Australian Government
Australian Transport Safety Bureau

Runway excursion involving Raytheon B200, VH-MVP

Lord Howe Island Airport, New South Wales on 18 February 2022

ATSB Transport Safety Report
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Addendum

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Executive summary

What happened

On the morning of 18 February 2022, the pilot of a Raytheon B200, registered VH-MVP and operated by Eastern Air Link, conducted an air transport flight from Port Macquarie, New South Wales to Lord Howe Island. At about 0800 local time, the pilot commenced a distance measuring equipment (DME) arrival procedure into Lord Howe Island. While the flight was conducted under instrument flight rules (IFR), the pilot established visual meteorological conditions early in the approach enabling a transition to a visual approach.

The pilot then descended the aircraft visually below cloud while over the water to an altitude below 1,000 ft, while also positioning the aircraft for a straight-in approach to runway 10. During the approach, the aircraft entered an area of reduced visibility in rain and the aircraft touched down to the left of the runway.

What the ATSB found

At the time of the aircraft's final approach and landing, the aerodrome was experiencing a heavy rain shower with limited visibility, conditions that were marginal for visual flight. While the pilot commenced a visual approach to the runway with the required visual cues, it was highly unlikely that the required visual contact with the runway was retained throughout the approach.

Contrary to the missed approach requirements, the pilot did not commence a go around with the loss of visual cues, but instead continued towards the runway. This resulted in an increasing displacement from the runway centreline. Late in the approach with the aircraft close to the runway but with a significant displacement from the runway centreline, visual contact with the runway was reacquired.

Considerable manoeuvring with significant heading changes were required to realign the aircraft with the runway, resulting in an unstable approach. Despite not being within the operator's stabilised approach criteria the pilot elected to continue and land after assessing that a missed approach from short final held excess risk due to the high terrain in the vicinity of the runway. The realignment was unsuccessful, resulting in the aircraft touching down off and to the left of the runway, on the runway strip.

The investigation also identified several flights conducted by the operator that followed a similar approach profile to runway 10 as that used by the occurrence flight, which were also conducted in marginal weather conditions for visual approach operations. This practice significantly reduced obstacle clearance assurance for both an approach and a potential missed approach, thereby increasing risk. Consequently, the ATSB brought this safety issue to the operator's attention.

Further, the practice of joining for a short straight-in approach from well within the 3 NM requirement while also below a normal circuit height presented an increased collision risk to any aircraft operating within the aerodrome’s circuit using normal non-controlled aerodrome circuit procedures, or any aircraft conducting an instrument approach.

What has been done as a result

The operator, Eastern Air Link, amended its operations manual to ensure compliance with straight-in approach operational procedures as required under relevant regulations and the aeronautical information publication. The ATSB acknowledges this proactive action taken by Eastern Air Link but does not consider that it addresses the practice of conducting a visual approach in marginal weather conditions.

Consequently, the ATSB issued a recommendation to Eastern Air Link that further action be taken to address this safety issue.

Safety message

Adherence to operational procedures ensures consistency of pilot action and aircraft operation during the approach and landing phases of flight. This, along with careful monitoring of aircraft and approach parameters, ensures approaches are conducted safely.

Most importantly, an operator should encourage the use of the most appropriate and safe approach available. When conditions are marginal, the use of an instrument approach that provides obstacle clearance assurance minimises the risks of any unforeseen deterioration in conditions. These approach types provide a protected flight path for any missed approach and have been shown to be significantly safer than a visual approach when weather conditions are marginal.

Contents

The occurrence

At 0639 local time on 18 February 2022, a Raytheon B200 aircraft, registered as VH-MVP and operated by Eastern Air Link,[1] departed Port Macquarie, New South Wales (NSW), on an air transport flight[2] to Lord Howe Island, NSW, under the instrument flight rules.[3] The aircraft was crewed by a single pilot and was carrying 6 passengers.

At 0707, the aircraft reached its cruise altitude of flight level (FL) 230.[4] Prior to descending the aircraft, the pilot recorded the weather conditions at Lord Howe Island[5] aerodrome as being: wind 020° at 6 kt, temperature 23 °C, broken[6] cloud at 1,100 ft and overcast cloud at 1,900 ft. At 0747, the pilot commenced the descent.

The pilot intended to conduct a distance measuring equipment (DME)[7] arrival procedure (see section titled *Aids to navigation*) with the aim of establishing visual flight conditions[8] as early as possible. Based on the reported weather conditions, the pilot expected to 'become visual' early in the arrival procedure. At that point, the pilot planned to conduct a visual approach, which entailed maintaining visual flight below any cloud while continuing towards the airport.

Before entering the island's lagoon (Figure 1), the intention was to establish visual contact with the runway (see the section titled *Aerodrome information*). The aircraft would then be tracked towards a point between North Head and Rabbit Island, which would enable the pilot to intercept the runway's extended centreline and position the aircraft on its final approach track. Once established on the final approach, the aircraft's vertical profile could be checked using a known altitude target of 300 ft when abeam Rabbit Island.

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1 Eastern Air Link was a subsidiary of the Eastern Air Services Group. VH-VMP was owned by Eastern Air Services but operated by Eastern Air Link.

2 A passenger transport operation or cargo transport operation that is conducted for hire or reward, as defined under the Civil Aviation Safety Regulations Dictionary Part 2.

3 Instrument flight rules (IFR): a set of regulations that permit the pilot to operate an aircraft in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules (VFR) under which pilot's must operate to the visual meteorological conditions (VMC). Procedures and training are significantly more complex for IFR as a pilot must demonstrate competency in IMC conditions while controlling the aircraft solely by reference to instruments. IFR-capable aircraft have greater equipment and maintenance requirements.

4 Flight level: at altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 230 equates to 23,000 ft.

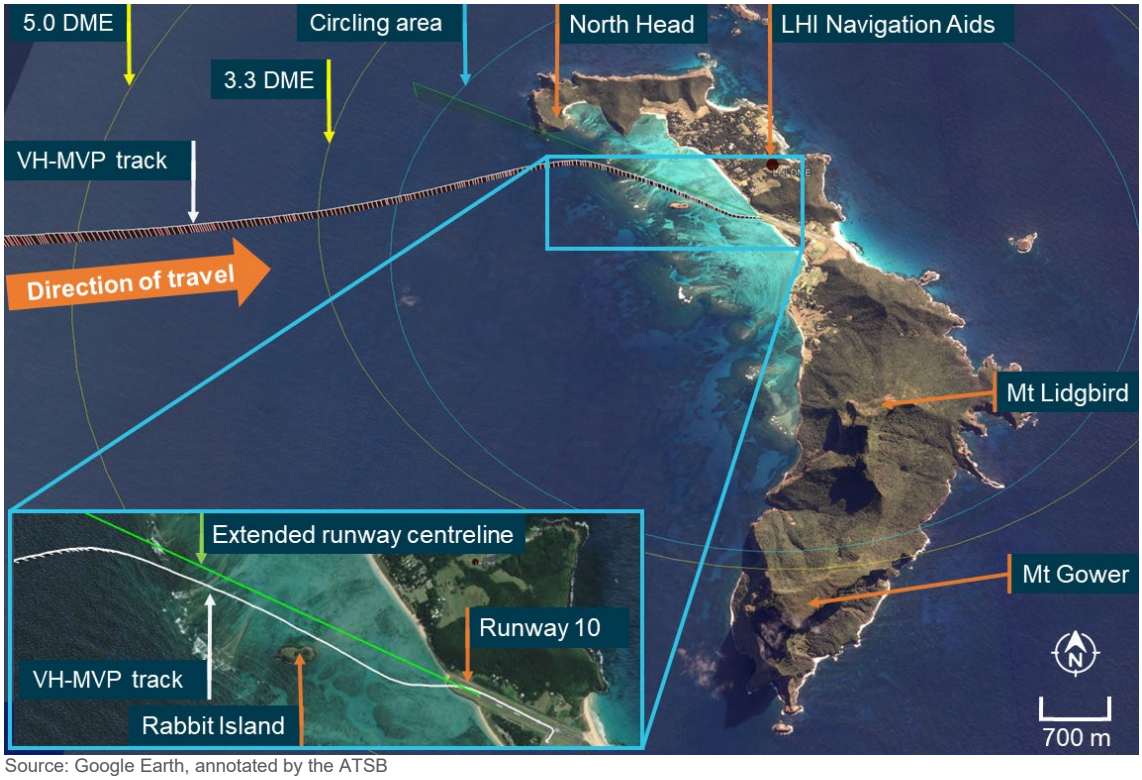
5 The weather information was sourced from the Aviation Weather Information Service (AWIS). For further information, see the section titled *Automatic weather station and weather reporting*.

6 Cloud cover: in aviation, cloud cover is reported using words that denote the extent of the cover – 'scattered' indicates that cloud is covering between a quarter and a half of the sky and 'broken' indicates that more than half to almost all the sky is covered.

7 A radio navigation aid that provides the distance (in nautical miles) from the aircraft to the aid.

8 See the section titled *Visual approach and circling rules applicable to VH-MVP*.

Figure 1: VH-MVP approach into Lord Howe Island



Source: Google Earth, annotated by the ATSB

Early in the DME arrival procedure, the pilot established visual flight conditions, and at about 10 NM from the DME (10 DME), the aircraft descended below the 1,700 ft[9] segment lowest safe altitude for the arrival procedure. The pilot continued descending the aircraft towards the aerodrome, passing 1,000 ft at about 7 DME, and 600 ft at 5 DME. Near 5 DME, the aircraft commenced a slow left turn to track towards a point between North Head and Rabbit Island. At 3.3 DME, the aircraft descended to about 400 ft and then entered the aerodrome's circling area.[10]

Following the incident, the pilot reported that on entering the circling area, North Head, Rabbit Island and the aerodrome were visible. Recorded tracking data showed that the aircraft turned onto final approach about 1.5 NM from the runway threshold, however, it was not established on the runway centreline. The aircraft began to track towards the airport, but with a displacement of about 125 m to the right of the extended runway centreline. As it descended toward the runway, the aircraft continued to track to the right of and parallel to the extended runway centreline. On passing Rabbit Island, the pilot reported that the aircraft's altitude was the targeted 300 ft. From that point onwards, the aircraft began to diverge further from the runway centreline, and as it reached about 400 m from the runway threshold, it was about 140 m to the right of the centreline.

The pilot stated that visual contact with the runway was maintained throughout the final approach but, due to crosswind from the left and as the aircraft tracked into the lee of the mountain to the north of the runway, some realignment with the runway was necessary. Recorded data showed that at about 350 m from the runway threshold, there was a track change of about 15° to the left, toward the threshold. As the aircraft passed over the threshold, a right turn was initiated, and the pilot flared the aircraft for touchdown on the runway.

According to the pilot, during the final approach the aircraft started deviating from the centreline almost immediately after crossing the runway threshold. This coincided with the aircraft entering an unexpected rain shower, which led to a reduction in visibility and loss of visual contact with the

[9] All heights are referenced to sea level, unless otherwise stated.

[10] See the section titled *Visual approach and circling rules applicable to VH-MVP*.

runway. A go-around was commenced, but at the same time, the wheels touched down on the grass strip to the left of the runway. The pilot was aware that the aircraft had touched down to the side of the runway, but at the time thought that only the left main tyre was displaced at or around the edge of the runway. The pilot elected to therefore continue the landing, manoeuvring the aircraft onto the runway, and the landing rollout was completed on the runway. The aircraft landed at 0806.

Subsequently, the aircraft taxied clear of the runway at about 0807 and parked at the terminal. A postflight inspection of the aircraft did not identify any damage, and the pilot conducted the return service to Port Macquarie in VH-MVP later that morning.

Context

Pilot information

The pilot held an Air Transport Pilot (Aeroplane) Licence with a Class 1 medical certificate, was appropriately qualified for the flight, and had accumulated about 20,100 hours of flight experience, of which 2,500 hours were on the B200 type aircraft. In the previous 28 days, the pilot had flown 40 hours on this type. The pilot had significant experience of operations into Lord Howe Island.

The ATSB found no indicators that increased the risk of the pilot experiencing a level of fatigue known to affect performance.

Flight plan

The pilot submitted a flight plan prior to departure from Port Macquarie. That flight plan stated that:

- the flight was a scheduled air service flight operating under instrument flight rules.
- the aircraft's performance category was CAT B.[11]
- the aircraft was fitted with GNSS,[12] and both the aircraft and pilot were approved for performance-based navigation (PBN) operations,[13] such that:
  - for route navigation, the aircraft met the required navigation performance (RNP)2[14] requirements
  - for approaches, the aircraft was capable of the RNP APCH[15] standard.
- the aircraft was fitted with an ADS-B transceiver.[16]
- Port Macquarie, New South Wales was nominated as an alternate airport.[17]

Aerodrome information

General

Lord Howe Island is in the Tasman Sea about 600 km to the east of Port Macquarie. Lord Howe Island airport is non-controlled aerodrome situated in the centre of the island at one of its narrowest points (Figure 2). Significant terrain lies to the south of the airport, the most prominent

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[11] For the purposes of determining safety-based criteria such as landing minima for an instrument approach procedure, aircraft are separated into performance categories. These categories are based on aircraft configuration and weight criteria, and the aircraft's indicated airspeed under these conditions at the threshold when landing. CAT B covers airspeeds from 91-120 kt.

