Australian Government
Australian Transport Safety Bureau

# TAWS alert involving ATR-GIE Avions de Transport Regional ATR72-212A, VH-FVR

Moranbah Airport, Queensland | 15 May 2013


Investigation

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**Addendum**

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# Safety summary

## What happened

On 15 May 2013, an ATR-GIE Avions de Transport Regional ATR72-212A (ATR72), registered VH-FVR and operated by Virgin Australia Regional Airlines Pty Ltd (VARA), was conducting an instrument flight rules flight from Brisbane Airport to Moranbah Airport, Queensland. During the visual approach to Moranbah, the aircraft descended to a height of 440 ft above ground level as the pilot manoeuvred to avoid cloud. As the pilot levelled the aircraft, a number of terrain awareness warning system (TAWS) ground proximity warning system alerts activated. The aircraft was climbed and the circuit was continued, with the activation of another TAWS alert prior to the aircraft landing.

**ATR72 – VH-FVR**

Source: ATSB

## What the ATSB found

The ATSB found that the captain's rapid decision to descend limited the opportunity to discuss alternative approach options, descent limits and go around options should visibility reduce to below that required for visual flight.

The ATSB also identified significant underreporting by VARA of ATR72 TAWS-related occurrences to the ATSB.

## What's been done as a result

VARA advised the ATSB of a number of safety actions following this occurrence. This includes the incorporation of the ATR fleet into the company's cyclic recurrent check programme, the provision of safety promotion briefings to all company pilots, and the production of safety publications that alert crew to the defences that standard operating procedures and threat and error management provide.

In addition, VARA directed its flight crew to submit occurrence reports for all ground proximity warning system (TAWS) occurrences and implemented a review process to ensure that all relevant reports are passed to the ATSB. A review of the ATSB database in the period since these initiatives and the production of this investigation report showed that VARA's reporting of TAWS occurrences was now consistent with other similar operator/operation reporting rates.

## Safety message

This occurrence highlights the importance to flight crew of good communication and the inherent risk of spontaneous decision making. In addition, the advantages of following procedural information contained in operational documentation and aeronautical publications, such as the Aeronautical Information Publication Australia, is evident.

# Contents

# The occurrence

On 15 May 2013, an ATR-GIE Avions de Transport Regional ATR72-212A (ATR72) aircraft, registered VH-FVR (FVR), was being operated by Virgin Australia Regional Airlines Pty Ltd (VARA) on a scheduled passenger transport flight from Brisbane Airport to Moranbah Airport, Queensland.

During flight planning, the crew noted that the meteorological forecasts indicated the probability of fog affecting their arrival and cloud in the terminal area that required a suitable alternate airport. As such, sufficient fuel was added to the aircraft to allow a return to Brisbane if required.

The aircraft departed Brisbane at 0532 Eastern Standard Time[1] climbing to a final cruise altitude of flight level (FL)[2] 180 with the captain as pilot flying (PF). At about 0700, which was reported to be about 10 minutes before the planned descent point, the crew prepared for the descent and briefed the approach for Moranbah.

As part of those preparations, the first officer (FO), as the pilot not flying, tuned the Moranbah aerodrome weather information service (AWIS) frequency;[3] however, the actual weather conditions at Moranbah could not be obtained at that time as the aircraft was not within range of the associated AWIS radio transmitter. Instead, the crew decided to use forecast weather information for descent and approach planning and to review this later, when within range of the AWIS. The FO radioed their estimated arrival time to a company representative at Moranbah and requested an appreciation of the weather. The representative advised that there was some fog and cloud in the area although it was clear above the airport. The crew reported that due to the forecast cloud, they tuned the aircraft's navigation equipment to the appropriate frequency and briefed the NDB-A[4] instrument approach (see appendix A).

The crew recalled that, nearing top of descent, they were cleared to descend and advised by air traffic control that the crew of a following, faster and higher Bombardier Inc DHC-8 aircraft (DHC-8) estimated arriving at Moranbah Airport 2 minutes before FVR. The crew of FVR reported that during the descent the DHC-8 crew confirmed by radio that they would arrive first and their intention was to conduct a visual approach, tracking for downwind runway 16. The crew of FVR acknowledged and, in order to facilitate the approach by the DHC-8, changed their approach plan from the NDB-A approach to also conducting a visual approach[5] for runway 16.

Later in the descent, the DHC-8 crew advised the FVR crew that they would slow down to allow FVR to arrive first. The FVR crew reported that at about this time they obtained the AWIS weather for Moranbah Airport, which confirmed that a visual approach was still appropriate for their arrival.

The crew reported that after descending though an overcast cloud layer[6] at about 6,000 ft[7], they became visual with the Moranbah township and the area surrounding the airport. They noted some low cloud and patches of fog around the runway 34 threshold.

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1 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

2 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 180 equates to 18,000 ft.

3 The aerodrome weather information service provides actual weather conditions, via telephone or pilot-activated radio broadcast, from Bureau of Meteorology automatic weather stations. The frequency of the Moranbah AWIS was 122.075 Mhz.

4 A non-directional (radio) beacon (NDB) is a radio transmitter at a known location, used as a navigational aid. The signal transmitted does not include inherent directional information.

