with the flight despite encountering inclement weather conditions. It could not be determined if the pilot consulted the most current weather forecasts on the morning of the accident.

Safety message

Weather-related accidents remain one of the most significant causes of fatal accidents in general aviation and continues to be a focus of the ATSB's *SafetyWatch* initiative. *SafetyWatch* highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns relates to inflight decision making, particularly involving pilots flying with reduced visual reference. *SafetyWatch* provides information about each safety concern, and strategies to help manage risk areas, along with links to safety resources. In relation to visual flight rules (VFR) pilots flying into areas of reduced visibility, some key messages are:

- Pilots should avoid deteriorating weather by conducting thorough pre-flight planning. They should ensure they have alternate plans in case of an unexpected deterioration in the weather and make timely decisions to turn back, divert or hold in an area of good weather.
- VFR pilots should use a 'personal minimums' checklist to help control and manage flight risks through identifying risk factors that include marginal weather conditions and only fly in environments that do not exceed their capabilities.
- Pressing on into instrument meteorological conditions without a current instrument rating carries a significant risk of severe spatial disorientation due to powerful and misleading orientation sensations with reduced visual cues. Disorientation can affect any pilot, no matter what their level of experience.
- If VFR pilots find themselves in marginal weather and becoming disoriented or lost, they should seek whatever help is available. Air Traffic Services (ATS) may be able to provide assistance, especially if the aircraft is in ATS surveillance coverage. There have been a number of reported occurrences where this simple action has averted potential disaster.

The occurrence

On the morning of 16 June 2017, a Cessna Aircraft Company C172M, registered VH-FYN (FYN), was being operated on a private flight under the visual flight rules (VFR)[1] from Southport Mason Field, Queensland to Ballina Airport, New South Wales. The purpose of the flight was to ferry the aircraft to Ballina for routine maintenance. The pilot, who was the owner of the aircraft, was the sole occupant.

The maintenance release for the aircraft was due to expire on Saturday 17 June 2017. Approximately four to six weeks prior to this, the pilot rang his maintenance provider in Ballina to book FYN in for its annual inspection. The initial booking was scheduled for Tuesday 13 June. On Monday 12 June, the pilot rang the maintenance provider to request the booking be moved to Wednesday 14 June due to inclement weather forecast at Ballina on the Tuesday. On Wednesday 14 June, the booking was moved again, this time to Friday 16 June, again due to inclement weather forecast at Ballina. Later on Wednesday 14 June, the pilot rang again to confirm the appointment for Friday.

On the morning of Friday 16 June, the pilot rose at his usual time of 0500 Eastern Standard Time[2] and at about 0645 departed for the airfield. At 0737 the pilot entered the clubhouse at Southport Flying Club and spoke with the aerodrome manager and another club member. The pilot was reportedly in good spirits but reported that he had had trouble submitting his on-line flight plan. At 0800 the pilot radioed air traffic control (ATC) to submit a flight plan to Ballina. The plan was accepted and at 0811 the aircraft departed Southport Mason Field. Recorded ATC data[3] showed the aircraft climbed to an altitude of 1,500 ft above mean sea level (AMSL)[4] and turned south-east, see Figure 1. The aircraft then tracked to Stotts Island at between 1,500 and 1,800 ft. At 0828, while overhead Stotts Island, the pilot radioed ATC to report his position. This was the last radio call recorded from the pilot of FYN. At this point FYN departed controlled airspace and turned further south to track towards Ballina.