[12] Global navigation satellite system. The term GNSS is given to a worldwide position, velocity, and time determination system, that includes one or more satellite constellations, receivers, and system integrity monitoring, augmented as necessary to support the required navigation performance for the actual phase of operation. There are currently four implementations of GNSS, the US GPS, the European GALILEO, the Russian GLONASS and the Chinese BDS.

[13] Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure, or in a designated airspace. Performance requirements are expressed in navigation specifications using terms of accuracy, integrity, continuity, availability and functionality needed for the proposed operation in the context of a particular airspace concept. The availability and use of GNSS is a key component of the PBN specification.

[14] Required navigation performance (RNP). A navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting. The suffix to RNP identifies the type and precision (in NM) of the navigation for a particular phase of flight.

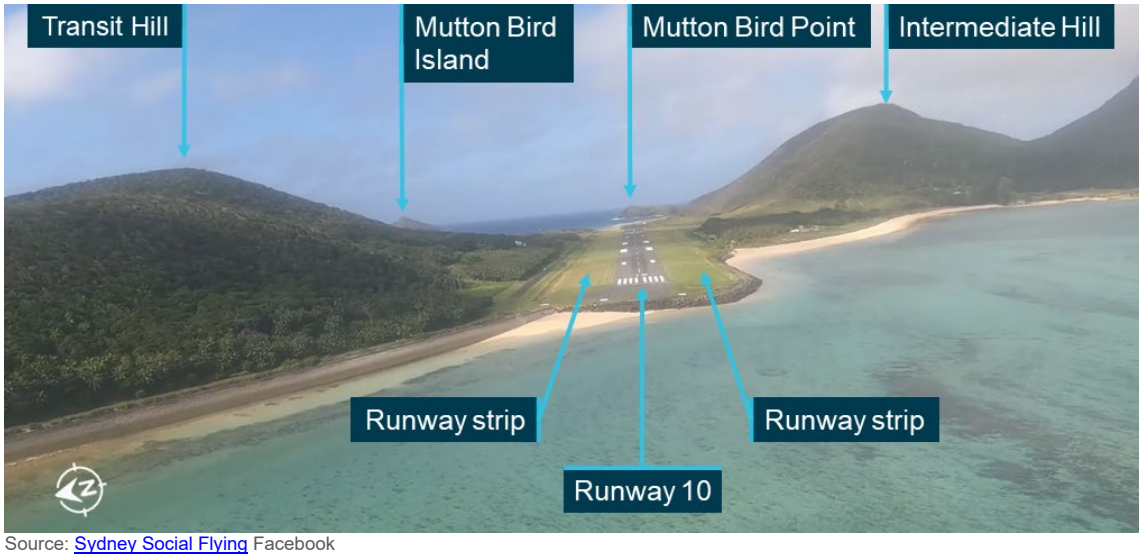
[15] RNP APCH, previously designated as the RNAV GNSS approach, is a GNSS based non-precision approach procedure. It requires more precise navigation accuracy as the aircraft progresses along the approach, with 1 NM accuracy for the initial and intermediate segments, and 0.3 NM for the final approach segment.

[16] See the section titled *Recorded information*.

[17] An aerodrome to which an aircraft may proceed—when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing—where the necessary services and facilities are available, where aircraft performance requirements can be met and which is operational at the expected time of use.

being Mount Lidgbird (2,549 ft) at about 3.2 km and Mount Gower (2,871 ft) at about 5.1 km from the airport (Figure 1). The terminal was located at the south-eastern section of the airport. A Bureau of Meteorology automatic weather station (AWS) was also located at the eastern end of the airport.

Figure 2: Approach to runway 10



Source: Sydney Social Flying Facebook

The runway is located on level terrain between two hills, Transit Hill (433 ft) to the north, and Intermediate Hill (809 ft) to the south-east (Figure 2). The runway is at a height of 17 ft and aligned 100 °M and 280 °M (10/28). The sealed runway is 30 m wide, and the associated runway strip 90 m wide.[18] The published aerodrome information required operations to be confined to the runway's sealed surface.

The approach to runway 10 was over the island's lagoon. Significant terrain for the approach (Figure 1) was:

- North Head Hill, (441 ft) situated 3.4 km from the runway threshold and about 300 m to the north of the extended runway centreline
- Rabbit Island[19] (98 ft) located 1.1 km from the threshold and 250 m to the south of the extended runway centreline.

Significant terrain also affected a go-around from an approach to runway 10. Transit Hill and Intermediate Hill were the primary obstacles, but the departure track was also affected by:

- Mutton Bird Point at 1.5 km from the end of the runway on the runway centreline
- Mutton Bird Island (265 ft) at 2.7 km from the end of the runway and 950 m to the north of the centreline.

When the wind was more than 12 kt and from the northern sector—between 320 and 060 degrees—runway 10 and its approaches could be affected by moderate to severe mechanical turbulence.[20]

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18 The runway strip is a defined area around a runway that is provided to, amongst other things, reduce the risk of damage to an aircraft that may run off the runway. The strip is graded and generally free from obstacles. The runway is located centrally within the strip.

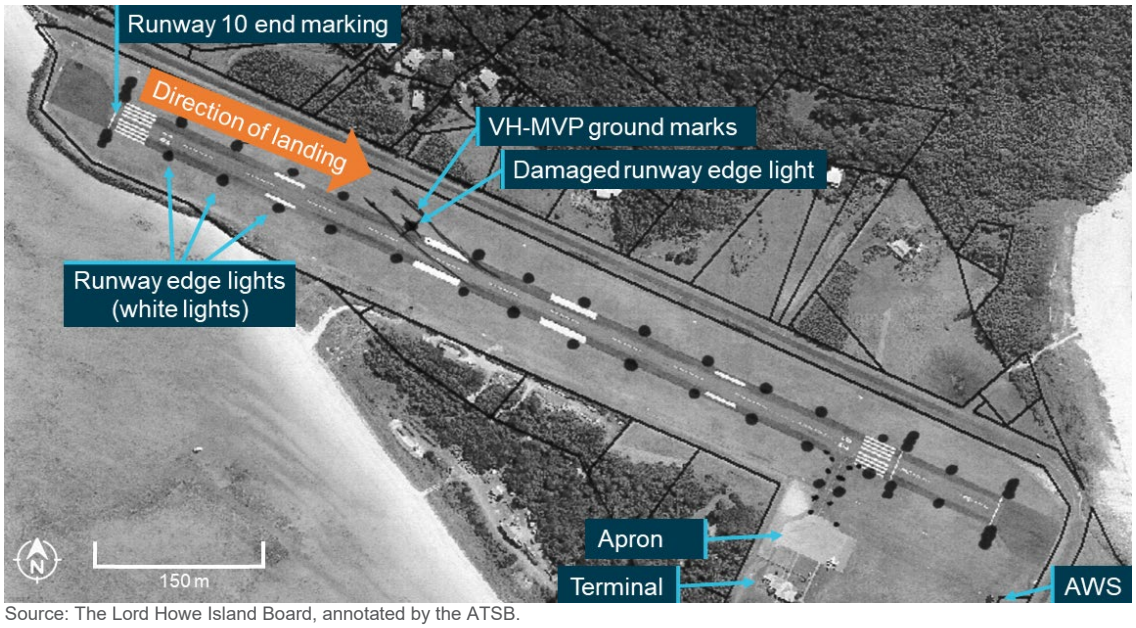
19 A previous name for the island, now known as Blackburn Island.

20 Interaction between flowing air and terrain, in particular irregular terrain and man-made obstacles, causing turbulence known as mechanical turbulence.

Aerodrome damage

After receiving notification about the off-runway landing by VH-MVP, the aerodrome operator inspected the runway. The inspection identified ground marks from an aircraft's tyres along the left section of the runway strip, and a broken runway edge light on the left side of the runway about 1,000 ft (300 m) from the threshold of runway 10 (Figure 3). The ground markings indicated that the aircraft had touched down on the runway strip, with the closest main landing gear to the sealed runway surface about 2 m from the edge, and that the aircraft had quickly regained the runway shortly after touchdown.

Figure 3: Runway 10 damage



Source: The Lord Howe Island Board, annotated by the ATSB.

Aids to navigation

The island had a non-directional beacon (NDB)[21] and DME, which were co-located to the north of Transit Hill. Runway 10 was served by a straight-in RNP approach procedure (RNP RWY 10),[22] which had minimum descent altitude (MDA) of 800 ft and 4.5 km visibility for an aircraft fitted with a vertical profile capability (which VH-MVP was). An NDB approach procedure was also available, but this positioned the aircraft to the east of the runway and required a visual circling manoeuvre to enable the aircraft to land on runway 10.

The airport also had DME or GNSS arrival procedures that were based on sectors around the island. These arrival procedures were not associated with any runway, but instead provided a means for the aircraft to descend towards the airport and become established within the airport's circuit area at a safe altitude. The route flown by VH-MVP placed the aircraft in the Sector A arrival procedure (Figure 4), which covered inbound tracks from 026-088°. The descent profile for VH-MVP has been superimposed over the arrival procedure's profile. The circling minima for that arrival procedure, based on a CAT B aircraft, was an MDA of 1480 ft[23] with 2.4 km visibility. The arrival procedure chart also stated that circling to the south of the runway was prohibited.

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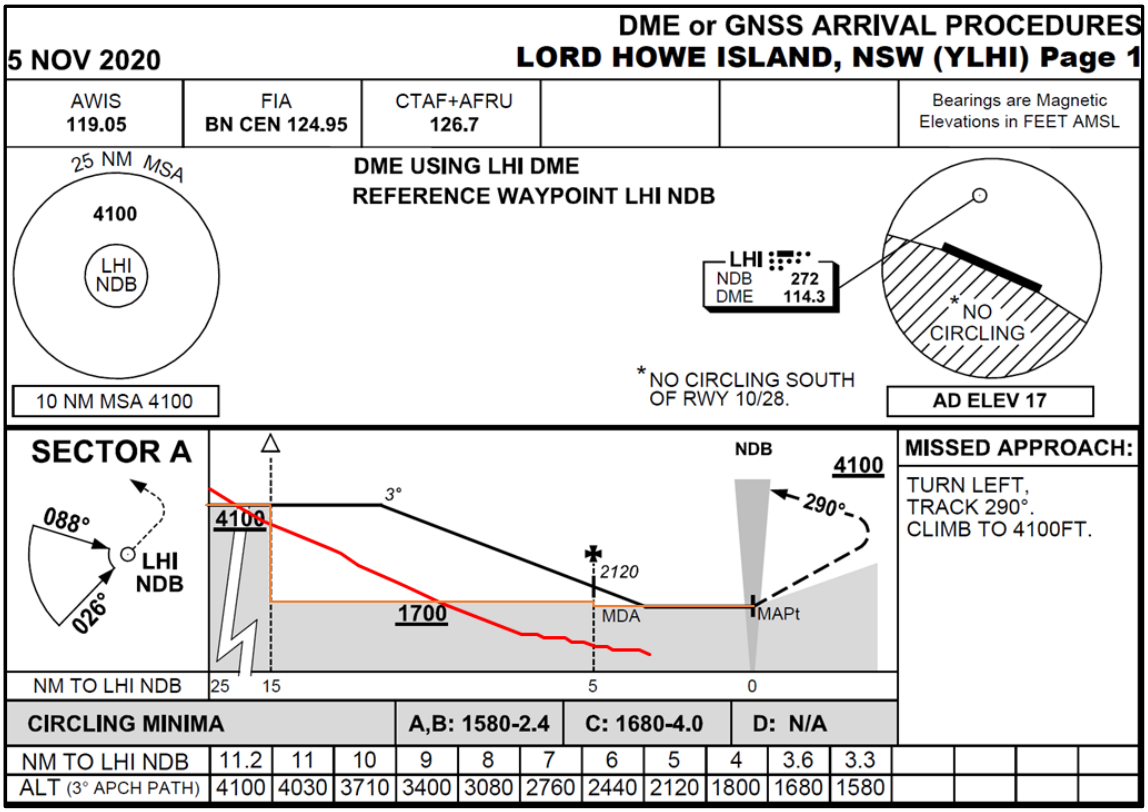
21 A radio beacon operating in the medium or low frequency bandwidths. NDBs transmit a signal of equal strength in all directions. The signal contains a coded element which is used for station identification. NDBs are often associated with Non-Precision Approach procedures.

22 See *Appendix C – Lord Howe Island instrument approaches.*

23 The minima titles are shaded, identifying that the published minima could be reduced by 100 ft when using an actual QNH, such as that provided by the Lord Howe Island AWIS.