5 A landing approach conducted by visual reference to terrain.

6 Cloud cover is normally reported using expressions that denote the extent of the cover. The expression few indicates that up to a quarter of the sky is covered, scattered indicates that cloud is covering between a quarter and a half of the sky. Broken indicates that more than half to almost all the sky is covered, while overcast means all of the sky is covered.

The descent continued as planned and, passing about 2,400 ft, the aircraft's autopilot began capturing the 2,300 ft altitude set by the crew on the aircraft's flight guidance and control panel which was intended to level the aircraft at 1,500 ft above ground level (AGL) (the standard circuit height for the ATR72). In the event, the aircraft commenced levelling at an initially-indicated 1,600 ft AGL.

Concurrently the captain recognised that, if the current flight path was continued and the aircraft levelled at 1,500 ft AGL on downwind, they would enter cloud. Without discussing it with the FO, the captain decided and announced that they were disconnecting the autopilot and continuing the descent in an attempt to remain clear of the cloud. The captain reported that they believed the aircraft would only need to descend 200-400 ft to be clear of the cloud layer. The captain stated that during the approach and manoeuvring, they were in sight of the runway and ground; although visibility along the flight path was reduced because of the cloud.

The crew recalled that 'if due stress of weather', the procedures in VARA's Flight Operations Policy and Procedures Manual (FOPPM) allowed a descent from the standard circuit altitude of 1,500 ft AGL. The captain further stated that 'technically', according to the regulations, the aircraft could be flown to an altitude of 500 ft AGL, which although below the standard circuit altitude, was considered a 'safe' altitude.

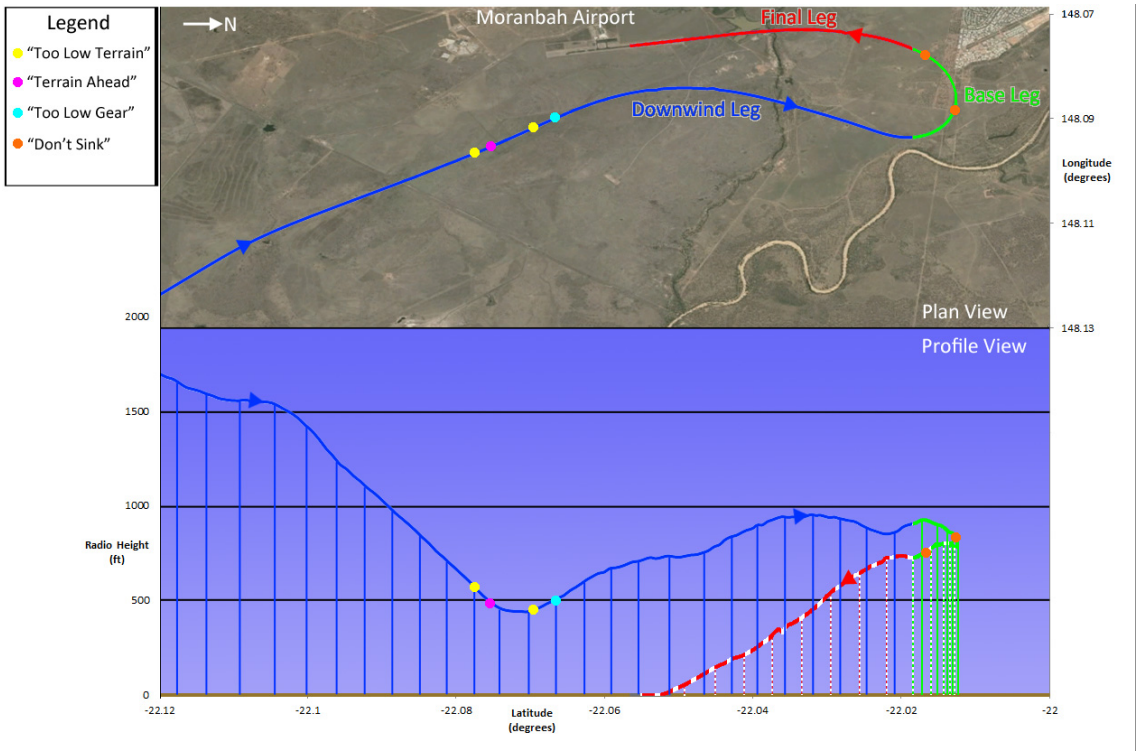
The FO reported that a number of tasks were required to be conducted approaching the downwind leg of the circuit and that a descent at that time was unexpected. The FO indicated that, because of these tasks and that the captain was the pilot flying, the FO gave less attention to the outside conditions. However, the FO recalled observing the cloud was at or below 1,500 ft and sloped in appearance with underlying fog, but the base of the cloud or its extent along the planned flight path could not be seen.

Consistent with the recorded vertical speed, the FO indicated that, soon after descending from the intended circuit height, they observed the aircraft's vertical speed at about 700 ft/min in descent. About 30 seconds later, while passing 562 ft AGL, the aircraft's terrain awareness warning system (TAWS) ground proximity warning system activated (Figure 1), sounding an aural 'Too Low Terrain' alert together with a visual 'caution' annunciation on the glareshield. This alerted the crew of the aircraft's proximity to terrain and was followed shortly after by a 'Terrain Ahead' alert, another 'Too Low Terrain' alert and then a 'Too Low Gear' alert. All occurred within 12 seconds of the aircraft being levelled at about 440 ft AGL.