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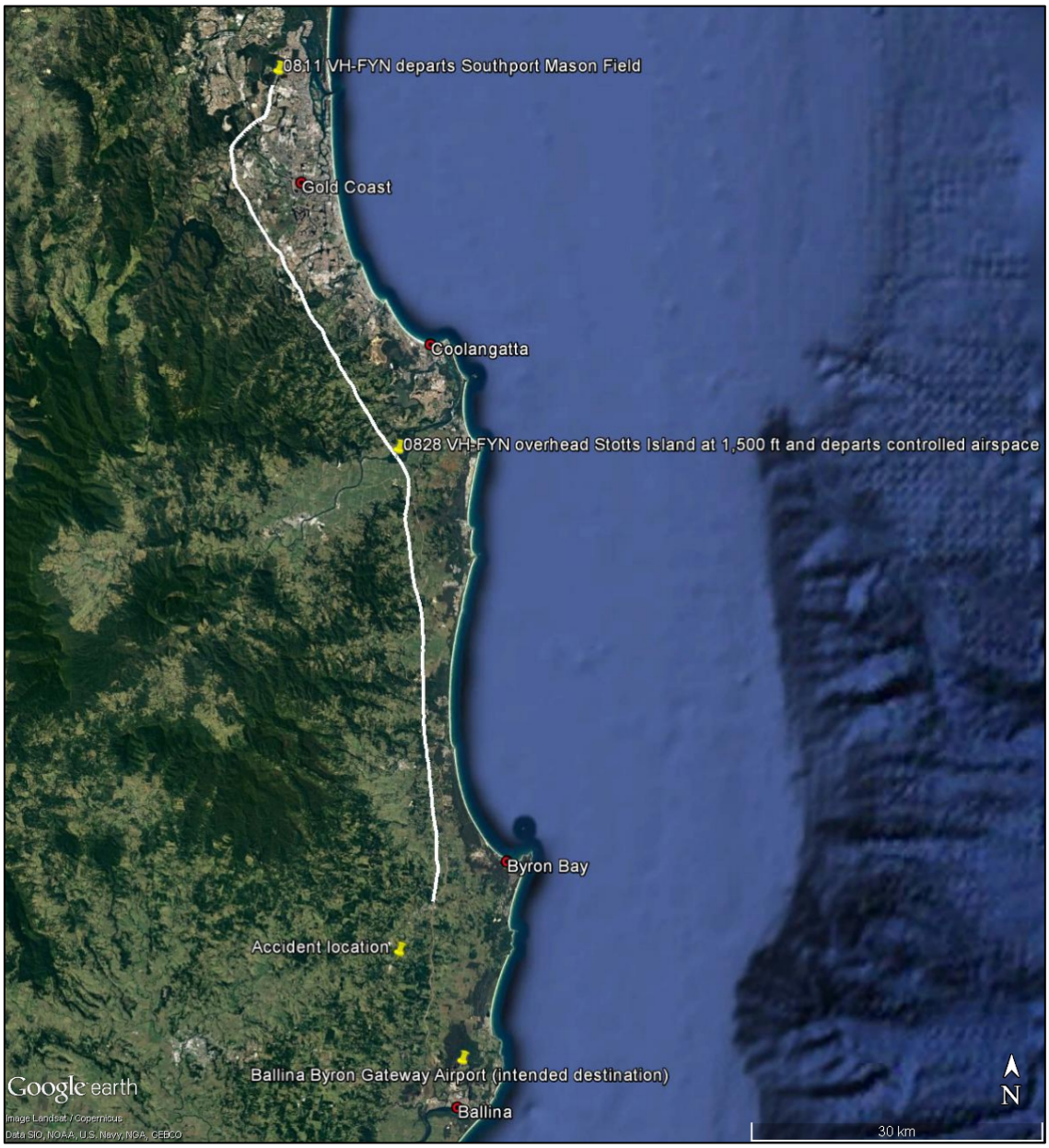
1 VFR: a set of regulations that permit a pilot to operate an aircraft only in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.

2 Eastern Standard Time (EST): Coordinated Universal Time (UTC) + 10 hours.

3 The aircraft was fitted with a Garmin GPSMAP 495 Global Position System (GPS) device. This device logged GPS data from 0758 to 0813 on the accident day, enough data to capture the take-off and part of the initial climb. It could not be determined why the device ceased logging data at this point. The data that was obtained from this device was consistent with that provided by the ATC radar.

4 All levels are AMSL unless otherwise stated.

Figure 1: Radar track of VH-FYN on 16 June 2017



Radar track sourced from Airservices Australia overlaid on a Google Earth image showing the track of VH-FYN on 16 June 2017. The radar data show the aircraft take-off from Southport Masson Field and head south-east along the western VFR route to Stotts Island before tuning south towards Ballina. Also shown is the accident location approximately 13 km north-north-west of Ballina.
Source: Google Earth, modified by the ATSB

The flight from Stotts Island onwards took place between about 1,500 and 2,000 ft, tracking alongside the Pacific Highway. At 0842, when the aircraft was about 6 km north of Bangalow, a steady descent was commenced (see Figure 2).

Figure 2: Radar track of VH-FYN near Bangalow, NSW

Radar track sourced from Airservices Australia overlayed on a Google Earth image showing the track of VH-FYN on 16 June 2017. The radar data show the aircraft descended from 1,500 to 800 ft just north of Bangalow before radar identification was lost. Also shown further to the west are the last radar data obtained from VH-FYN as well as the position of the last known eyewitness of the aircraft and the location of the accident site. Source: Google Earth, modified by the ATSB

By the time the aircraft was about 1 km north of Bangalow, at 0844, it had descended to 800 ft, at which point radar identification was lost. A short time later, at approximately 0845, and about 3 km further south, a witness driving south on the Pacific Highway reported seeing an aircraft overhead in front of her vehicle. The witness noted that the aircraft was flying lower than she would normally have expected. The witness then saw the aircraft turning gradually to the right (west) and disappear into cloud. The witness reported low patchy clouds, fog and drizzle in the area at the time.

At 0847, about 6 km south west of the end of the initial radar track, surveillance data was regained momentarily capturing three points, five seconds apart (the standard radar sample rate). These data points showed the aircraft heading in a west-south-westerly direction at an altitude of 700 ft. The elevation of terrain in this area ranged between about 88 and 233 ft.

At approximately 0850, several witnesses in the vicinity of Brooklet, NSW heard the engine noise of a low flying aircraft, followed by a loud bang. The aircraft wreckage was located on a farming property near Brooklet at an elevation of about 400 ft, 13 km north-north-west of Ballina airport. Several witnesses in the vicinity of the accident site reported low cloud and fog in the area at the time of the accident.