Figure 4: DME arrival procedure with VH-MVP descent profile superimposed



Source: Airservices Australia, modified by ATSB.

The DME arrival procedure provided obstacle clearance for an IFR flight by positioning the aircraft within the aerodrome's circling area at the circling MDA. From that point, the pilot was required to conduct a visual circling procedure, which required the pilot to establish visual contact with the landing runway and then manoeuvre to join that runway's circuit pattern.

Once established within the circuit pattern at the MDA, further obstacle clearance for the descent to the runway was assured by remaining within the pattern, keeping the runway threshold in sight, and conducting a normal descent profile to the landing. For runway 10, the use of the normal circuit pattern, that is manoeuvring to the north of the runway using left turns for the circuit pattern, was critical for obstacle clearance, as manoeuvring to the south of the runway was prohibited—most likely due to the location and height of Intermediate Hill and the high terrain further south.

Aircraft information

General

The Raytheon Aircraft Company B200 aircraft, more commonly known as the Super King Air, is an all-metal, low-wing, twin-engine turboprop aeroplane equipped with a retractable tricycle undercarriage. VH-MVP could carry 2 flight crew and 9 passengers.

Maintenance inspection of the aircraft

On completion of the return flight to Port Macquarie, the operator's maintenance provider conducted a manufacturer's 'operating from very soft or unusual terrain' inspection. That inspection also included checks related to the suspected contact with a runway light. No damage was found, and the aircraft was returned to service.

Regulations and Aeronautical Information Publication

The Civil Aviation Safety Regulations (CASR) Part 91 and the Aeronautical Information Publication (AIP) contained several rules and procedures applicable to the descent and approach conducted by VH-MVP into Lord Howe Island. These concerned minimum en-route altitude, the conduct of operations at a non-controlled aerodrome, the visual approach for an IFR flight, visual circling, and the requirements for a missed approach.[24].

Descent and operations into a non-controlled aerodrome

Minimum safe altitudes

As an IFR flight, there were various minimum safe altitudes that the pilot of VH-MVP was required to meet during the flight. Under the CASR, the lowest safe altitudes for the enroute and descent segments were based on route or route segment minimum safe altitudes. Once established on the DME arrival procedure, the required minimum safe altitudes to be met were the various segment minimum safe altitudes and finally the minimum descent altitude (MDA) for that procedure (see the section titled *Aids to navigation*). After the pilot established visual flight conditions and transitioned to a visual approach, the descent was then limited to 500 ft above the water, until the landing phase of flight.

Operations into a non-controlled aerodrome

The CASRs also contained regulations governing the operation of aircraft in the vicinity of a non-controlled aerodrome. These regulations required that, once an aircraft had joined the aerodrome's circuit pattern, all turns were to be to the left, unless otherwise stated in the aerodrome's published information. Runway 10 required a left circuit. The AIP included further procedures and guidance that recommended aircraft arriving at a non-controlled aerodrome conduct at least 3 legs of the local circuit pattern before landing. The regulations also required that, for the conduct of a straight-in approach, any manoeuvring prior to becoming established on the straight-in approach be carried out at least 3 NM from the threshold of the intended landing runway.

The Civil Aviation Safety Authority advisory circular (AC) *91-10v1.1—operations in the vicinity of non-controlled aerodromes* provided advice and guidance on the conduct of operations around non-controlled aerodromes. This AC contained discussion on the various hazards that exist within this environment, which included those specific to the traffic circuit:

> Most collisions occur on downwind or on final approach. There are many distractions during this time, including configuring the aircraft, completing checklists, setting equipment and communicating. Early completion of checklists and configuration changes will help to minimise distractions at this critical time.

The AC also contained the following regarding the conduct of straight-in approaches:

> Pilots who choose to adopt a straight-in approach should only do so when it does not disrupt or conflict with the flow of circuit traffic. Regulation 91.395 requires a pilot conducting a straight-in approach to give way to any other aircraft flying in the circuit pattern. Nonetheless, pilots conforming to the circuit pattern, particularly on the base leg, should continue to check for traffic entering along the final approach path.
>
> When conducting a straight-in approach, the aircraft must be established on final approach at not less than 3 NM from the landing runway threshold (regulation 91.395).

Visual approach and circling rules applicable to VH-MVP

The pilot of VH-MVP could transition from the DME arrival to a visual approach, but only under specific conditions:

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[24] For further detail see *Appendix B – Regulation and the Aeronautical Information Publication*.

- the aircraft was required to be at an altitude of not less than the appropriate segment minimum safe altitude step for the DME arrival and less than 30 NM from the airport, and
- the pilot had established and was able to continue flight to the aerodrome with visual reference with the ground or water, and
- have visibility along the flight path of not less than 5,000 m or have the aerodrome in sight.

When the above conditions were fulfilled, a descent below the approach procedure's segment minimum safe altitude could be commenced, but to no less than 500 ft above the water until the final descent to the runway.

If conditions for a visual approach did not exist, the pilot was required to maintain the aircraft at or above the MDA of 1,480 ft until the aircraft was established within the circling area, which commenced at 2.66 NM (4.9 km) from the runway's threshold. Once within the circling area, the pilot was required to observe the following visual circling requirements while positioning the aircraft for final approach:

- the aircraft remained within the circling area and clear of cloud
- the pilot maintained:
  - sight of the ground or water
  - visual contact with the landing runway environment
  - flight visibility of not less than 2.4 km.

The pilot was also required to maintain a minimum of 300 ft clearance above all obstacles until the aircraft was established on the extended centreline of, and on a normal descent profile to, the runway. As the aircraft was entering the circling area in a no-circling segment by day, an additional requirement was that the pilot maintain visual flight conditions while operating within that segment.

Missed approach

For the visual approach conducted by VH-MVP into Lord Howe, the AIP indicated that a missed approach be conducted if visual reference was lost.[25] Visual reference was stated to mean the runway threshold, or approach lights, or other markings identifiable with the landing runway, being clearly visible to the pilot.

Operational information

Operations manual

The operator had an Operations Manual[26] that contained information required by flight operations personnel to perform their duties. These manuals also contained several policies and procedures relevant to the conduct of the approach into Lord Howe Island.

Descent procedures

Under the Operations Manual requirements, a pilot conducting an instrument flight rules (IFR) flight was authorised to conduct a visual descent and landing when the in-flight conditions met or exceeded visual meteorological conditions (VMC) criteria applicable for that airspace. For the approach into Lord Howe Island, when below 3,000 ft, the relevant criteria for VMC was visibility of 5,000 m while remaining clear of cloud and in sight of ground or water.

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[25] Advice from CASA stated that the AIP requirements regarding the missed approach procedures did not properly reflect that a missed approach must be executed from a visual approach if the required visibility is lost (see *Appendix B – Regulation and the Aeronautical Information Publication*).

[26] The term 'Operations Manual' was used by the operator to describe 6 volumes required under aviation legislation. The volumes relevant to the conduct of the approach and landing of VH-MVP were: Volume 1 Administration, Volume 2 Aircraft Operations, and Volume 3 Aerodrome and Routes.

If the descent was to be conducted in instrument meteorological conditions, the operator's policy stated that the pilot should consider conducting an instrument approach with a straight in landing rather than a circle-to-land manoeuvre. However, if operations below the normal circuit altitude were necessary due to weather, the manual required that the operation be conducted in accordance with the AIP visual circling procedures.

Approach and landing procedures

When an instrument approach was expected, the pilot was required to conduct that approach using instrument procedures. Once visual reference was established and could be maintained to the circling area of the destination airport, the pilot could transition from instrument procedures to visual procedures.

A visual approach was only authorised when VMC criteria were established, or the landing area was in sight, and at an altitude of not less than that prescribed for VFR flight which can then be maintained to the landing site. The manual also required compliance with the provisions of the AIP when conducting manoeuvres in the vicinity of aerodromes.

Stabilised approach criteria

In both VMC and IMC, all flights were required to be stable on the correct flight path by 300 ft above the aerodrome elevation, with only small changes in heading and pitch required to maintain that path. Additional stabilised approach criteria applied to instrument approaches, including that, during a circling approach, wings were to be level on final by 300 ft above aerodrome elevation. A special briefing was required when the pilot anticipated the need for unique approach procedures or abnormal conditions requiring a deviation from the elements of a stabilised approach.

Missed approach

When doubt existed as to the safe continuation of an approach and landing, or the approach was not stable below 300 ft above the aerodrome elevation, the pilot was required to conduct a missed approach. The missed approach policy also required pilots to comply with the AIP rules for when a missed approach was to be conducted following an instrument approach.

Aerodromes and routes

Policy, guidance and procedures for routes and airports used by the operator was contained in the operator's Aerodromes and Routes Manual. This manual contained several general observations and requirements relevant to the conduct of operations at Lord Howe Island.

The manual noted that approach zones to either runway, as well as operations over the runway, could be subject to standing waves, severe turbulence, and wind shear. These standing waves were most likely to be encountered in the lee of the mountains. For approaches to runway 10, the manual noted that, in conditions where the wind was from the north, airspeed fluctuations and turbulence could be expected when on final.

The manual contained guidance recommending the latest METAR(s)[27] be obtained during flight, and early radio communication with Lord Howe Island to establish actual weather conditions. For instrument approaches into Lord Howe Island, the manual stated:

> 1. If it is necessary to conduct an instrument approach the DME/GPS Arrival offers the most convenient approach and uses the least fuel.
> 2. RNAV and NDB/DME approaches are also available with slightly lower minimum descent altitudes.

The manual also contained guidance on the conduct of an approach and landing to runway 10, which included:

[27] See the section titled *Aerodrome weather reports*.

1. When conducting a visual approach over the lagoon ensure that the weather conditions will permit a go-around to be conducted whilst remaining visually clear of terrain.
2. The aircraft must be established on final with wings level by 300' AGL to comply with Eastern Air Link's stable approach requirements…
5. A strong northerly will produce moderate turbulence when inside the lagoon on final for this runway and may produce down-draughts.
6. In northerly winds, the air curves around Transit Hill and can produce downwind on both runway thresholds. As a result undershoot shear may be experienced on late final approach to both runways. A strong up-draught is then set up around the middle of the runway, where the tailwind component becomes a headwind… If touch down is not achieved close to the threshold a roller coaster effect is then encountered, the aircraft then tends to climb or float. Depending on wind strength, a go-around may encounter moderate to severe turbulence until crossing Blinky Beach and into free air again.

Meteorological information

Automatic weather station and weather reporting

As well as the automatic weather station (AWS) located at the airport, the Bureau of Meteorology (BoM) also had a weather observer at Lord Howe Island. That observer was generally only available from 1000-1600 local time. For further information on the AWS and weather data, see *Appendix A – Bureau of Meteorology data*. The airport also had an aerodrome weather information system (AWIS) service, which broadcast actual weather conditions as recorded by the AWS at 1-minute intervals. The AWIS was available to pilots through multiple sources, including through a standalone VHF transmitter.

Terminal forecasts

The pilot's briefing package for the flight included an aerodrome forecast (TAF)[28] for Lord Howe Island issued at 0506. It covered a 24-hour period from 18 Feb at 0500 through to 19 Feb at 0500. The expected conditions for the aerodrome were wind 050° at 12 kt, visibility of 10 km or greater but with showers of light rain, scattered cloud at 1,000 ft[29] and broken cloud at 2,500 ft. However, from 0500 to 1200, and for periods of more than 30 minutes but less than 1 hour (TEMPO), the weather could be expected to deteriorate in showers of moderate rain, with a visibility of 2,000 m and broken cloud at 1,000 ft.

Prior to the aircraft's departure, two amendments to the TAF were issued. The first, issued at 0546, forecast similar weather conditions, but for the 0500 to 1200 TEMPO period the cloud associated with the moderate rain showers and reduced visibility had lowered to broken cloud at 800 ft. The second, issued at 0613, was substantially unchanged for the period covering the aircraft's arrival. The pilot had not received the amended TAFs prior to the aircraft's arrival at Lord Howe Island.

A further amended TAF was issued at 0801, just before the aircraft landed at Lord Howe Island. That TAF was also substantially unchanged for the period covering the aircraft's landing.

Aerodrome weather reports

The BoM provided regular meteorological aerodrome reports (METARs) that were normally issued on the hour and half hour. When the data for the report was exclusively sourced from an AWS, the report would include AUTO within the text. When certain components of the report dropped below specific minima relevant to operations at the aerodrome, the Bureau would issue a special report (SPECI). If that report coincided with the normal METAR schedule, that scheduled report would be

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[28] Aerodrome Forecast (TAF): 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 reference point.

[29] The stated cloud height was for the base of that cloud mass. For TAF, cloud heights are referenced to the aerodrome elevation. For other forecasts, heights are expressed with reference to mean sea level.

issued as a SPECI. A SPECI would also be issued where there was an improvement in the observed conditions that had persisted for 10 minutes.