The recorded average vertical speed during the descent from circuit height to 440 ft AGL, the lowest recorded height before the crew initiated a climb, was 1,750 ft/min.

[7] Unless specified, all altitudes are heights above mean sea level (AMSL). The runway 16 threshold was 729 ft AMSL.

**Figure 1: Flight path and descent with TAWS alerts indicated (see legend)**




**Source: Google Earth, modified by the ATSB**

The lower level of the cloud base was reported by the crew as being about 500 ft AGL. The crew indicated that as they were 'visual', clear of the cloud, had the ground/runway in sight, were aware that no obstacles existed along the downwind leg of the circuit and that they knew why the TAWS alert activated, they could acknowledge the alerts and continue the approach.

The FO reported that during the descent, they had an understanding of what the captain was trying to achieve and at no stage did they have any concern about the safety of the aircraft or the captain's decision to descend. As such, the FO believed that communicating any in-flight observations to the captain was unnecessary and would only have added to their existing workload.

The crew elected to continue the downwind leg of the circuit and commenced a climb to 1,500 ft (or about 870 ft AGL) while configuring the aircraft for landing by selecting flap 15 and the landing gear down. The crew reported that they felt it unnecessary to climb the aircraft back to the standard circuit height of 1,500 ft AGL (2,270 ft) as they would only have had to descend the aircraft again as they approached the base leg position.

After passing the abeam position of the downwind leg, the crew turned left onto the base leg of the circuit where flaps 30 was selected and a bank angle of 38° recorded. During the base leg an aural 'Don't Sink' TAWS alert activated indicating that the aircraft was descending. The crew reported that the aircraft was not descending at that time, the alert was therefore considered erroneous, and so cancelled.

The aircraft subsequently intercepted the final leg of the circuit where the captain reported being stabilised by 500 ft AGL for a normal landing.

The following DHC-8 aircraft then landed on runway 16. Recorded radio transmissions from the crew of the DHC-8 indicated the conduct by that crew of a wide left circuit.

# Context

## Personnel information

### *Captain*

The captain held an Air Transport Pilot (Aeroplane) Licence with an ATR72 rating and held a valid Class 1 Aviation Medical Certificate. Four days prior to the incident the captain successfully completed the company command upgrade training program and had since conducted 3.5 hours on the ATR72 in command. The captain had a total of about 4,530 hours aeronautical experience, including about 1,750 hours on the ATR72.

Crew training records showed that the captain, who had experience flying into Moranbah in the role of first officer and during their command upgrade training, was approved to operate into Moranbah Airport. The captain's performance during command training was recorded as being above average.

The ATSB considered the possibility that fatigue may have been a factor in this occurrence. Based on the captain's roster and reported sleep, the captain's fatigue levels were assessed as low at the time of the occurrence. In addition, the captain did not report any fatigue-related concerns associated with the occurrence flight.

### *First Officer*

The first officer (FO) held an Air Transport Pilot (Aeroplane) Licence with an ATR72 rating and held a valid Class 1 Aviation Medical Certificate. The FO had a total of about 2,880 hours aeronautical experience, including about 610 hours on ATR72 aircraft.

According to the operator's requirements, the FO had sufficient experience to be paired with a captain who had recently been checked to line.

After reviewing the first officer's roster and reported sleep, the ATSB assessed that fatigue was not a factor for the first officer at the time of the occurrence. The first officer did not report any fatigue-related concerns associated with the occurrence flight.

## Aircraft information

### *Terrain awareness and warning system*

The aircraft was fitted with an integrated terrain and traffic collision avoidance system that incorporated a number of functions. These included a terrain awareness warning function (TAWS), a ground proximity warning function and a traffic alert and collision avoidance function (TCAS)[8]. TAWS is designed to assist in preventing accidents involving controlled flight into terrain.

The following TAWS alerts were activated after the crew descended from the intended circuit height of 1,500 ft AGL (Figure 2):

#### *'Terrain Ahead' - TAWS terrain alert*

The 'Terrain Ahead' alert is a predictive, look ahead, alerting function. The system looks forward along the predicted flight path and alerts the crew of any approaching terrain conflict within the performance limits of the aircraft.

[8] Traffic collision avoidance system (TCAS) is an aircraft collision avoidance system. It monitors the airspace around an aircraft for other aircraft equipped with a corresponding active transponder and gives warning of possible collision risks.