Context

Pilot information

General information

The pilot held a Private Pilot Licence (Aeroplane) issued under the Civil Aviation Safety Authority (CASA) Civil Aviation Regulations (CAR 5) on 29 June 1992. He then transferred his licence to Civil Aviation Safety Regulations (CASR) Part 61 on 19 February 2016. The pilot was rated for single-engine aeroplanes and had no additional endorsements. He most recently completed a flight review in accordance with CASR Part 61 in VH-FYN (FYN) on 3 February 2016 that was valid for 24 months. The pilot's logbook showed a total flying experience of 580 hours to the last entry dated 9 June 2017. His total experience on type was 350 hours, representing almost all of his flying experience since August 2009. In the 90 days prior to the accident, the pilot had flown 5.0 hours, all in FYN. The pilot did not hold an instrument rating and had recorded only 4.1 hours of instrument flight time, most of which was gained during training for his licence. The most recent instrument flying was recorded in August 1997.

Medical information

The pilot held a Class 2 Medical Certificate. His last medical examination was conducted on 1 December 2015 and was valid until 13 December 2017. The pilot's Medical Certificate required him to have reading correction available while flying. The ATSB was unable to determine whether spectacles were worn or carried by the pilot at the time of the accident. The pilot was reported to have displayed normal behaviour on the morning of the flight and was said to be well rested. He was not taking any prescription medications and had no reported medical condition that might have affected his ability to operate an aircraft that day.

A post-mortem examination identified no significant background natural disease which could have contributed to the accident. Toxicological analysis concluded that the toxicology was also non-contributory to either the accident or cause of death.

Aircraft information

Overview

FYN (Figure 3) was a Cessna Aircraft Company 172M four-seat, single-engine, high (strut braced) wing, all metal, unpressurised, fixed (tricycle) undercarriage aircraft. The aircraft was manufactured in the United States in 1976 and first registered in Australia on 21 October 1976. The pilot had been the registered owner of the aircraft since 4 August, 2009. It had current certificates of airworthiness and registration.

Figure 3: VH-FYN, taken in September 2009 at Dunwich, Queensland

Source: Dave Wilson (www.jetphotos.com)

Maintenance

FYN was maintained by a CASA-approved maintenance facility. The aircraft was VFR night certified in the private operational category and maintained under CASA CAO 100.5 – CASA schedule 5. The aircraft had a maintenance release that was valid until 17 June 2017 or 4164.3 flight hours, whichever was reached first. At the time of the accident there were nil recorded defects noted on the maintenance release nor were there any defects known by the maintenance provider. The maintenance release, which was recovered from the accident site, indicated that the aircraft had accumulated 4090.2 flight hours up to the previous flight.

Engines and propellers

The aircraft was originally fitted with a Textron Lycoming O-320-E2D with a McCauley 1C160DTM propeller. In April 2011, the aircraft was upgraded with a Textron Lycoming O-360-A4M 180 horsepower four-cylinder reciprocating engine. At the same time, a Sensenich two blade fixed pitch propeller model number 76EM8S14-0-60 was installed.

Wreckage and accident site information

Accident site

The accident site was located on the outskirts of the town of Brooklet, approximately 13 km north-north-west of Ballina, New South Wales (NSW). The initial impact occurred at the top of a ridge, at about 400 ft (122 m) elevation, on the border of two agricultural properties. The wreckage trail then continued for over 40 m down the side of the ridge through dense bush and rainforest. The trajectory of the wreckage trail was on a heading of about 145°.

Wreckage examination

On-site examination of the wreckage found that the aircraft collided with terrain with the right wing down at an angle of about 30° (Figure 4). The outboard section of the left wing, with the left aileron and aileron bell crank was situated in a tree about six to eight meters above the ground at the beginning of the wreckage trail. The right navigation light assembly was captured on a wire that

was strung along the bottom of a net at ground level. Associated with the navigation light was a ground scar consistent with the wing tip colliding with the ground. The outer points of the wings were consistent with the Cessna 172M wingspan. Measurements of tree scars at the site indicated that the wreckage trail was at about a 50° downwards trajectory, indicating that the aircraft was in a significant nose-down attitude at the time of impact.

Figure 4: Initial collision with terrain at Brooklet, New South Wales

Image shows the initial impact points of VH-FYN. The left wing impacted trees while the right wing impacted the ground, indicating an angle of bank at the time of impact of about 30° to the right.
Source: ATSB

Airframe

The bulk of the fuselage was situated approximately 25 m from the initial point of impact. The engine and propeller were a further 16 m down the slope. No evidence of either a pre or post-impact fire was found.

Engine and propeller

The engine and propeller assembly were found 41 m from the initial impact point. On-site examination of both the engine and propeller did not identify any mechanical defects that may have contributed to the accident. It was determined that at the time of the accident, the engine was producing significant power, which was translated through the propeller.

Flight controls

All primary and secondary flight control surfaces were identified in the wreckage trail. Additionally, all control cables were attached to either the appropriate control surface, or control mechanism. Cables that were fractured were identified as failing due to overstress, consistent with impact forces.

Weight and balance

The on-site examination found a small amount of cargo, which was stowed in the rear part of the fuselage and secured with a cargo net. The amount of cargo was not significant enough to have adversely affected the centre of gravity of the aircraft.