In the period 0730 to 0830, the Bureau issued 6 SPECI reports. Those reports, listed at *Appendix A – Bureau of Meteorology data*, were issued as SPECIs for the following reasons:

- The 0730 was a standard report issued as a SPECI due to the recorded cloud extent being broken with the base being below the alternate minima[30] of about 2,100 ft.
- The 0800 was a standard report issued as a SPECI due to cloud below the alternate minima. Of note, this report included moderate showers of rain.
- A SPECI distributed at 0802, about 4 minutes prior to the occurrence, was an extra report issued due to the visibility dropping below the alternate minima of 6 km, but also with cloud below the minima. The visibility had reduced to 5,000 m in light showers of rain.
- A SPECI distributed at 0825, was a clearing report, issued due to visibility increasing above the alternate minima.

Two further SPECI's were issued at 0828 and 0830. Both reported substantial reductions in visibility (5,000 m and 3,500 m, respectively) in showers of rain that were reported to be light and then heavy.

Bureau of Meteorology analysis of the weather for the arrival

The BoM provided an analysis of the weather conditions observed at Lord Howe Island during the period 0600 through to 0900 on 18 February. That analysis noted that the lowest cloud layer was mostly broken, with a base that varied between 800 ft and 1,800 ft. Rainfall was recorded in two distinct periods, including between 0802 and 0853. That rainfall was accompanied by visibility reductions and low cloud.

Recorded information

Airservices Australia used Automatic Dependent Surveillance Broadcast (ADS-B) data as a component of the airspace surveillance system. ADS-B is a satellite-based technology that requires aircraft to be fitted with an ADS-B capable transponder. Aircraft data is transmitted by the transponder via data link to a satellite and ground stations. That data included aircraft identification and four-dimensional position information derived from on-board navigation systems. The data was automatically provided in data packets at a rate of transmission greater one per second. ADS-B data records provided by Airservices were used to derive VH-MVP's tracking into Lord Howe Island.

The ADS-B data from VH-MVP provided the following information about its approach and landing:

- The aircraft turned onto a straight-in final when it was about 1.5 NM from the runway threshold.
- When on final approach, the aircraft was initially displaced by about 125 m to the right of the runway centreline.
- During the initial part of the final approach, the aircraft's track converged slightly with the centreline until, just before passing abeam Rabbit Island, it was displaced about 110 m to the right.
- From that point, at about 1,400 m from the runway, the aircraft's track began to diverge from the centreline.

[30] Alternate minima: specified weather conditions or facilities for a particular aerodrome such that, if the weather conditions or facilities are less than the alternate minima, the pilot in command must provide for a suitable alternate aerodrome.

- At about 400 m from the runway threshold, and with a divergence of about 150 m to the right of the centreline, that divergence ceased, and shortly after the aircraft turned towards the runway, resulting in a track change of about 15° to the left.
- The data included the aircraft's landing phase, and turnoff at the taxiway into the terminal. The data was correctly aligned with the taxiway, indicating accurate navigational tolerance during the late phases of flight and the landing.

Airservices flight and communications data showed that, at the time of the approach and landing of VH-MVP, there was no record of any other aircraft operating in the Lord Howe Island airport circuit area. A second aircraft landed on runway 10 about 2 minutes after VH-MVP.

Witness observations

Ground witnesses

A number of witnesses near the airport observed the aircraft's landing. These witnesses advised that, at the time of the aircraft's arrival, there was a very heavy rain shower at the airport, with very limited visibility and very low cloud overhead (probably at about 100 ft). When the aircraft appeared out of the rain, it was very low. It banked sharply left to reach the runway and then right, which was almost immediately followed by a pronounced flare and touchdown. The touchdown occurred off the runway, on the grass.

Aircraft passenger

A passenger on board VH-MVP stated that the aircraft was in the clear approaching the lagoon, and that over the lagoon the cloud increased significantly. The pilot had turned the windscreen wipers on early during the approach as the aircraft had passed showers up towards North Head. During the approach, the witness could see the runway out the right side, but then the aircraft entered zero visibility with rain. The aircraft's wipers were on for the whole of the approach and landing.

Organisational and management information

Operations into Lord Howe Island

The operator provided advice relating to operations into Lord Howe Island, and the threats that were unique to this airport. This advice included the use of the DME arrival procedures, techniques for the approach to runway 10, and risks associated with that approach as well as for any subsequent go-around.

DME arrival priority

For an instrument approach into the island, the operator preferred the use of the DME arrival procedure as, while it did not align the aircraft with the runway, it was considered to provide the best opportunity to get into the airport. When the arrival weather was poor, most often those poor conditions were to one side of the island, while the other side was likely to be better. The DME arrival enabled the aircraft to descend early while on track and below any weather. If the aircraft could not descend below the minima, the arrival procedure brought the aircraft across the top of the island and most likely into better conditions, from which visual conditions and descent could be achieved.

Final approach to runway 10

For final approach off the DME arrival, the goal was to align with the centreline at North Head, which was 1.8 NM from touchdown. The aircraft would not join the circuit, but instead the goal was to position for a turn to join for a straight-in final approach. Pilots were instructed to establish the aircraft visually within the lagoon before positioning for final approach—this enabled clearance from obstacles, while the observation of wind lanes on the lagoon's water aided in identifying likely

turbulence. North Head and Rabbit Island enabled the pilot to establish alignment with the runway centreline.

The predominant risk for the approach into runway 10 at Lord Howe Island was from the turbulence often created by the hills in the immediate runway environment, and mountains further to the south. North Head also presented a risk, from both an obstacle and turbulence perspective, but also as a locale for bird populations.

Missed approach from runway 10

For the missed approach or go-around from runway 10, the hills around the airport were an immediate obstacle threat, particularly in poor weather. Strong turbulence early in the missed approach was most likely, which, when combined with the complexities of reconfiguring the King Air during this manoeuvre, while also operating single pilot and most likely head down, significantly increased risk. For this reason, pilots were required to ensure that the hills within the immediate north and south of the runway were visual before committing to final approach.

Operator's assessment of VH-MVP's approach

The operator stated that the final approach tracking of VH-MVP during this occurrence complied with the Operations Manual stabilised approach criteria.

ATSB review of operations

The aircraft that landed 2 minutes after VH-MVP was also an air transport service operated by the same operator. That aircraft used the same DME approach procedure profile, transiting into a visual approach, with the aircraft joining for a straight-in final approach from a point between North Head and Rabbit Island. That flight landed without apparent incident.

The similarity of these two approaches prompted the ATSB to review ADS-B data for other flights conducted by the operator into Lord Howe Island when conditions were most likely to be marginal for flight under VMC. The flights reviewed were air transport operations, and the conditions were based on Bureau of Meteorology METAR and SPECI reports covering the arrival times for that flight. The data is presented at *Appendix D – Operations into Lord Howe Island runway 10.*

Thirteen flights operated by the same operator into Lord Howe Island were reviewed. Seven conducted a DME arrival, where the aircraft descended below the MDA before the final approach fix and entered the aerodrome circling area below the circling MDA. The ADS-B data for these flights indicated the conduct of a visual approach for runway 10.

In each instance, the aircraft entered the circling area in the non-circling segment and conducted a straight-in final approach from a right turn onto final while well inside 3 NM from the runway threshold. All but one were below the circling minima when they entered the circling area. For each of those 7 flights, the visibility recorded by the AWIS identified that the visibility at the automatic weather station was either at or below the 5 km required for VMC operations.

There were also examples of pilots using the RNP RWY 10 approach, but these were limited to aircraft arriving from Queensland and when weather conditions were significantly below that required to achieve VMC.

CASA surveillance

Due to the safety implications identified following the ATSB review of the operator's approach tendencies, specifically the unstable nature of the occurrence approach, in June 2022 the ATSB advised the operator of an intent to disclose[31] these matters to the Civil Aviation Safety Authority (CASA). Following a meeting with CASA on the subject matter, CASA conducted an unscheduled surveillance event on Eastern Air Link's operations during July and August 2022. The report from

[31] Under the provisions of the Transport Safety Investigation Act 2003 section 61.

that surveillance event found that the off-runway landing of VH-MVP was likely the result of inconsistent operational practices relating to stabilised approach standard operating procedures.

In the period January 2018 to December 2022 CASA conducted 6 surveillance events on the operator. Of these events, 5 were scheduled events, 1 in 2019 and 4 in 2021, while the remaining event was the July/August 2022 unscheduled event. The observation from the unscheduled event was the only finding or observation raised from the 6 surveillance events.

Related occurrence

ATSB Investigation AO-2021-014

On 22 March 2021, the pilot of a Piper PA-31P-350 Mojave commenced a GPS instrument approach into runway 11C at Bankstown Airport, NSW. The flight was conducted under the instrument flight rules. While the initial part of the approach proceeded normally, the aircraft started to deviate from the required track, with that deviation increasing to 0.5 NM (0.9 km) to the south of the required track. The Bankstown tower controller observed this and advised the pilot. The deviation continued until, after the aircraft had passed the final approach fix, the tower controller instructed the pilot to discontinue the approach. The pilot did not conduct a missed approach, but instead initially acknowledged the instruction and then requested clearance to continue the approach visually. While this was approved by the controller, it resulted in the aircraft operating significantly below the minimum allowable altitude.

The pilot then conducted extensive manoeuvring, including 2 orbits, at low altitude that were not in accordance with the approach requirements. Further, having descended visually below the minimum descent altitude, and commenced manoeuvring to position the aircraft for a landing at Bankstown Airport, the pilot did not conduct a missed approach when the aircraft exited the circling area and the required visual reference with the runway was lost. The aircraft completed the circling approach and landed safely on runway 11C.

Safety analysis

Introduction

On the morning of 18 February 2022, the pilot of a Raytheon B200, VH-MVP commenced a distance measuring equipment (DME) arrival procedure into Lord Howe Island. While the flight was conducted under instrument flight rules (IFR), the pilot established visual meteorological conditions (VMC) early in the approach enabling a transition to a visual approach. The pilot descended VH-MVP below the DME arrival procedure's descent profile (a 'low early' profile), while positioning the aircraft for a straight-in approach to runway 10 from a point between North Head and Rabbit Island. Following the approach, the aircraft touched down to the left of the runway. This analysis will examine the meteorological and operational factors that led to the off-runway landing and the conduct of other similar approaches by the operator's aircraft at this airport.

Marginal weather conditions

The aerodrome weather forecast (TAF) covering the arrival, which had been reviewed by the pilot, identified conditions were generally above that necessary for a visual approach, but also included periods when visibility would significantly deteriorate below those requirements. These weather conditions were substantially unchanged in subsequent amended forecasts. While the automated weather information system (AWIS) data recorded by the pilot prior to descent indicated suitable conditions for a visual approach, the AWIS only provided current conditions at the automatic weather station (AWS). It did not indicate likely changes in weather, nor conditions in the approach to runway 10.

Bureau of Meteorology weather observations covering the aircraft's arrival identified weather conditions that were consistent with the forecasts and were marginal for the conduct of a 'low early' visual approach. Those reports, and witness observations, identified that at the time of the approach and landing, the aerodrome was experiencing a heavy rain shower with limited visibility. Further, information from a passenger on board the aircraft indicated that the aircraft had entered rain showers well before arriving over the runway threshold. The runway weather conditions recorded by the pilot from the AWIS preceded the deterioration in weather at the aerodrome prior to the aircraft's landing.

The 'low early' plan

As the flight was an IFR operation, the pilot was required to meet specific safety heights and procedural rules for the descent and approach into Lord Howe Island. These safety heights and procedural rules could be relaxed through establishing criteria suitable to transition to a visual approach. In accordance with the operator's preference, the pilot conducted a DME arrival procedure while also seeking to transition to a visual approach and descend below the arrival procedure's circling approach minimum descent altitude (MDA) of 1,480 ft as early in the approach as possible (the low early profile).

Having transitioned to a visual approach, the pilot descended the aircraft below the MDA while well outside of the aerodrome's circling area, entering the circling area from a direction that placed it within the no-circling zone. As a result, while manoeuvring the aircraft to intercept final approach, it was critical for terrain separation that the pilot maintain VMC (visibility of at least 5,000 m and not the circling visibility requirement of 2,400 m) and keep the runway threshold in sight.

Further, the pilot did not join the circuit for landing but instead turned onto a straight-in final at a point between North Head and Rabbit Island, which was less than the 3 NM required under the regulations. However, as there were no records of other aircraft operating within the aerodrome's circuit pattern at the time, it is unlikely that this elevated risk during this phase of flight.

The final approach

The pilot stated that, on entering the aerodrome's circling area, the required flight visibility was maintained and visual contact with the runway established and retained until the aircraft reached the runway threshold, whereupon the aircraft unexpectedly entered a shower.

However, recorded ADS-B data showed that it is very unlikely that the required visual reference was maintained during this period. The recorded early turn onto final, where the aircraft turned to fly parallel the extended centreline but with a significant displacement to the south of the centreline, and the continued displaced and parallel tracking of the extended centreline, indicate that it was extremely unlikely that the pilot had the runway threshold visual. This is further supported by the late manoeuvring to return the aircraft to the runway centreline, indicating that visual contact with the runway was reacquired just before this manoeuvring. Witness accounts are also consistent with the late visual acquisition of the runway.