### *Mode 4 'Too Low Terrain/Too Low Gear/ Too Low Flaps'*

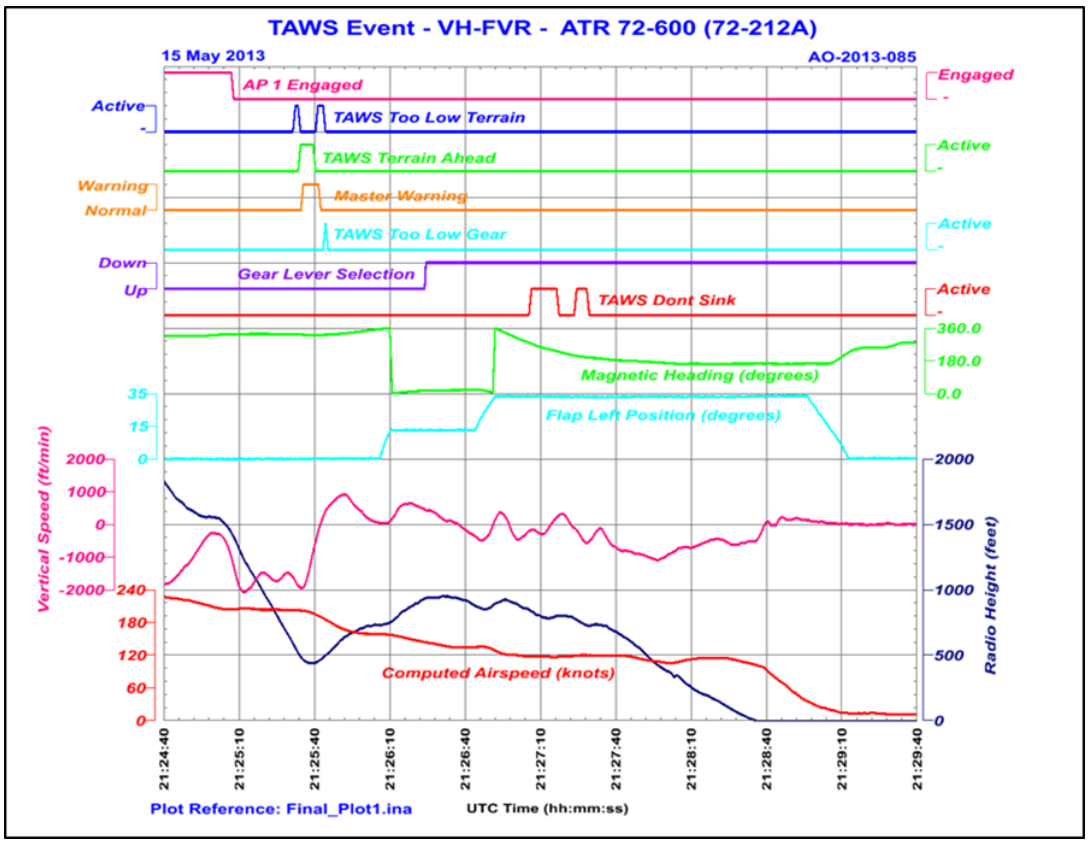
The 'Too Low Terrain/Too Low Gear/ Too Low Flaps' alert is a TAWS look-down function and is intended to alert the crew of approaching terrain directly below the aircraft and of potentially inappropriate landing configurations given other parameters at the time. The parameters for triggering this alert include the aircraft's radio altitude, computed airspeed and configuration (the position of the flaps and landing gear). Below 190 kt computed airspeed the envelope threshold is static at 500 ft AGL and will produce a 'Too Low Gear' or 'Too Low Flaps' aural alert if the landing gear or flaps are not correctly configured below that height.

### *Mode 3 'Don't Sink'*

A 'Don't Sink' alert is triggered by altitude loss after take-off or during a missed approach. According to the manufacturer of the TAWS, this mode was armed when FVR descended below 500 ft radio altitude for more than 2 seconds when not in the landing configuration and there was a subsequent positive vertical speed for more than 2 seconds.

In this case, the TAWS Mode 3 functionality was armed when the crew initiated the climb from 440 ft AGL when in a clean configuration. The 'Don't Sink' alert activated when the crew commenced their descent for landing without first reaching 1,500 ft AGL (as measured by the radio altimeter).

**Figure 2: Recorded aircraft flight parameters with TAWS alerts indicated**




Source: ATSB

## *Flight information displays*

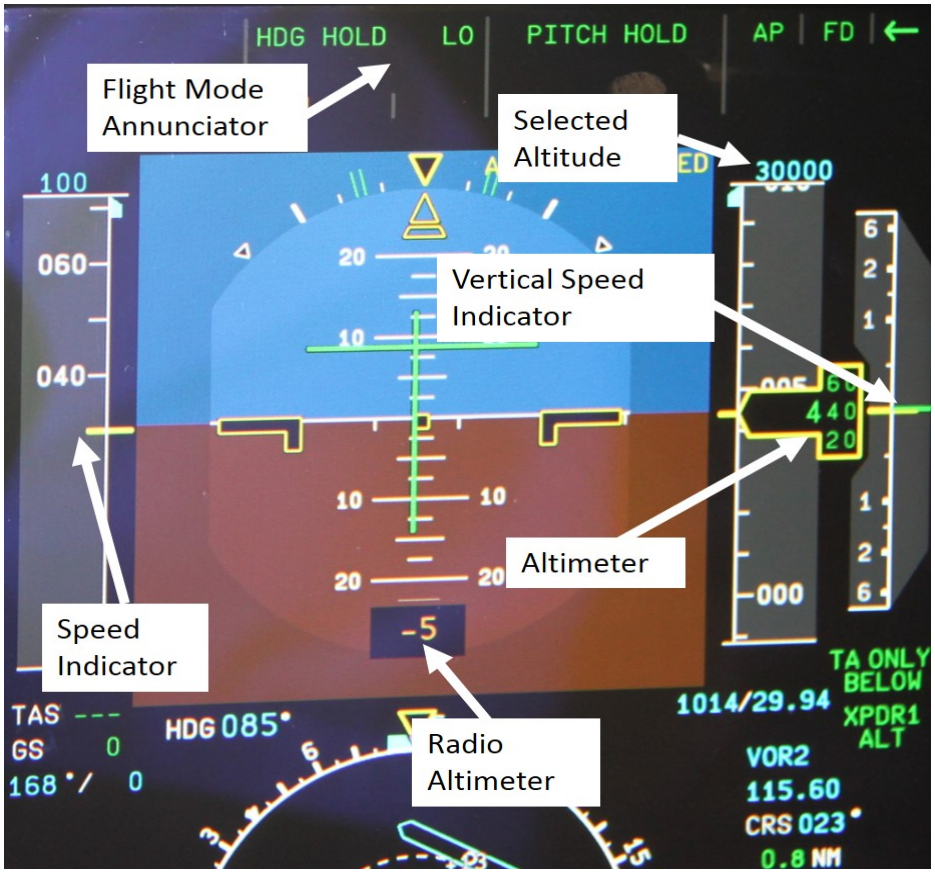
A number of cues were available to the crew to assist with monitoring the aircraft's performance and flight profile (Figure 3). The FO reported that during flight, attention was normally given to information presented on the primary flight display (Figure 4). This included monitoring the radio altitude when at lower altitudes, the speed indicator (or 'tape') to ensure the aircraft did not exceed