Fuel

Ten days prior to the accident, on 6 June 2017, fuel records show that that the pilot fuelled his aircraft with 64.84 litres of Avgas at Southport Flying Club. It is unknown if this amount filled the aircraft to its capacity of 42 US gallons (approximately 160 litres). There were two flights between 6 and 16 June 2017 (the date of the accident), totalling 1.2 flight hours. Dependant on throttle settings and altitude, the fuel burn rate of a standard Cessna 172M is about 8 US gallons per hour, or about 30 litres per hour. However, it would be slightly higher with the O-360 engine installed.

Although a fuel sample was not available at the accident site due to the significant disruption of the aircraft, investigators identified a strong smell of fuel at the accident site. Additionally, several witnesses reported hearing the sound of the engine up until the point of impact, indicating there was fuel on board the aircraft at the time of the accident.

Flight instruments

All instruments were identified in the main portion of the wreckage. A number of flight instruments, including the artificial horizon, altimeter, airspeed indicator, vertical speed indicator, directional gyroscope and the turn co-ordinator were retrieved from the accident site for further examination at the ATSB's technical facilities in Canberra. The subsequent examinations did not find evidence to support a failure of any of these instruments prior to impact.

The vacuum supply line to the artificial horizon and directional gyroscope was found to have cracks in the outer sheath of the hose. The hose was retrieved from the site for further examination. Testing of the hose indicated that the cracking was superficial and did not affect the capacity of the hose to maintain the vacuum required to operate the instruments.

Meteorological information

Bureau of Meteorology forecasts

The flight from Southport to Ballina overlapped two forecast areas. [5] The flight originated in Area 40, which covers the area from just north of Rockhampton to just south of the Gold Coast. The destination, Ballina, is in Area 20, which covers the area from just south of the Gold Coast down to Lake Macquarie. Details of these forecast areas can be found on the Airservices Australia's Planning Chart Australia (PCA).

Sections of the area forecast (ARFOR) for Area 40, which was valid from 0300 to 1800 on 16 June 2017, that potentially affected the flight included:

- Areas of broken low cloud east of Thangool - Tenterfield until 1100 (see Figure 5).
- Broken stratus clouds between 500 and 2,500 ft near precipitation
- Scattered cumulus and stratus clouds between 2,500 and 8,000 ft east of Injune – Dalby - Stanthorpe
- Significant weather in Area 40 was forecast as being fog, mist, showers of rain and smoke. Visibility was forecast to be 500 m in fog, 2,000 m in mist and thick smoke, 3,000 m in showers of rain and 8 km in smoke haze. The freezing level was above 10,000 ft and icing was forecast to be moderate in cloud above the freezing level. Turbulence was forecast to be moderate in cumulus clouds.

The amended ARFOR for Area 20 was valid from 0730 to 1500 on 16 June 2017. It forecast:

- Scattered fog and mist on land south east of Tenterfield – Murrurundi - Doora until 0900, with isolated fog and mist on the remainder of land in area 20 until 1100.

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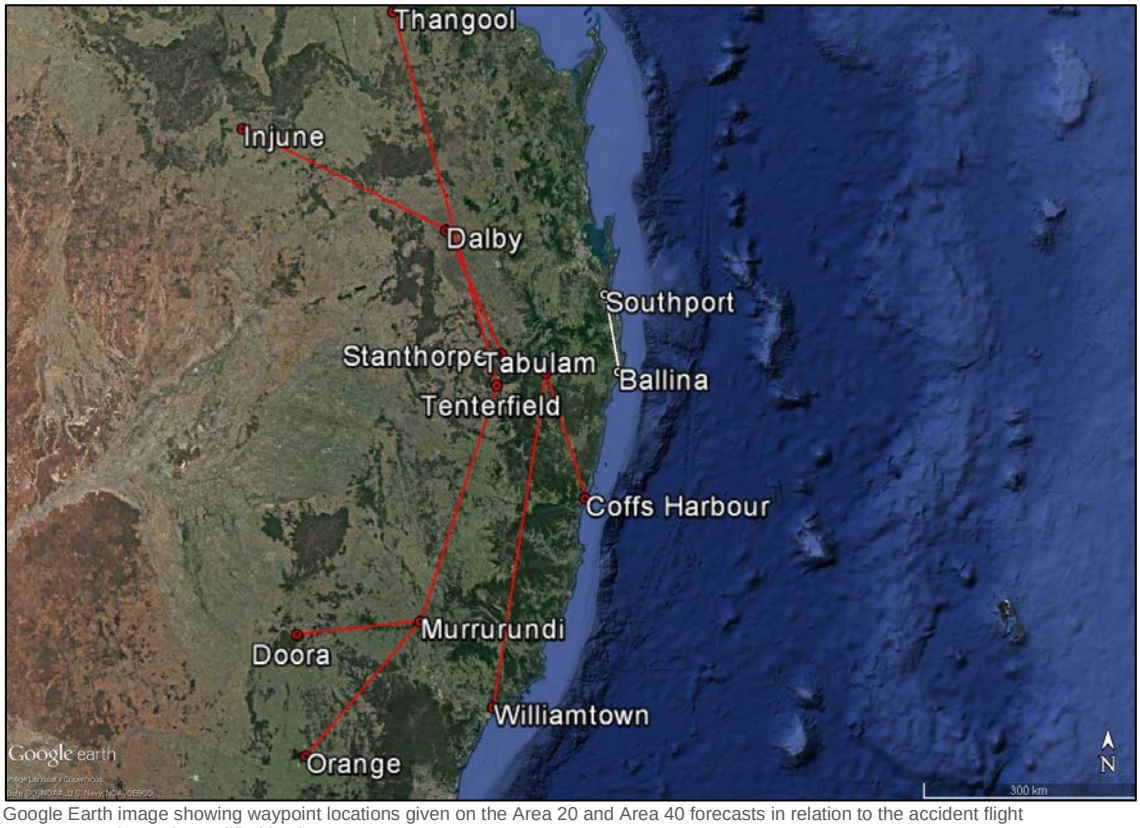
[5] Area forecast (ARFOR): routine forecasts for designated areas and amendments when prescribed criteria are satisfied. Australia is subdivided into a number of forecast areas.