The operator's guidance for Lord Howe Island also stipulated that, when conducting a visual approach to runway 10, weather conditions should be sufficient to ensure that visual contact with the terrain around the runway can be maintained. This was intended to ensure the safety of a go-around-, if needed. The late turn towards the runway indicated that it was extremely unlikely that the pilot had visual conditions capable of meeting this safety requirement. Further, the pilot was required to observe the AIP missed approach criteria, which included commencing a go-around- where visual contact with the runway was lost.

An unstable approach

The operator's stable approach criteria required 'only small changes in heading' to maintain the correct flight path. The correct flight path for the final approach to the runway included being on the extended runway centreline, or if displaced, needing only small changes in heading to return to that centreline. While the operator's view that the realignment undertaken by VH-MVP was within those criteria, a change in heading to enable a 15° track adjustment to reacquire the centreline when only about 400 m from the threshold does not constitute a small change in heading.

The aircraft was not within the operator's stabilised approach criteria, and under those policies, was required to conduct a go-around. However, having continued an approach without the requisite visual contact, both a continuation of the unstable approach, and a go-around without the required visual terrain separation, carried significant risk.

The late manoeuvring to reacquire the runway centreline resulted in the aircraft deviating left of the runway's sealed runway surface and touching down to the left of the runway. Although the aircraft quickly recovered to the runway, it damaged a runway light.

Inappropriate use of the visual approach in marginal weather

For the approach into runway 10, the occurrence flight used a DME arrival and visual approach transition to descend below weather and position for a straight-in approach, but in visibility conditions that were marginal for this type of operation. The flight also approached the runway's circuit area from a no-circling zone, and then joined the non-controlled aerodrome's circuit through a turn onto a straight in approach from the opposite side to the normal circuit pattern while well within the required 3 NM limit for that manoeuvring. The investigation identified a number of similar approach profiles, also in marginal weather conditions for visual approach operations, that were conducted by the operator's aircraft to runway 10.

As demonstrated by the occurrence flight, this approach method in marginal weather conditions removes obstacle clearance assurance for both an approach and any potential missed approach, thereby increasing risk. Further, as identified by advisory circular (AC) 91-10v1.1, the operator's regular practice of joining for a short straight-in approach from well within the 3 NM requirement

while also below a normal circuit height, presented an increased collision risk to aircraft operating within the aerodrome's circuit using normal non-controlled aerodrome circuit procedures, or any aircraft conducting an instrument approach.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the touchdown off the runway surface by VH-MVP at Lord Howe Island Airport on 18 February 2022.

Contributing factors

- At the time of the aircraft's final approach and landing, the aerodrome was experiencing a heavy rain shower with associated limited visibility, conditions that were marginal for visual flight.
- The pilot commenced a visual approach to the runway with the required visual cues, but during final approach over the lagoon visual contact with the runway was lost as the aircraft entered a heavy shower. Contrary to the missed approach requirements, the pilot did not commence a go around but instead continued towards the runway, resulting in an increasing displacement from the runway centreline until late in the approach when visual contact with the runway was reacquired.
- Contrary to the operator's stabilised approach criteria, the pilot elected to continue and land from an unstable approach, where the aircraft required significant late heading changes to align with the runway. The realignment was unsuccessful, resulting in the aircraft touching down off and to the left of the runway, on the runway strip.
- The pilot did not conduct a missed approach, as, based on their significant experience with operations at Lord Howe, the pilot assessed that a missed approach from short final held excess risk due to the high terrain in the vicinity of the runway.
- The pilot elected to conduct a distance measuring equipment arrival with the intent to convert to a visual approach as early as possible and continue the approach below any weather to the aerodrome's circling area and then continue for a landing in marginal weather conditions.

Other factors that increased risk

- **The occurrence flight used a distance measuring equipment arrival procedure to establish a visual approach in unsuitable visibility conditions. The investigation identified a number of similar approaches conducted by the operator in marginal visibility conditions. Using this approach method, rather than a straight in instrument approach, significantly reduced obstacle clearance assurance for both an approach and any potential missed approaches, and increased the risk to both the operator's and other aircraft through the use of a non-standard circuit procedure. (Safety issue)**

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties were provided with a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions are provided separately on the ATSB website, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website as further information about safety action comes to hand.

Inappropriate use of the visual approach in marginal weather

Safety issue description

The occurrence flight used a distance measuring equipment (DME) arrival to establish a visual approach in unsuitable visibility conditions. The investigation identified a number of similar approaches conducted by the operator in marginal visibility conditions. Using this approach method, rather than a straight in instrument approach, significantly reduced obstacle clearance assurance for both an approach and any potential missed approaches, and also increased the risk to both the operator's and other aircraft through the use of a non-standard circuit procedure.

Issue number:	AO-2022-007-SI-01
Issue owner:	Eastern Air Link
Transport function:	Aviation: Air transport / Aviation
Current issue status:	Open – Safety action pending
Issue status justification:	To be advised

Initial response by Eastern Air Link

On 14 February 2023, following ATSB's briefing on the safety issue titled 'Inappropriate use of the visual approach in marginal weather' and request for advice on safety action to address the issue, Eastern Air Link advised the ATSB that notification of these events to the Civil Aviation Safety Authority (CASA) resulted in CASA initiating surveillance activity. As a result of that activity, the Operations Manual Volume 2 -- Aircraft Operations was amended, with CASA acceptance. The relevant amendments within this manual were as follows:

- In the Approach and Landing Procedures section, under the stabilised approach component of the approach and landing precautions subsection, a note that followed the specific stabilised approach criteria originally stated:

  'If an approach requires a sink rate greater than 1000 fpm, a special briefing should be conducted...'

  That note was amended to read:

  Unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing. Locations where this may be commonplace, typically

due to meteorological and/or topography factors, relevant information will be included in the 'Supplemental Operations – (Location)' section of Volume 3, the Aerodrome and Routes Manual; e.g. Lord Howe Island.'

- In the section on Instrument approach procedures, the Circuit and Landing Procedures subsection included requirements for straight in approaches in a CTAF. These requirements were amended with respect to how straight-in approaches were to be conducted, with the relevant points now reading:

  1. Procedures for Straight in Approaches at non-towered aerodromes are documented in the AIP/Jeppesen. The main points are summarised below: …

  - All manoeuvring must be carried out, to establish the aircraft on the final approach, at least 3 NM from the threshold of the runway intended to be used for the landing. Only minor corrections to speed and flight path, to maintain a stable approach, should be required within 3 NM on final…
  - The aircraft's transponder should be selected to ON/ALT (Mode C) and ensure that landing lights, as well as anticollision and strobe lights where fitted, are illuminated from 3 NM from the landing threshold until after landing and clear of all runways.

In response to a request from the ATSB for further detail on the reason for these changes, Eastern Air Link provided the following additional information:

> The current text to Vol 3 [which provided specific guidance on meteorological threats specific to Lord Howe Island] but text in Vol 2 [the operations manual] required amendment as it appeared to offer a disconnect with Vol 3. Amended text to Vol 2 was subsequently offered and approved by CASA (3/8/22) …
>
> The changes did not call for any specific training, per se. What was required was information to alert Flight Crew to the nuances of the changes, namely – (a) the precautionary statements with regard to self-briefing when meteorological conditions or terrain demanded, shall we say, "a little more attention" and this would be highlighted in Vol 3 and (b) the requirement with regard to manoeuvring within the 3 NM of the runway. Neither is trainable but what was put into effect was:
>
> 1. [through] a check of the sign on process the Chief Pilot confirmed that the Flight Crew were aware of the amendment and the requirements to each issue, and
>
> 2. thereafter, this will be confirmed via the Flight Crew's subsequent route check…
>
> Regarding methods and systems employed to ensure that these changes are being applied in practice, and to ensure effective implementation, it is a requirement of our Training and Checking System that the Flight Crew are checked annually on the route. Therefore, as well as being made aware of changes through the Ops Manual amendment process, the Chief Pilot, who conducts this check, will confirm compliance with this as well as all relevant aspects of the Operations Manual generally.
>
> Regarding what training systems and notification methods were used to ensure that flight crew were conversant with these changes to the operations manual, when any amendment is made to the Operations Manual, Flight Crew are advised by Flight Standing Order.

ATSB comment

The ATSB acknowledges Eastern Air Link's changes to the 3 NM limit for manoeuvring for a straight-in approach, but notes these were actioned through notice only with no supported training. Consequently, the ATSB examined flight crew actions during approaches into Lord Howe Island during a period of potential marginal weather conditions on 3 February 2023. While the weather conditions at that time did not qualify as being marginal for a visual approach, the data was mixed, with 2 of the 4 arrivals positioning for a straight-in approach while within the 3 NM manoeuvring limit. This prompted a request for further clarity on how the proposed changes were being implemented as the non-adherence to the operational change indicates that, without any attached guidance or training component to emphasise and support the change, its implementation had been ineffective.

The changes to the stabilised approach criteria, and the later advice on the intention of this change, also required closer examination. In guidance on the appropriate response to deviation from stabilised approach criteria, the Flight Safety Foundation recommends that:

> If the approach is not stabilized before reaching the minimum stabilization height, or if any flight parameter exceeds deviation limits **(other than transiently)** when below the minimum stabilization height, a go-around must be conducted immediately.[32]

Transient deviations from stabilised approach criteria are generally accepted when turbulent conditions exist, whether the result of weather or the effects of local terrain, although should conditions result in serious deviation, the safest option is to go around. A transient deviation acceptance could be read into the content of 2C6.6.2, with the statement that 'only minor corrections to speed and flight path, to maintain a stable approach, should be required…' however, both this text, and the new note raised the question of what is required where more serious deviation results. The note gives no indication of transient exceedances being the issue but permits intentional exceedance of stabilised approach criteria should conditions necessitate, if that exceedance was foreseen through a special briefing. However, the ATSB notes that:

- The stated 'self-briefing' component is not apparent from the text.
- There is no guidance on what is considered a safe deviation from these criteria. As stated, the text permits an unrestricted authorisation to deviate from the standards.
- The operator has not introduced a monitoring or reporting component to this authorised deviation.

The stabilised approach method, and the well-established limits therein, has resulted in a significant reduction in loss of control and collision with terrain accidents during approach and landing. This method and the associated limits are recognised and followed globally and operate successfully in environments that present the possibility of conditions more extreme than that presented by Lord Howe Island, and without the need for acceptance of deviation. Further, this modification to the note following the stabilised approach criteria has the potential to validate the manoeuvring conducted during the occurrence event, as well as introducing the potential to significantly increase risk where meteorological conditions exist to justify extreme breaches of stabilised approach criteria.

In summary, the ATSB considered that Eastern Air Link's initial response and the associated safety action did not address the safety issue. Therefore additional information was sought from the operator.

Additional response by Eastern Air Link

In response to the request for advice on actions specific to the safety issue, Eastern Air Link provided the following statement:

> General Comment
>
> Lord Howe Island (LHI) should never be considered your average Australian airport and should always be treated with great respect. Eastern Air Link (EAL) has quite an extensive Pilot in Command initial route training program supported by an annual route qualification regime. Moreover, and for good reason, the LHI section of Volume 3 of the EAL Operations Manual (Aerodromes and Routes) is by far the most extensive. The information in that manual is there to inform and remind Flight Crew that LHI's remote location, together with its topography, oceanic weather environment and significant seasonal bird life creates, and will continue to create, a challenge for Flight Crew who regularly operate there.

[32] Flight Safety Foundation, 2000. FSF ALAR briefing note 7.1—Stabilized approach. *Flight Safety Digest*, pg.136.

Naturally, the Australian Aviation Regulations apply at LHI but strict application of the standard, rectangular circuit pattern without considering the actual LHI conditions, may well place the aircraft in an unsafe position. Sound, safe airmanship is always required.

Visual Approach in Marginal conditions

At the heart of this issue is a safe assessment of what constitutes Visual Meteorological Conditions (VMC). This assessment is the responsibility and the prerogative of the Pilot in Command (PIC). If safely and correctly assessed, a visual approach, even in marginal conditions, remains a viable and safe option. With refence to ATSB's concerns, the discontinuance of an IFR approach in marginal conditions, the PIC must ensure that VMC exists and will continue to exist during the approach - otherwise the published Missed Approach must be conducted. However, in marginal weather conditions it is not uncommon for there to be 'holes' or 'areas of VMC' that enable a safe approach to be conducted even when the rest of the sky would be deemed to be non VMC. In this scenario, a visual approach in marginal conditions remains a safe option. EAL expects its Flight Crew to be wise with their assessments and, if any doubt exists, to always take the safer option. This is stressed in their training and is regularly assessed.