any limitations and the vertical speed indicator to ensure the aircraft's vertical speed was appropriate for the phase of flight.

**Figure 3: VH-FVR flight information displays**

Source: ATSB

**Figure 4: ATR primary flight display**




Source: ATSB

## Meteorological information

The crew recalled reviewing the applicable area and aerodrome forecasts prior to departing Brisbane Airport. This review indicated a mid-level cloud layer, light rain, areas of isolated fog and broken cloud with associated drizzle in the area of operation.

Specifically, the aerodrome forecast (TAF)[9] for Moranbah indicated that from 0600, cloud was predicted to be few at 1,000 ft and broken at 4,500 ft with 10 km visibility. In addition there was 30 per cent probability that from 0600 fog would reduce the visibility to 800 m.

A SPECI[10] was issued by the Bureau of Meteorology at 0700 that indicated light winds from the south with visibility reduced to 1,000 m. Overcast cloud at 6,400 ft and a temperature and dewpoint[11] of 17 °C were also reported. This was broadly consistent with the report of the weather that was provided to the crew by the company representative at the airport (see the earlier section titled *The occurrence*).

## Aids to navigation

The Moranbah non-directional beacon (NDB)[12] provided for appropriately-qualified crews to conduct the published NDB-A instrument approach procedure for runway 16 (see appendix A). Other instrument approach procedures, such as the Moranbah global navigation satellite system radio navigation-N (GNSS RNAV-N) approach and the GNSS arrival procedure were also available for use by appropriately qualified crew. The crew of FVR were not approved to conduct RNAV approaches.

## Operational information

### *Aeronautical Information Publication Australia requirements for a visual approach*

Once the aircraft was descended out of controlled airspace and into Class G airspace for the approach into Moranbah Airport, there was no requirement for the crew to obtain a clearance for their approach. In this instance, the crew elected to carry out a visual approach.

Aeronautical Information Publication Australia (AIP)[13] ENR 1.5-12 section 1.15 *Visual Approaches* described the requirements for the conduct of a visual approach by an aircraft when operating under the instrument flight rules. These included that by day, the crew of FVR could commence a visual approach to Moranbah once within 30 NM (56 km) of the airport at an altitude not below the lowest safe altitude/minimum sector altitude for the route segment, the appropriate step of the distance measuring equipment or global positioning system arrival procedure, or the minimum descent altitude for the procedure being flown and provided the aircraft was operated:

(1) Clear of cloud

(2) In sight of ground or water

(3) With a flight visibility not less than 5,000M or, in the case of a helicopter, is able to proceed under helicopter VMC, or the aerodrome is in sight; and

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

10 Special Reports (SPECI) are aerodrome weather reports that are issued whenever weather conditions fluctuate about or are below specified criteria.

11 Dewpoint is the temperature at which water vapour in the air starts to condense as the air cools. It is used among other things to monitor the risk of aircraft carburettor icing or likelihood of fog at an aerodrome.

12 A non-directional (radio) beacon (NDB) is a radio transmitter at a known location, used as a navigational aid. The signal transmitted does not include inherent directional information.

13 A package of documents that provides the operational information necessary for the safe and efficient conduct of national (civil) and international air navigation throughout Australia and its Territories.

(4) Subsequently can maintain (1), (2) and (3) at an altitude not less than the minimum prescribed for VFR flight (CAR 157), to within the circling area or, in the case of a helicopter, can subsequently maintain helicopter VMC to the HLS.

In the context of these requirements, as the captain had the airport in sight during the approach, they were not required to maintain 5,000 m flight visibility.