- Broken low cloud on the ranges and slopes east of Tenterfield – Murrurundi - Orange until 1200, contracting to the ranges northeast of Tabulam – Coffs Harbour.
- Broken low cloud in precipitation as well as isolated showers on land east of Tabulam - Williamtown and scattered showers at sea.
- Broken stratus clouds between 1,000 ft and 2,500 ft at sea and on the coast in precipitation.
- Broken stratus clouds between 2,000 ft to 5,000 ft on the ranges and slopes east of Tenterfield –Murrurundi - Orange until 1200, then contracting to the ranges northeast of Tabulam - Coffs Harbour.
- Broken cumulus and stratus clouds between 2,000 ft and 10,000 ft at sea and on the coast, with cloud tops above 10,000 ft at sea after 1200.
- Significant weather in area 20 was forecast as being fog, mist and showers of rain. Visibility was forecast to be 300 m in fog, 2,000 m in mist and 4,000 m in showers of rain. The freezing level was above 10,000 ft, tending to 9,000 ft south of Murrurundi after 0900 with no significant icing conditions forecast. Turbulence was forecast to be moderate in cumulus clouds.

Figure 5: Figure showing the accident flight in relation to waypoint references given in the Area 20 and 40 forecasts. Boundaries given by the Area forecast are shown in red; the location of the flight path is shown in white.



Google Earth image showing waypoint locations given on the Area 20 and Area 40 forecasts in relation to the accident flight
Source: Google Earth, modified by the ATSB

In addition to the area forecasts, the Bureau of Meteorology also provided a terminal forecast (TAF)[6] for Ballina. The Ballina TAF, issued at 0300 on 16 June 2017 was valid between 0600 and 1600. The TAF forecast 8 kt winds from 200°, visibility greater than 10 km and showers of rain. Cloud was forecast to be scattered with a base of 2,000 ft above the aerodrome and broken with a base 3,500 ft above the aerodrome. It was forecast that there would be intermittent periods (less than 30 minutes) between 0600 and 1600 where visibility would drop to 4,000 m there would be showers of rain, and broken cloud with a base of 1,000 ft above the aerodrome. The conditions

6 Aerodrome Forecasts are a statement of meteorological conditions expected for a specific period of time, in the airspace within a radius of 5 NM (9 km) of the aerodrome.

forecast on the Lismore TAF were broadly consistent with the conditions at Ballina. The exception being the addition of a forecast 30 per cent probability of deteriorations of one hour or more with visibility to 4,000 m, mist, and scattered cloud with a base at 500 ft above the aerodrome, between 0800 and 1000 on 16 June.

Bureau of Meteorology observations

The Ballina Automatic Weather Station (AWS) recorded that at 0900 on the day of the accident, the wind at Ballina Airport was from the south-west at an average speed of 13 km/h, the temperature was 17.6 °C, the relative humidity was 95 per cent, the mean sea level pressure was 1024.5 hPa and cloud covered 8 oktas[7] of sky.

Witness observations of weather

The weather conditions at Southport on the morning of 16 June 2017 were reported by several witnesses to be clear and fine, with no rain or significant wind or cloud cover. In contrast, the maintenance provider described the conditions at Ballina on the morning of 16 June as 'amongst some of the worst weather I had seen. There was very heavy rain, low cloud and very poor visibility'.

The last known eyewitness of FYN flying just south of Bangalow described the conditions as being 'low patchy clouds, fog and drizzly rain', and visibility that was 'fairly low'. Witnesses in Brooklet at the time of the accident described the conditions in the vicinity of the accident site as 'overcast with fairly low cloud', with a 'ceiling of about 200 ft.' Other witnesses described 'very low fog and cloud, there may have been some drizzle but it wasn't raining.'