ATSB comment

The safety issue does not question the conduct of a visual approach in appropriate weather conditions. However, the safe conduct of a visual approach in marginal conditions relies on the pilot's subjective assessment and introduces the possibility of encountering either improved or deteriorating conditions, particularly in the significantly dynamic meteorological environment that Lord Howe Island often presents.

In the case of the occurrence approach, a visual approach conducted in marginal weather conditions introduced an unnecessary risk of loss of visual reference in relatively close proximity to terrain, which was further exacerbated as the 'visual only missed approach' could not be performed safely due to loss of adequate visual reference and reduced obstacle clearance assurance. The advantages to conducting a visual approach in marginal condition are outweighed by the significant increase in safety risk. Further, the concept of utilising 'VMC holes' further increases risk, through the reliance on local improvements in weather conditions that may quickly deteriorate, as was the case in this occurrence.

The ATSB remains concerned that the operator's conduct of visual approaches in marginal weather conditions presents an unacceptable and ongoing risk of a similar occurrence, with possibly more severe consequences. As such, the ATSB makes the following safety recommendation.

Safety recommendation to Eastern Air Link

The ATSB makes a formal safety recommendation, either during or at the end of an investigation, based on the level of risk associated with a safety issue and the extent of corrective action already undertaken. Rather than being prescriptive about the form of corrective action to be taken, the recommendation focuses on the safety issue of concern. It is a matter for the responsible organisation to assess the costs and benefits of any particular method of addressing a safety issue.

Recommendation number:	AO-2022-007-SR-18
Responsible organisation:	Eastern Air Link
Recommendation status:	Released

The ATSB recommends that Eastern Air Link address the safety issue, through provision of guidance and training to flight crew concerning the safest option in the selection of an approach method when weather conditions are marginal for the conduct of a visual approach.

Safety action not associated with an identified safety issue

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Additional safety action by the Civil Aviation Safety Authority

The Civil Aviation Safety Authority identified a lack of clarity/imprecision within the Aeronautical Information Publication regarding the application of AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.5 HOLDING, APPROACH AND DEPARTURE PROCEDURES, subsection 1. HOLDING AND INSTRUMENT APPROACH TO LAND (IAL) PROCEDURES, sub subsection 1.9 Missed Approach – Standard Procedures, and its link to sub subsection 1.14 Visual approach requirements for IFR flights.

Specifically, while paragraph 1.14.6 outlines that the visual approach is subject to the requirements of sub subsections 1.6, 1.9 and 1.13, 1.9 does not itself reflect that a missed approach must be executed from a visual approach if the required visibility is lost. To clarify this requirement, CASA will propose to other AIP stakeholders to amend AIP ENR 1.5 to include new content containing this requirement.

General details

Occurrence details

Date and time:	18 February 2022, 0815 Eastern Daylight-saving Time	
Occurrence class:	Serious incident	
Occurrence categories:	Runway excursion, Collision with terrain	
Location:	Lord Howe Island Aerodrome, New South Wales	
	Latitude: 31° 32.29998' S	Longitude: 159° 4.63332' E

Aircraft details

Manufacturer and model:	Raytheon Aircraft Company B200	
Registration:	VH-MVP	
Operator:	Eastern Air Link	
Serial number:	BB-1812	
Type of operation:	Part 135 Australian air transport operations - Smaller aeroplanes - Standard Part 135	
Activity:	Commercial air transport-Scheduled-Domestic	
Departure:	Port Macquarie Aerodrome	
Destination:	Lord Howe Island Aerodrome	
Persons on board:	Crew – 1	Passengers – 6
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	None	

Glossary

AC	Advisory circular
ADS-B	Automatic dependent surveillance broadcast
AIP	Aviation information publication
ATC	Air traffic control
AWIS	Aerodrome weather information service
AWS	Automated weather station
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
CAT B	Aircraft performance category B
DME	Distance measuring equipment
FL	Flight level
FO	First officer
GNSS	Global navigation satellite system
IFR	Instrument flight rules
IMC	Instrument meteorological conditions
MDA	Minimum descent altitude
METAR	Aviation routine weather report
NDB	Non-directional beacon
PBN	Performance based navigation
RNP(x)	Required navigation performance with the designator (x) identifying the accuracy in nautical miles
RNP APCH	RNP approach
SPECI	Aviation special weather report
TAF	Aerodrome forecast
VFR	Visual flight rules
VMC	Visual meteorological conditions

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the pilot of VH-MVP
- Eastern Air Link
- Civil Aviation Safety Authority
- Airservices Australia
- Bureau of Meteorology
- Lord Howe Island Board
- witnesses to the incident.

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section 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 the following directly involved parties:

- the pilot of VH-MVP
- Eastern Air Link
- Civil Aviation Safety Authority

Submissions were received from:

- Eastern Air Link
- Civil Aviation Safety Authority
- witnesses.

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Appendices

Appendix A – Bureau of Meteorology data

Automated weather stations

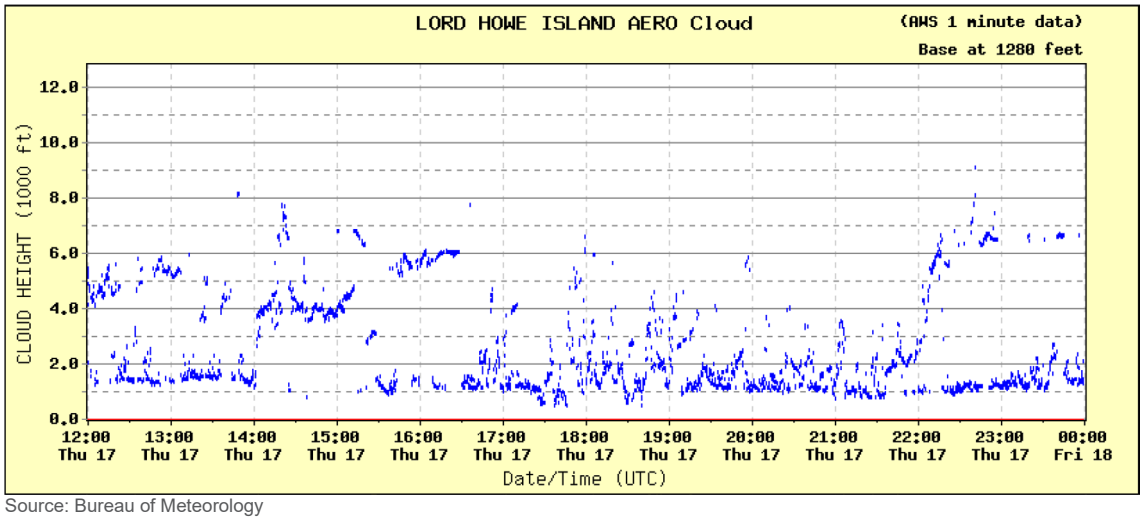
The Bureau of Meteorology's automated weather stations (AWS), such as the one located at Lord Howe Island airport (YLHI), provided automated weather observations at one-minute intervals on sensor derived data that included surface wind, air pressure, rainfall, cloud information, and visibility. This data was transmitted to the Bureau for use in forecasting, and was also used for other information services, including the provision of aerodrome weather information services (AWIS) and aerodrome weather reports, also known as meteorological aerodrome reports (METAR).

The wind records were generally an average of the previous 10 minutes, but with exceptions that covered significant variations. The cloud and visibility data were based on one-minute data output from ceilometer and visibility meters.[33]

Ceilometer

The ceilometer used a single vertical-pointing laser beam to obtain spot heights of the cloud base directly above. The cloud base was identified as being the height of the peak reflected light intensity. Only heights up to 12,500 ft were reported. Cloud type was not reported. Processing data over time produced an estimate of cloud amount. There were several limitations to ceilometer data, including misreporting of stationary cloud amounts due to minimal cloud movement, and a time lag in reporting rapidly changing cloud conditions, as well as other limitations related to the accuracy of the ceilometer output associated with the instrument and the sampling method used. Figure 5 displays the recorded ceilometer data for the YLHI AWS covering the period 17 February at 1200 UTC to 2359 UTC (17 February at 2300 to 18 February 1100 local time).

Figure 5: YLHI ceilometer data



Source: Bureau of Meteorology

Visibility meter

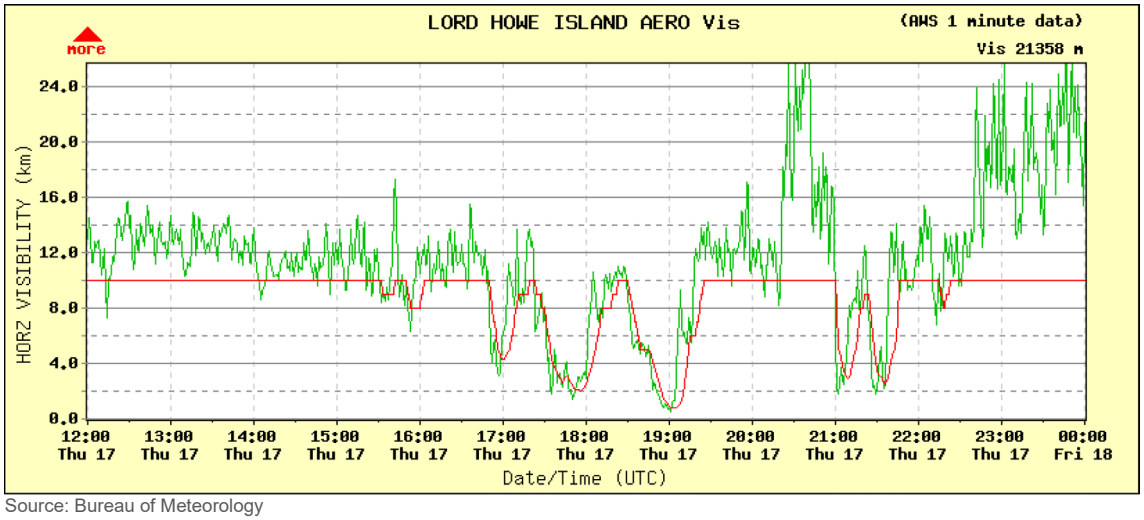
The visibility meter used the visible light forward scatter principle of operation. Light from a high intensity light source was beamed into a scattering volume (approximately 1 litre) which was viewed by a receiver. Visibility was deduced from the amount of light received. Water, dust or

[33] The ceiling and visibility data was not subject to the Bureau's quality control procedures, this should be considered when interpreting the data.

smoke particles, which cause a reduction in visibility, will increase the scattering. Data is collected over a 10-minute period and processed using a formula which gives a higher weighting to any reports of lower visibility. Visibility meter output represents the visibility at a single point and may not be representative of the visibility away from that point.

When an air mass with reduced visibility moved across the airfield, such as a fog bank or a shower, the sensor will not detect that reduced visibility unless it also moved across the sensor. There may be other limitations as to the accuracy of the visibility output associated with the instrument and the sampling method used. Figure 6 displays the recorded ceilometer data for the YLHI AWS covering the period 17 February at 1200 UTC to 2359 UTC (17 February at 2300 to 18 February 1100 local time).

Figure 6: YLHI visibility meter data



Source: Bureau of Meteorology

Terminal forecasts issued for Lord Howe Island

The following terminal forecast (TAF) for Lord Howe Island (YLHI) were issued by the Bureau of Meteorology on the 18 February:

TAF YLHI 171721Z 1718/1818
05012KT 9999 -SHRA SCT012 BKN030
FM180100 01014KT 9999 -SHRA SCT015 BKN030
TEMPO 1718/1801 5000 SHRA BKN010
INTER 1801/1808 6000 SHRA BKN010
RMK
T 22 22 23 24 Q 1012 1013 1013 1012

TAF AMD YLHI 171806Z 1718/1818
05012KT 9999 -SHRA SCT010 BKN025
FM180100 01014KT 9999 -SHRA SCT015 BKN030
TEMPO 1718/1801 2000 SHRA BKN010
INTER 1801/1808 4000 SHRA BKN010
RMK
T 22 22 23 24 Q 1011 1012 1013 1012

TAF AMD YLHI 171846Z 1718/1818
05012KT 9999 -SHRA BKN015
FM180100 01014KT 9999 -SHRA SCT015 BKN025
TEMPO 1718/1801 2000 SHRA BKN008
INTER 1801/1808 4000 SHRA BKN010
RMK
T 22 22 23 24 Q 1011 1012 1013 1012

TAF AMD YLHI 171913Z 1719/1818
06016KT 9999 -SHRA BKN015
FM180100 01014KT 9999 -SHRA SCT015 BKN025
TEMPO 1719/1801 2000 SHRA BKN008
TEMPO 1801/1804 3000 SHRA BKN010
INTER 1804/1808 4000 SHRA BKN010
RMK
T 21 23 23 24 Q 1012 1013 1013 1012

TAF AMD YLHI 172101Z 1721/1818
01014KT 9999 -SHRA SCT015 BKN025
TEMPO 1721/1801 2000 SHRA BKN008
TEMPO 1801/1804 3000 SHRA BKN010
INTER 1804/1808 4000 SHRA BKN010
RMK
T 23 24 24 24 Q 1012 1013 1012 1011

Weather observations issued for Lord Howe Island

The weather observation reports were sourced from the island's AWS. Data sourced solely from automated observations included AUTO in the report's text. Actual weather observations (METAR) were reported at the hour and half hour. A METAR would be designated as a SPECI, or issued in addition to the regular reports, under the following conditions:

> SPECI is used to identify reports of observations when conditions are below specified levels of visibility and cloud base; when certain weather phenomena are present; and when the temperature, pressure or wind change by defined amounts. SPECI is also used to identify reports of observations recorded 10 minutes following an improvement in visibility, weather or cloud to METAR conditions.