## *VARA approach procedures*

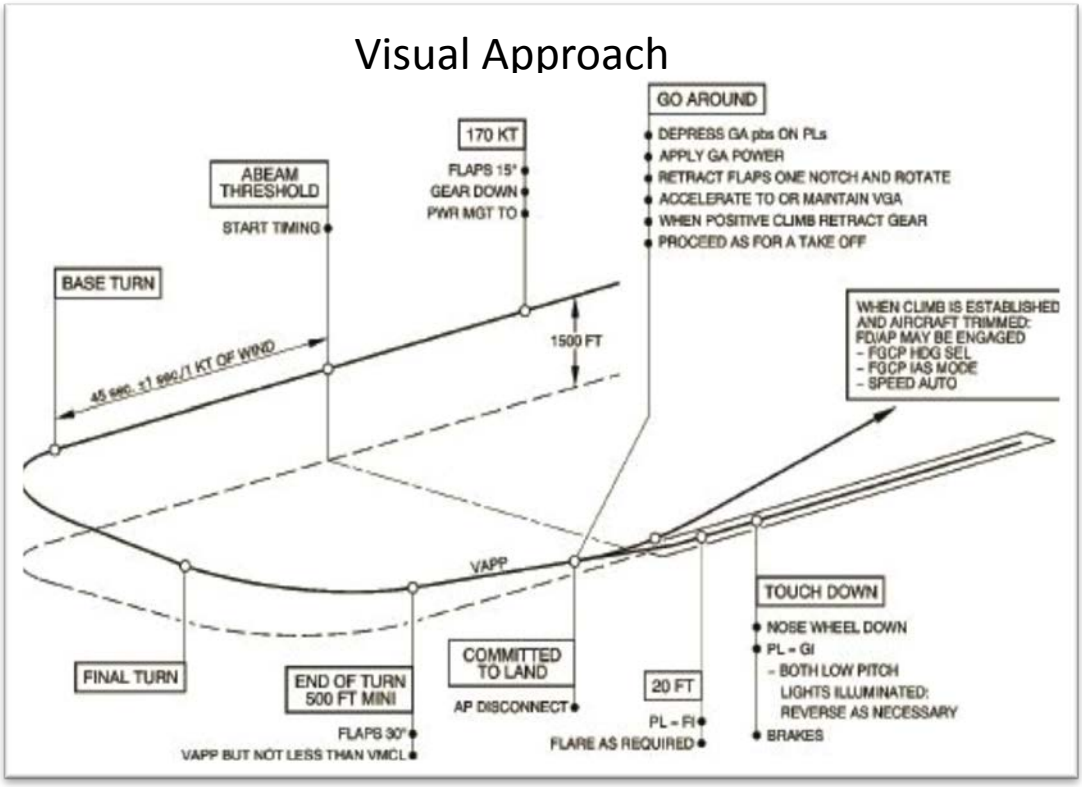
The VARA document suite included the aircraft operating manual and flight crew operating manual (FCOM), which were the principal documents, as well as a flight crew training manual (FCTM) and flight operations policy and procedures manual (FOPPM). The procedures in these documents that were relevant to the conduct by the crew of a visual approach and circuit at Moranbah that day are discussed in the following sections.

### *FCOM*

The FCOM includes the aircraft manufacturer's information and procedures specific to the operation of the ATR72 and the contents are unable to be modified by the operator. A visual approach procedure diagram was included that highlighted the required altitudes, speeds, descent positions, aircraft configuration and crew actions at various points in the approach (Figure 5).

A low visibility circling approach procedure was also detailed for the ATR72, although the FOPPM stated that no circling was permitted in the ATR72. In this respect, the Civil Aviation Safety Authority advised that it is an industry-wide standard and accepted practice for procedural authorisations, such as in this case the VARA restriction on the conduct of circling approaches in its ATR72s, to be contained in a separate section or document from any description of how to conduct those procedures, such as in the manufacturer's FCOM.

**Figure 5: Visual approach procedure in the ATR72 FCOM**




**Source: VARA**

In the case of TAWS alerts in visual meteorological conditions[14], the FCOM stated that:

> When flying under daylight VMC conditions, should a warning threshold be deliberately exceeded or encountered due to a known specific terrain at certain locations, the warning may be regarded as cautionary and the approach may be continued.
>
> A go-around shall be initiated in case warning cause cannot be identified immediately.

***FCTM***

The FCTM contained standard operating procedures (SOPs) and callouts that crew were required to follow during a visual flight pattern with the autopilot selected OFF. The FCTM expanded on a number of the key flight events outlined in the visual approach procedure contained in the FCOM (Figure 5).

***FOPPM***

FOPPM procedure 7.13.10 *Flight Management Considerations before Approach* highlighted a number of flight management items to be considered by crews before an approach to ensure that any decision made by the pilot in command to continue the approach was the safest course of action. All flight crew members shared responsibility for flight path awareness and were required to inform the pilot in command of any deviation from a safe flight path. In this respect, flight crews were required to:

> …ensure that there is sufficient time available to resolve all discrepancies, prepare the aircraft and complete all checklists in an unhurried manner, ideally prior to 500 ft AGL. If not possible, flight crew should initiate a go-around.

In addition to the visual fight patterns SOPs in the FCTM, the FOPPM outlined standard pilot responses for various flight conditions during a visual approach in the ATR72. Of note, if an aircraft was below 500 ft in visual conditions and the airspeed was more than 5 kt from the target speed, the pilot not flying was required to call ‘speed’. If below 1,000 ft AGL and the vertical speed was in excess of 1,000 ft/min, the pilot not flying was required to call ‘sink’. The pilot flying was required to acknowledge the callout by calling ‘checked’ and take appropriate action in response.