Pilot access to weather information

The pilot was reported to be diligent with checking weather conditions on a regular basis. He had an Airservices Australia National Aeronautical Information Processing System (NAIPS) account, which he accessed through the OzRunways electronic flight bag application. The NAIPS account provides meteorological information, Notice to Airmen (NOTAM), as well as briefing information. The pilot accessed his NAIPS account (though OzRunways) a number of times in the week leading up to the day of the accident. The last successful NAIPS logon was at 1703 on Thursday, 15 June 2017 (the evening before the accident flight), during which a location briefing was requested. The location briefing consisted of an Area 20 forecast valid from 1400 on 15 June to 0300 on 16 June 2017. A number of unsuccessful login attempts were made later that evening, between 2030 and 2037.

On the morning of the accident, the pilot reported that the weather was fine. Although there are no NAIPS logins reordered on that morning, it is possible that weather information was obtained from other sources. Upon reaching the Southport Flying Club, the pilot reported to other members that he had trouble submitting his flight plan, as he could not log in. At 0800, the pilot submitted his flight plan to ATC by radio.

Additional information

Visual Flight Rules

The CASA Visual Flight Rules Guide outlined that flight under the visual flight rules (VFR) can only be conducted in Visual Meteorological Conditions (VMC).[8] Additionally, when operating at or below 2,000 ft above the ground or water, the pilot must be able to navigate by visual reference to the ground or water.

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[7] Okta: Unit of sky area equal to one-eighth of total sky visible to celestial horizon.

[8] VMC: a series of minimum meteorological conditions in which flight is permitted under the visual flight rules – that is, conditions in which pilots have sufficient visibility to fly the aircraft while maintaining visual separation from terrain and other aircraft.

The majority of the flight, and the location of the accident, were in (uncontrolled) Class G airspace. The following conditions were stipulated for flight under the VFR in Class G airspace when below 10,000 ft and above 3,000 ft AMSL or 1,000 ft above ground level (whichever is higher):

- a flight visibility of 5,000 m
- a minimum vertical distance of 1,000 ft and horizontal distance of 1,500 m from cloud.

In the case of aeroplane operations in Class G at or below 3,000 ft AMSL or 1,000 ft above ground level (whichever is higher), the following minimum conditions were stipulated:

- a flight visibility of 5,000 m
- that the aeroplane shall be maintained clear of cloud and in sight of the ground or water

Risks of flying in areas of reduced visual cues

The safety risks of VFR pilots flying from VMC conditions into instrument meteorological conditions (IMC) are well documented. This has been the focus of numerous ATSB reports and publications, as VFR pilots flying into IMC represents a significant cause of aircraft accidents and fatalities. In 2013 the ATSB Avoidable Accidents series was re-published. Of these publications, the booklet titled *Accidents involving pilots in Instrument Meteorological Conditions* outlined that:

> In the 5 years 2006–2010, there were 72 occurrences of visual flight rules (VFR) pilots flying in instrument meteorological conditions (IMC) reported to the ATSB…About one in ten VFR into IMC events result in a fatal outcome.

Additionally, a study conducted by the United States National Transportation Safety Board (NTSB, 2005) found that 'reduced-visibility weather represents a particularly high risk to [general aviation] operations' and that 'weather may…test the limits of pilot knowledge, training, and skill to the point that underlying issues are identified.'

The NTSB study also outlined that historically, about two-thirds of all general aviation (GA) accidents that occur in IMC are fatal; a rate much higher than the overall fatality rate for GA accidents. A study by Newman (2007) conducted for the ATSB titled *An overview of spatial disorientation as a factor in aviation accidents and incidents* outlined that there was a four times greater chance of fatality in a VFR flight into IMC accident than any other sort of accident (quoting Batt & O'Hare, 2005 and NTSB, 1989).

Spatial disorientation

Spatial disorientation is a type of loss of situation awareness, and is different to geographical disorientation, or incorrectly perceiving the aircraft's distance or bearing from a fixed location. Spatial disorientation occurs when pilots do not correctly sense their aircraft's attitude, airspeed or altitude in relation to the earth's surface. In terms of an aircraft's attitude, spatial disorientation is often described simply as the inability to determine 'which way is up', although the effects can often be more subtle than implied by that description.

Spatial disorientation occurs when the brain receives conflicting or ambiguous information from the sensory systems. It is likely to happen in conditions in which visual cues are poor or absent, such as in adverse weather or at night.[9] Spatial disorientation presents a danger to pilots, as the resulting confusion can often lead to incorrect control inputs and resultant loss of aircraft control.

Research on spatial disorientation indicates that, for pilots who are not instrument rated, loss of control will likely occur between about 60 seconds (Benson, 1988 in Gibb, Gray and Scharff, 2010) and 178 seconds on average (Bryan, Stonecipher, & Aron, 1954) after the loss of visual reference. These studies led to the FAA's and CASA's '178 seconds to live' educational

[9] More information about spatial disorientation can be found in the ATSB aviation research and analysis report B2007/0063, *An overview of spatial disorientation as a factor in aviation accidents and incidents*.

campaigns. Gibb, Gray and Scharff (2010) also state that 'spatial disorientation accidents have fatality rates of 90–91 percent, which indicates how compelling the misperceptions can be.'