Regarding the criteria that would trigger a SPECI for YLHI, these were:

- visibility less than the highest alternate minimum (which was 6,000 m) or 5,000 m, whichever was greater
- when there is broken or overcast cloud below the aerodrome's highest alternate minimum cloud base (which was 2,160 ft AGL) or 1,500 ft, whichever is greater
- moderate or heavy precipitation.

The Bureau issued the following automated METAR/SPECI reports on the 18 February for Lord Howe Island (YLHI) between 0730 and 0830:[34]

> SPECI YLHI 172030Z AUTO 03006KT 350V050 9999 // BKN012 BKN016 OVC021 23/21 Q1012 RMK RF00.0/021.2
>
> SPECI YLHI 172100Z AUTO 03013KT 9999 SHRA SCT010 OVC016 22/21 Q1012 RMK RF00.0/021.2
>
> SPECI YLHI 172102Z AUTO 02013KT 5000 -SHRA BKN010 OVC018 22/20 Q1012 RMK RF01.0/022.2
>
> SPECI YLHI 172125Z AUTO 04012KT 8000 -SHRA BKN010 OVC018 22/21 Q1012 RESHRA RMK RF00.0/023.4
>
> SPECI YLHI 172128Z AUTO 04013KT 5000 -SHRA BKN010 OVC018 OVC033 22/21 Q1012 RESHRA RMK RF01.0/024.4
>
> SPECI YLHI 172130Z AUTO 04013KT 3500 +SHRA BKN010 OVC018 OVC033 22/21 Q1012 RMK RF01.8/025.2

[34] The reason for the SPECI designation is in brackets after the report.

Analysis of weather data

The Bureau of Meteorology provided an analysis of observed weather conditions at Lord Howe Island. For the period 1900-2200 UTC on the 17 February 2022 (18 February from 0600 to 0900 local), the following conditions were observed.

Wind speed and direction

Observed winds at YLHI were moderate north to north-easterly.

Cloud

The Lord Howe Island ceilometer recorded a layer of mostly broken, occasionally scattered, low cloud with base varying between approximately 800 ft to 18,00 ft AGL. Cloud base was lowest during periods of rainfall. A secondary layer of cloud with base at approximately 5,000 ft to 6,000 ft AGL was observed at times. These observations were consistent with the 23Z aerological diagram, which indicated two shallow saturated air layers at approximately 1,000 ft and 5,500 ft AGL.

Rainfall

Rainfall was recorded in the METAR/SPECIs up until 1924 UTC (0624 local time) and then again between 2102 and 2153 UTC (0802 to 0853 local time), and the ceilometer and visibility meters indicated accompanying visibility reductions and low cloud. Satellite imagery indicated that this rainfall was associated with a convective cloud moving over the aerodrome. This was consistent with the 23Z areological diagram which indicated an unstable convective environment.

Low Cloud within 5 NM of the aerodrome

Satellite imagery indicates that some areas within a 5 NM radius of the airport were, at times, clear of any cloud. Where cloud was present on the satellite imagery, it is reasonably likely that these were areas of broken low cloud. The uncertainty is due to the lack of direct observations and the difficulty in determining whether low cloud is less or more likely to form over the ocean than at Lord Howe Island. On the one hand, a moist marine environment was favourable for the development of low cloud, but conversely, the absence of orographic uplift (uplift of air caused by movement over elevated topography) was less favourable for the development of low cloud.

The likely presence of showers in the marine environment increased the likelihood of low cloud.

Appendix B – Regulation and the Aeronautical Information Publication

The Civil Aviation Safety Regulations (CASR) Part 91[35] and the Aeronautical Information Publication (AIP)[36] contained certain rules and procedures relevant to the conduct of the descent and approach of VH-MVP—which was an Instrument Flight Rules (IFR) flight operating in class G[37] airspace to a non-controlled aerodrome. These rules and procedure covered minimum heights, operations into a non-controlled aerodrome, the visual approach, and visual circling.

Minimum heights

For the en-route and descent phase of the flight, CASR r.91.305 required a minimum height to be maintained. This height was determined by methods including either a published lowest safe altitude for the aircraft's route or route segment, or a minimum sector altitude published in an aeronautical information publication. This minimum height requirement did not apply when the aircraft was:

- being flown in visual meteorological conditions (VMC) by day
- landing
- being flown in accordance with a visual approach procedure, or
- being flown in accordance with an instrument approach procedure.

These minimum height requirements were repeated in various parts of the AIP, but more specifically, the exceptions to the minimum height requirement included the conduct of a published DME or GNSS arrival procedure.[38]

Once established in VMC and conducting the visual approach, CASR regulations 91.265 and 91.267 determined the minimum height for the descent and continued tracking into Lord Howe Island. As the route was exclusively over water and not over a populous area or a public gathering, the minimum height was 500 ft above the water or land within 300 m immediately below the aircraft, or any obstacles thereon, except when the aircraft was landing.

Operations into a non-controlled aerodrome

The Civil Aviation Safety Regulations (CASR) contained regulations that mitigated the risk of collision for aircraft operating in the vicinity of a non-controlled aerodrome.[39] A non-controlled aerodrome was one that was in uncontrolled airspace, while the vicinity of that aerodrome included being within 10 NM of the aerodrome reference point. Two regulations specifically applied to the conduct of the approach into Lord Howe Island airport, a non-controlled aerodrome, by VH-MVP.

- For aircraft operating within the circuit pattern for landing at YLHI, all turns were required to be to the left.[40]

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35 CASR Part 91 General operating and flight rules.

36 The AIP edition applicable for the approach was dated 2 December 2021.

37 Class G airspace was uncontrolled airspace. Both IFR and VFR aircraft were permitted to operate within this airspace, and an ATC clearance not required for these operations. See AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.4 ATS AIRSPACE CLASSIFICATION, subsection 4. CLASSES OF AIRSPACE-SERVICES AND REQUIREMENTS.

38 AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.5 HOLDING, APPROACH AND DEPARTURE PROCEDURES, subsection 1. HOLDING AND INSTRUMENT APPROACH TO LAND (IAL) PROCEDURES, sub-subsection 1.4 Minimum Route Altitudes.

39 CASR Part 91 General operating and flight rules, Subpart 91.D—Operational procedures, Division 91.D.4—Flight rules, Subdivision 91.D.4.6—Avoiding collisions at or in the vicinity of aerodromes.

40 CASR 91.385.

- A straight-in approach to YLHI runway 10 was prohibited, except when all manoeuvring to establish the aircraft on final approach was carried out at least 3 NM from the threshold of the runway intended to be used for the landing.[41]

The AIP also contained procedures and guidance on circuit entry,[42] which recommended aircraft joining the circuit do so no later than mid-downwind while also giving way to other circuit traffic. The AIP also repeated the rule concerning straight-in approaches at non-controlled aerodromes.[43]

Visual approach procedure

The AIP contained the visual approach procedure applicable to an IFR flight.[44] For the approach of VH-MVP into Lord Howe Island, these procedures stated that the pilot could discontinue the DME arrival procedure if, by day and within 30 NM of the aerodrome, with the aircraft at or above the relevant DME step altitude, the aircraft is established: [45]

- clear of cloud
- in sight of ground or water
- with flight visibility of not less than 5,000 m, or the aerodrome in sight
- and can subsequently maintain these 3 criteria while at an altitude of not less than 500 ft[46] above the water.

A visual approach procedure should be visually terminated by joining the circuit as per AIP ENR 1.1 paragraphs 9.12, 9.13 or 9.14. By contrast, visual circling and missed approach procedures are terminating phases of an instrument approach.

In the specific case of Lord Howe Island, a visual approach procedure can be flown in lieu of continuing the DME arrival or instrument approach if the above conditions exist. By undertaking a visual approach the DME arrival or instrument approach is discontinued and the flight continued to the aerodrome visually, joining the circuit as per AIP ENR 1.1 paragraphs 9.12, 9.13 or 9.14.

Alternatively, if the DME arrival or instrument approach is continued, the flight should continue tracking as per the published procedure, where dependant on the conditions encountered, either visual circling or a missed approach conducted. A missed approach should also be conducted if the required visibility is lost while conducting a visual approach.

Advice from CASA on the relationship between the visual approach and missed approach requirements under the AIP, stated that there was a lack of clarity between these two procedural requirements. While ENR 1.5 paragraph 1.14.6 outlined the visual approach and is subject to the requirements of paras 1.6, 1.9 and 1.13, paragraph 1.9 does not itself reflect that a missed approach must be executed from a visual approach if the required visibility is lost.

Circling approaches and visual circling

An instrument approach can be aligned with a particular runway, in which case it is described as a straight-in approach, or non-aligned. For the non-aligned case, the instrument approach positions the aircraft within the aerodrome environment, from which the pilot is then required to visually

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41 CASR 91.395.

42 AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.1 GENERAL RULES, subsection 9. OPERATIONS IN CLASS G AIRSPACE, sub-subsection 9.12 Circuit Entry.

43 AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.1 GENERAL RULES, subsection 9. OPERATIONS IN CLASS G AIRSPACE, sub-subsection 9.13 Straight-in Approach, paragraph 9.13.4.

44 AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.5 HOLDING, APPROACH AND DEPARTURE PROCEDURES, subsection 1. HOLDING AND INSTRUMENT APPROACH TO LAND (IAL) PROCEDURES, sub subsection 1.14 Visual approach requirements for IFR flights.

45 AIP ENR 1 GENERAL RULES AND PROCEDURES, section 1.5 HOLDING, APPROACH AND DEPARTURE PROCEDURES, subsection 1. HOLDING AND INSTRUMENT APPROACH TO LAND (IAL) PROCEDURES, sub subsection 1.14 Visual approach requirements for IFR flights

46 Determined by the minimum heights prescribed under CASR 91.265 or 91.267.

manoeuvre the aircraft (visual circling) into position for a landing onto the runway. This extension of the instrument approach procedure is known as the circling approach.

The circling approach procedure was based on the concept of the pilot maintaining visual contact with the runway while the aircraft was circled at the circling minimum descent altitude (MDA) to position it within the aerodrome's traffic pattern. When the aircraft was established in the normal traffic pattern, descent would be commenced at a point that would enable a normal rate of descent to the runway, thereby further ensuring obstacle clearance below the MDA.

Circling approach MDA

Obstacle clearance during visual circling was assured through a survey of airspace above a specific area around the aerodrome—known as the circling area. This circling area was designed to circumscribe normal manoeuvring for landing under specific environmental conditions. The dimensions of the circling area were determined by the aircraft's performance category. VH-MVP was a CAT B aircraft. The circling area for a CAT B aircraft was established by drawing an arc of 4,926 m (2.66 NM) centred on the threshold of each usable runway and joining these arcs by tangents.

Under instrument flight conditions, a CAT B aircraft required a minimum of 300 ft separation from all obstacles within this circling area. An obstacle survey around Lord Howe Island aerodrome identified that an aircraft within this CAT B circling area was required to be at a minimum altitude (MDA) of 1,580 ft, or 1480 ft with an accurate barometric pressure reading, to ensure the required obstacle clearance was maintained. This was also the circling MDA for the DME/GNSS arrival procedure conducted into Lord Howe Island.

Descent from the circling MDA

For a circling approach into Lord Howe Island from the GNSS/DME arrival procedure, descent below the circling MDA required the pilot to meet a number of criteria:

- the aircraft was to be maintained within the circling area; and
- the pilot maintained a visibility, along the intended flight path, of not less than 2,400 m; and
- the pilot maintained visual contact with the landing runway environment (i.e. the runway threshold or approach lighting or other markings identifiable with the runway).