The approach procedures stated the importance of a stabilised approach, which was characterised by a constant angle, constant rate of descent approach profile that ended near the touchdown point and was followed by the landing manoeuvre. Specifically, for ATR72 operations, a speed reduction was to be commenced by 3,500 ft AGL with a glide path no greater than 3° to ensure the stabilised criteria were met. An approach in VMC was required to be stabilised by 500 ft AGL. The stabilised approach criteria for the ATR72 included that:

> The aircraft must be on the correct lateral and vertical flight path
>
> Only small changes in heading and pitch are required to maintain the correct flight path
>
> The aircraft speed is not more than Vref +20kt and not less than Vapp
>
> The aircraft is in the landing configuration
>
> The sink rate is no greater than 1000 ft/min
>
> Power is appropriate for the aircraft configuration
>
> All briefings and checklists have been completed other than the clearance to land checklist item.

If the aircraft was not stabilised by 500 ft AGL in VMC, or the safety of the aircraft was compromised, a go-around was required.

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[14] Visual Meteorological Conditions is an aviation flight category in which visual flight rules (VFR) flight is permitted—that is, conditions in which pilots have sufficient visibility to fly the aircraft maintaining visual separation from terrain and other aircraft.

#### *Minimum descent altitude*

Section 2.38 *Low Flying* of the FOPPM stipulated that an aircraft must not descend to a height lower than 1,000 ft over any city, town or populous area, or at a height lower than 500 ft over any other area unless through stress of weather or any other unavoidable cause it was essential that a lower height be maintained, or the aircraft was in the process of taking-off or landing. As FVR was not in the process of actually landing on runway 16 during the initial descent below 500 ft AGL, and other valid approach options were available, FOPPM section 2.38 did not apply. Instead, standard operating procedures for the conduct of visual flight patterns contained in the FCTM indicated that the circuit height was 1,500 ft AGL.

### *VARA decision-making guidance*

Decision making can range from a considered process over a period of time to the need for a quick resolution to a problem in a short timeframe. Crews regularly face these scenarios during their flights.

In an effort to support its crews' decision-making processes, the VARA FOPPM included decision-making guidance with a view to increasing crews' awareness of potential threats, assisting crews recognise the potential effect of these threats on the safety of the flight and on steps to ensure an effective outcome. This decision-making process was encapsulated in the mnemonic:

S State the problem

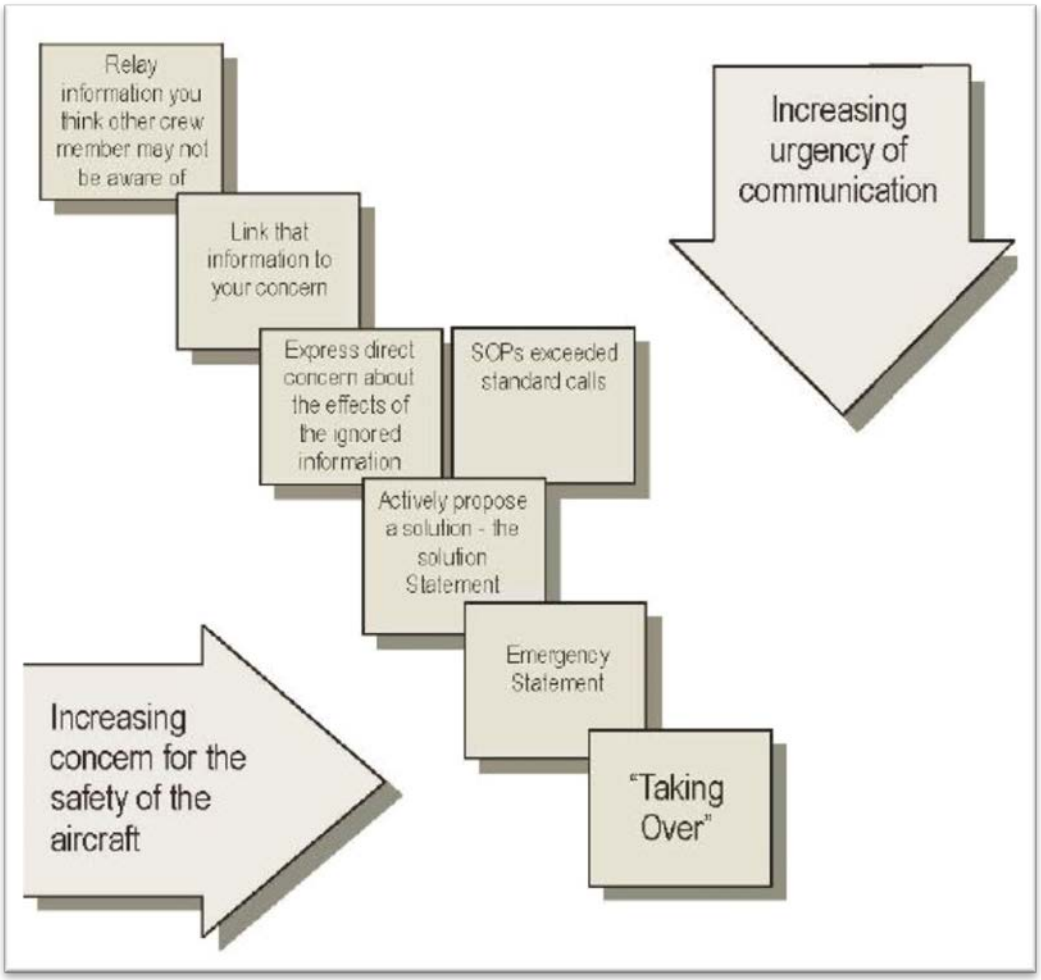
A Analyse the options

F Fix the problem

E Evaluate the result

The FOPPM also contained information on the importance of effective Crew Resource Management and of the support crew member proactively responding to any non-standard in-flight deviations that increase the risk to the safety of the flight. The urgency of communicating those concerns or observed deviations and taking appropriate action to ensure they were addressed in a considered way was highlighted (Figure 6). This included the use of standard calls.