Related occurrences

There have been a number of accidents relating to VFR pilots flying into reduced visibility conditions. Many of these occurrences have been summarised in the research reports previously mentioned (B2005/0127 and AR-2011-050) as well as in ATSB accident reports (for example, AO-2015-131 and AO-2016-006). Of particular interest are those occurrences where pilots have avoided an accident outcome by seeking assistance from other aircraft or from ATC. Of note is a similar occurrence that happened on the same day and in the same location as the accident involving FYN, but with a very different outcome. See below for details.

ATSB occurrence 201702740

On 16 June 2017, the pilot of a light aircraft was flying under VFR from Taree, NSW, to Southport, Queensland. While near Ballina, NSW the weather suddenly deteriorated and the pilot attempted to turn back to land at Coffs Harbor, NSW. However, the weather continued to close in, at which point the pilot reported to ATC that he was now flying in instrument meteorological conditions (IMC). ATC observed a sporadic radar return in the position described by the pilot and advised that the pilot gain altitude, which assisted with radar identification. ATC then guided the aircraft to Evans Head, NSW where the weather had cleared sufficiently for the aircraft to land safely.

Safety analysis

Introduction

While en route from Southport, Queensland to Ballina, New South Wales, Cessna Aircraft Corporation 172M, registered VH-FYN (FYN), entered an area of low visibility near the town of Bangalow, New South Wales. The aircraft began a descent just north of Bangalow before deviating off course and heading inland. The aircraft was last witnessed at low altitude about 2 km south of Bangalow disappearing into cloud in an area of low cloud, fog and drizzle. A short time later the aircraft collided with terrain on an agricultural property about 13 km north-north-west of Ballina.

There were no defects or anomalies found with the recovered components of the aircraft that might have contributed to the accident. Additionally, a review of the pilot's medical records, post-mortem and toxicology results indicated that it was unlikely that the pilot became incapacitated during the flight. Therefore, this analysis will focus on the examination of the factors that led to a visual flight rules (VFR) pilot losing control of his aircraft in an area of reduced visibility.

Decision to depart Southport

The reason for the flight on 16 June 2017 was to deliver the aircraft to a maintenance facility, as the aircraft's maintenance release was due to expire the following day. The pilot initially had the aircraft maintenance booked for Tuesday 13 June 2017. The pilot then rescheduled the booking twice that week based on the forecast weather conditions. The final booking was scheduled for Friday 16 June 2017. During the course of that week, the pilot had downloaded weather forecasts through his National Aeronautical Information Processing System (NAIPS) account a number of times. Additionally, the pilot had been in contact with the maintenance provider in Ballina to check the weather conditions and reschedule the bookings. The last call the pilot made to the maintenance provider was on Wednesday 14 June 2017. During that call, the maintenance provider told the pilot he could get a special flight permit to allow him to fly the aircraft to Ballina after the expiration of the maintenance release. Instead, the pilot confirmed the booking for Friday.

On the morning of the accident, the weather in Southport appeared fine. The pilot did not call ahead to the maintenance provider to check the weather conditions in Ballina. Due to difficulties logging into his account, the pilot did not access his NAIPS account to download a weather briefing. It is possible that the pilot accessed a weather forecast for Ballina through other means, however it could not be determined if that was done.

Neither the Area 20 forecast nor the Ballina Aerodrome Forecast (TAF) precluded a visual flight rules (VFR) flight from Southport to Ballina on the day of the accident. Both forecasts, however, indicated the possibility of encountering areas of fog, cloud and rain, in which visibility would reduce below that required for VFR flight. Additionally, the Ballina TAF intermittent (INTER) conditions indicated that for multiple periods of up to 30 minutes duration, the visibility at the aerodrome would be below that required for landing under the VFR. Although the planned flight from Southport to Ballina would have been possible under the VFR, the forecast conditions would have necessitated planning for an alternate landing point and/or being prepared to hold at Ballina during the INTER periods. Additional fuel would have been required to account for these diversions and holding time. It is unknown if these factors were taken into account by the pilot in his pre-flight planning but they were not mentioned in the verbal flight plan he lodged with Airservices Australia 11 minutes before taking off.

Development of the accident

Flying into area of reduced visibility

The majority of the flight south from Stotts Island was conducted between about 1,500 and 2,000 ft. Approximately 6 km north of Bangalow the aircraft began a steady decent. At 800 ft radar identification was lost. Given the witness descriptions of the weather conditions in this area, it is possible that the pilot initiated this descent to stay below cloud to maintain his visual reference to the ground, in accordance with the VFR requirements.

The last known eye witness observed FYN at a low altitude about 2 km south of Bangalow at about 0845. The witness saw the aircraft enter into cloud in an area of low cloud, fog and drizzle as the aircraft turned inland, to the west. Additionally, the last radar data showed the aircraft tracking in a west-south-westerly direction about 5 km to the west of the planned track.