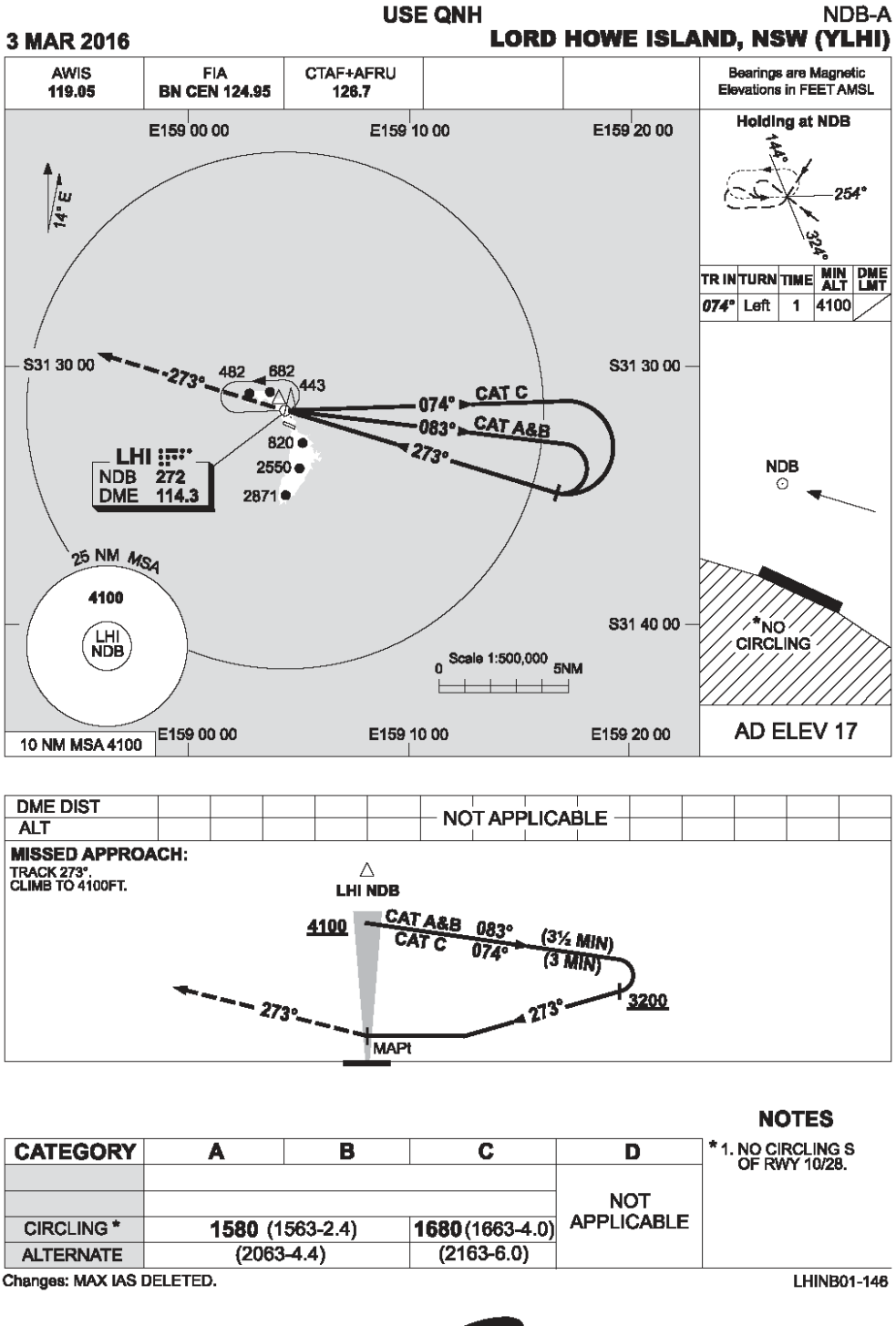
There were also criteria that related to the establishment of a continuous descent to the runway using normal manoeuvring and rates of descent, and obstacle clearance requirements until aligned with the runway.

Descent when not in the traffic pattern

The basic concept of establishing the aircraft within the traffic pattern before commencing the descent had an exception. In daylight and in conditions where obstacles could be seen, the pilot was permitted to descend from the circling MDA from any position within the circling area while maintaining obstacle clearance of not less than that required for the aircraft's performance category. Once the pilot had initiated descent below circling MDA, the obstacle protection offered by visual circling at the MDA ended and the pilot was responsible for visually ensuring the required clearance from obstacles.

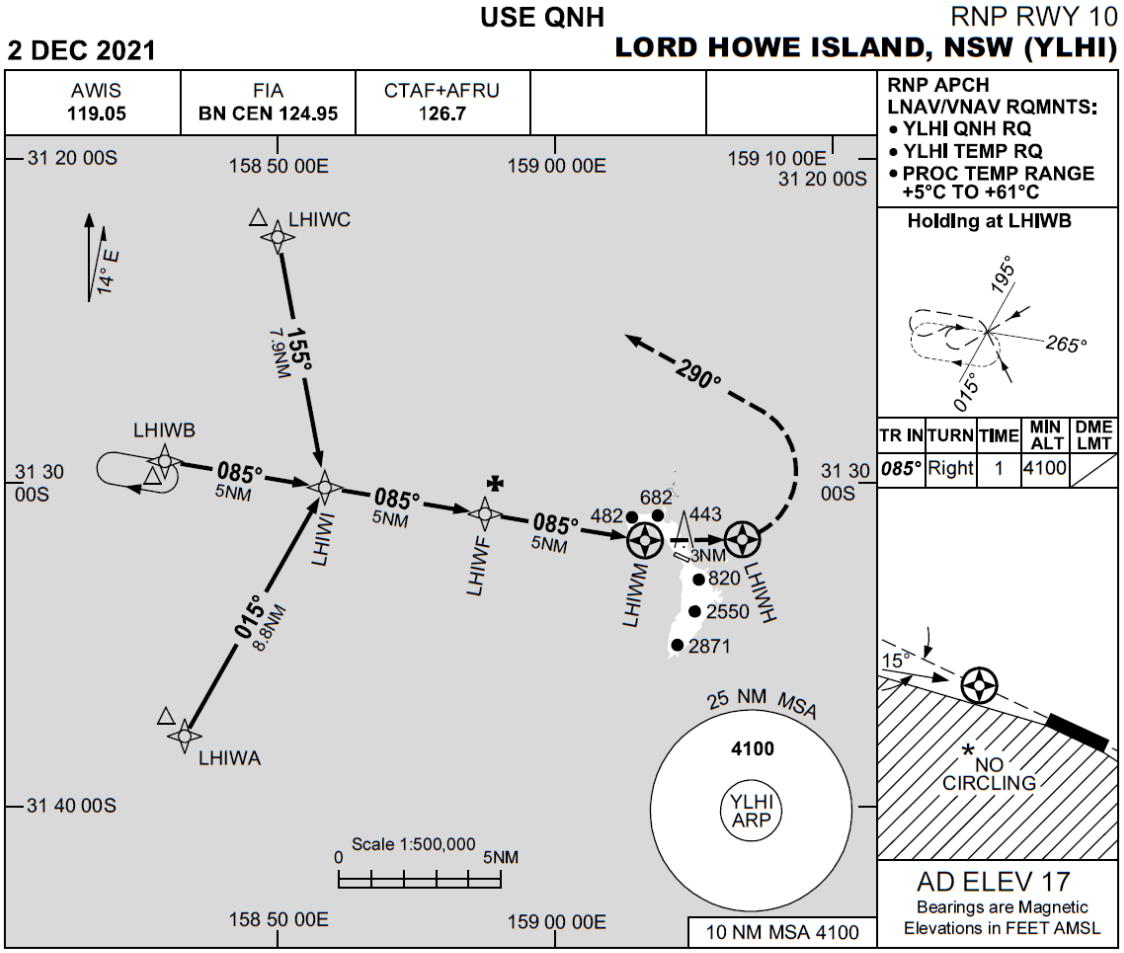
Appendix C – Lord Howe Island instrument approaches

Figure 7: Lord Howe Island NDB approach procedure

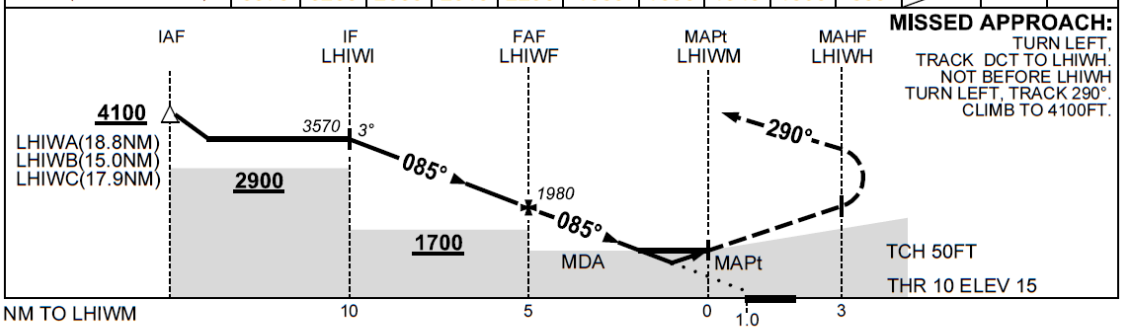


Source: Airservices Australia

Figure 8: Lord Howe Island RNP RWY 10 approach procedure



NM TO NEXT WPT	LHIWI	4	3	2	1	LHIWF	4	3	2.2	1.3	LHIWM		
ALT (3° APCH PATH)	3570	3250	2930	2610	2290	1980	1660	1340	1090	800			



CATEGORY	A	B	C	D
LNAV/VNAV	**800** (785-4.5)			NOT APPLICABLE
LNAV	**1090** (1073-5.0)			
CIRCLING *	**1580** (1563-2.4)		**1680** (1663-4.0)	
ALTERNATE	(2063-4.4)		(2163-6.0)	

NOTES

1. MAX IAS: INITIAL : 210KT.
* 2. NO CIRCLING STH OF RWY 10/28.

Changes: CHART TITLE, PBN SPECIFICATION BOX.

LHIGN01-169

airservices

Source: Airservices Australia

Appendix D – Operations into Lord Howe Island runway 10

Table 1 contains data relevant to various approaches by the operator into Lord Howe Island runway 10 during marginal weather conditions. For each flight, the table identifies the type of approach conducted by a particular flight, the manoeuvring to align that aircraft with final approach to land, and the latest reported meteorological conditions prior to the aircraft landing.

Table 1: Approaches into Lord Howe Island conducted by operator on days with marginal weather conditions (identified in red)

Landed YHLI (UTC)		Approach Type	Circling					METARs (UTC)
Date	Time		Visual circling	< MDA @ 5 NM	< circling MDA @ circle area	Within no circling zone	Right base < 3 NM	
17 Feb	2106	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 172102Z AUTO 02013KT 5000 -SHRA BKN010 OVC018 22/20 Q1012
17 Feb	2108	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 172102Z AUTO 02013KT 5000 -SHRA BKN010 OVC018 22/20 Q1012
17 Feb	2136	RNP 10	No					YLHI 172130Z AUTO 04013KT 3500 +SHRA BKN010 OVC018 OVC033 22/21 Q1012
3 Mar	2112	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 032100Z AUTO 07007KT 3500 BR SCT009 SCT014 BKN019 25/24 Q1010
3 Mar	2142	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 032130Z AUTO 06007KT 3800 BR SCT009 BKN016 25/23 Q1010
4 Mar	0205	RNP 10	No					YLHI 040200Z 09009KT 9999 FEW007 BKN180 26/23 Q1010 RF00.0/000.0 SEA HAZE
4 Mar	2114	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 042100Z AUTO 07019KT 3900 -SHRA SCT008 OVC012 24/23 Q1011
4 Mar	2134	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 042130Z AUTO 06019KT 5000 BR OVC008 24/23 Q1011 RF00.0/003.8
4 Mar	2139	RNP 10	No					YLHI 042130Z AUTO 06019KT 5000 BR OVC008 24/23 Q1011 RF00.0/003.8
5 Mar	0225	RNP 10	No					YLHI 050200Z AUTO 07018KT 1100 +RA BKN004 BKN009 OVC015 23/23 Q1010

Landed YHLI (UTC)		Approach Type	Circling					METARs (UTC)
Date	**Time**		**Visual circling**	**< MDA @ 5 NM**	**< circling MDA @ circle area**	**Within no circling zone**	**Right base < 3 NM**	
13 Mar	2106	DME Arr	Yes	No	No	Yes	No	YLHI 132100Z AUTO 14006KT 9000 -SHRA SCT021 BKN036 BKN050 22/20 Q1014 YLHI 132104Z AUTO 16006KT 9999 -SHRA SCT021 BKN038 BKN050 22/20 Q1014 YLHI 132105Z AUTO 17006KT 110V250 9999 -SHRA SCT021 BKN038 BKN050 22/20 Q1014
13 Mar	2124	DME Arr	Yes	Yes	Yes	Yes	Yes	YLHI 132114Z AUTO 10010KT 090V190 5000 -SHRA SCT016 BKN029 BKN043 22/20 Q1014 YLHI 132121Z AUTO 13007KT 080V200 3400 +SHRA BKN016 BKN032 BKN043 22/20 Q1014 YLHI 132130Z AUTO 14005KT 5000 SHRA SCT010 BKN017 BKN032 22/20 Q1014
14 Mar	0134	RNP 10	No					YLHI 140130Z 09010KT 1800 +SHRA FEW014 BKN026 BKN045 24/22 Q1013 YLHI 140135Z 09012G25KT 0500 +SHRA FEW012 BKN024 BKN045 22/20 Q1013

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- 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, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

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

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining 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. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.