From the information available, it could not be determined why the pilot altered his heading and continued 5 km off the planned track to Ballina. It is possible that the pilot inadvertently followed the road to Lismore or attempted to turn back towards the north, but became disorientated. It is also possible that the pilot was intentionally attempting to divert to Lismore (about 30 km to the west of Ballina). The last three radar data points show the aircraft heading at about 240°. This heading, if continued, would track the aircraft to Lismore airport. Additionally, the location of the turn to the west is roughly consistent with the location of the road turn-off to Lismore (Bangalow road). If the pilot did intend on diverting to Lismore, he could have used Bangalow road to navigate there as the last three radar data show the aircraft in close proximity to Bangalow road. However, the radar data at this location only covers 10 seconds of flight and it difficult to infer the intentions of the pilot with such little data. In addition, diversion aerodromes were not mentioned in the pilot's verbal flight plan submission and the Lismore TAF indicated that conditions at Lismore were probably no better than Ballina. It is not known, however, if the pilot had access to either the Ballina or Lismore TAFs.

En route decision making

The maintenance release for the aircraft was due to expire the day after the accident and the maintenance booking was rescheduled twice that week due to inclement weather conditions at Ballina. The maintenance provider had told the pilot he could apply for a special flight permit after the expiration of the maintenance release. Despite this, it is likely the pilot was under a degree of self-imposed pressure to continue to Ballina to conduct the maintenance inspection before it expired. Although it could not be determined what decisions the pilot made en route, an earlier decision to divert or return to Southport may have avoided flight into areas of reduced visibility.

Spatial disorientation resulting from a loss of visual cues

There was approximately five minutes between the last known sighting of FYN and the time of impact. The aircraft was last seen disappearing into cloud in an area of reduced visibility. The area in the vicinity of the accident site was also reported by a number of witnesses to have low cloud, fog, drizzle and reduced visibility. It is therefore likely that for most, if not all of the last five minutes of flight, FYN was flying in conditions of reduced visibility. The pilot of FYN did not hold an instrument rating and had logged only 4.6 hours of instrument flying, the most recent being in 1996.

Examination of the accident site found that at the time of impact, the aircraft was in a 30° right wing down and significant nose down attitude. This attitude is not consistent with normal operations of a C172, and is indicative of a loss of control. It is therefore likely that within five minutes of flying into conditions of reduced visibly, without adequate visual reference to the horizon, the pilot of FYN became spatially disorientated leading to a loss of control and collision with terrain.

Findings

From the evidence available, the following findings are made with respect to the collision with terrain involving Cessna 172, VH-FYN 13 km north-north-west of Ballina, NSW, 16 June 2017. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- The pilot departed Southport, Queensland for Ballina, New South Wales under the Visual Flight Rules with a forecast likelihood of low cloud, fog and showers of rain that reduced conditions below that required for visual flight.
- It is likely the pilot encountered conditions of reduced visual cues and became spatially disorientated which led to a loss of control and collision with terrain.

General details

Occurrence details

Date and time:	16 June 2017 – 0850 EST	
Occurrence category:	Accident	
Primary occurrence type:	Collision with terrain	
Location:	13 km NNW of Ballina, New South Wales	
	Latitude: 28° 43.63’ S	Longitude: 153° 32.35’ E

Pilot details

Licence details:	Private Pilot (Aeroplane) Licence, issued June 1992
Endorsements:	Single-Engine Aeroplanes less than 5,700 kg Maximum Take-off Weight
Ratings:	Nil
Medical certificate:	Class 2, valid to December 2017
Aeronautical experience:	Approximately 580 hours
Last flight review:	February 2016

Aircraft details

Manufacturer and model:	Cessna Aircraft Company	
Year of manufacture:	1976	
Registration:	VH-FYN	
Operator:	Owner	
Serial number:	17267270	
Total Time In Service	4,083.6 (as of last 100 hourly or as necessary to qualify)	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (fatal)	Passengers – 0
Damage:	Destroyed	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- the Civil Aviation Safety Authority (CASA)
- a number of witnesses
- the Bureau of Meteorology (BoM)
- Airservices Australia (Airservices)

References

Australian Transport Safety Bureau. (2005). *General Aviation Pilot Behaviours in the Face of Adverse Weather*. Aviation Research Investigation Report B2005/0127.

Australian Transport Safety Bureau. (2007). *An overview of spatial disorientation as a factor in aviation accidents and incidents*. ATSB Aviation Research and Analysis Report B2007/0063.

Australian Transport Safety Bureau. (2010). *Improving the odds: Trends in fatal and non-fatal accidents in private flying operations*. Aviation Research and Analysis Report AR-2008-045.

ATSB 2011, *Avoidable Accidents No. 4 Accidents involving pilots in Instrument Meteorological Conditions*. Aviation Research and Analysis publication AR-2011-050.

Risk Factors Associated with Weather-Related General Aviation Accidents, NTSB/SS-05/01

Groff L.S. & Price J.M. *General aviation accidents in degraded visibility: a case control study of 72 accidents*. Aviat Space Environ Med 2006; 77:1062–1067.

Gibb, R., Gray, R. & Sharff, L. *Aviation Visual Perception: Research, Misperception and Mishaps*. Ashgate, 2010.

Bryan, L.A., Stonecipher, J. W. & Aron, K. *180-degree turn experiment*. University of Illinois Bulletin Volume 52, Number 11. September 1954.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to CASA and the family of the pilot.

Submissions were received from both parties. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

VFR into IMC and loss of control involving Cessna 172, VH-FYN
13 km NNW of Ballina, NSW on 16 June 2017

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