**Figure 6: Support Process – a guide to the relative urgency of communication**




**Source: VARA**

## Tests and research

### *Related occurrences*

An analysis of all reported TAWS 'Too Low Terrain' alerts by all operators from 2008 to mid-2014 identified 40 notifications of occurrences during the approach phase of flight. These variously involved Boeing 737, Airbus A320, DHC-8, Embraer 190 and Fokker 28 aircraft. The occurrence involving FVR at Moranbah was the only recorded example of this type of alert on approach involving an ATR72.

All of the recorded 'Too Low Terrain' alerts were reported to have activated while flying in visual conditions. Of the 40, 36 approaches were continued by the crew after the 'Too Low Terrain' alert, while four were followed by a go-around. In most of the 36 continued approaches, the crew indicated that they did not understand why the alert activated at the time but, as they could see the terrain, felt safe to continue the approach.

### *TAWS/GPWS alerts reporting rates involving ATR72 operations*

The compulsory occurrence reporting requirements for all civil aviation occurrences with Australian Territory and for all occurrences involving civil-registered Australian aircraft outside that territory are legislated in the *Transport Safety Investigation Act 2003* and associated regulations (see also AIP ENR 1.14 *AIR TRAFFIC INCIDENTS*). These included that any ground proximity warning system (GPWS/TAWS) alert was to be reported to the ATSB for all air transport

operations. VARA documentation outlined its own reporting requirements and processes in the event of a TAWS/GPWS alert.

During its investigation, the ATSB examined whether there was a potential issue with the TAWS system fitted to the ATR72. This included a search of the ATSB occurrence database to determine the number of TAWS/GPWS alerts reported for each aircraft model flown by similar Australian operators in the 12 months prior to the occurrence. Given the hours flown by model and operator in that period, the rate of reported TAWS/GPWS alerts was calculated for each operator/aircraft model combination.

The examination found that VARA's rate of TAWS/GPWS notifications was disproportionately lower than those of the other operator/aircraft model combinations examined. As a result, all TAWS/GPWS records in VARA's own occurrence database were requested. A number of previously unreported TAWS/GPWS alerts were identified that were integrated with the other occurrence reports in the ATSB's occurrence database.

Consolidation of the VARA- and ATSB-held notifications of TAWS/GPWS alerts showed that the combined rate of reported occurrences involving the TAWS installation in the ATR72 was consistent with reporting rates from similar turboprop operators in Australia. Action was taken by VARA to ensure that in future all TAWS/GPWS notifications were reported to the ATSB (see the section titled *Safety issues and actions*).

# Safety analysis

While conducting a visual approach procedure for landing to runway 16 at Moranbah Airport, the crew of VH-FVR elected to deviate from the briefed and planned visual approach and descend below the required circuit altitude in an attempt to avoid cloud and continue with the visual circuit. The lower level of the cloud base was not fully ascertained by the crew and the aircraft continued to descend lower than originally anticipated. The aircraft reached a lower than normal altitude at a higher than normal descent rate, triggering a number of terrain awareness warning system (TAWS) ground proximity warning system alerts. This analysis will examine the operational factors and decisions that led to those alerts.

## Approach into Moranbah Airport

### *Planned approach*

Prior to the descent, and based on the weather information available to the flight crew at that time, they decided that an instrument approach via the Moranbah non-directional beacon (NDB) would be required. The associated navigation aids were tuned and identified and a briefing conducted in preparation for that approach. The approach plan was later changed to a visual approach as a result of the decision by the crew of a DHC-8 aircraft, who estimated arriving at Moranbah Airport 2 minutes before FVR, to conduct a visual approach for runway 16. Despite an agreed subsequent change in sequence, with FVR now landing first, the decision to conduct a visual approach was still considered by the flight crew as appropriate given the weather conditions observed on arrival at Moranbah.

### *Decision to change the approach*

However, while manoeuvring for the visual circuit, the crew of FVR encountered cloud at the intended circuit height of 1,500 ft AGL and the captain, who was the pilot flying, decided to descend below, rather than deviate around or climb above this cloud. This decision was simultaneously made and announced without discussion or input from the first officer (FO). Despite this lack of prior involvement, the FO reported being comfortable with the decision as they realised the captain's intent. At this stage, both crew believed that the base of the cloud would be about 300–400 ft below their intended circuit height.

The spontaneity of the descent below 1,500 ft AGL cancelled any opportunity for the crew to consider other approach options. These included the originally-planned NDB approach, for which the aircraft was still appropriately configured. Similarly, while the continuation of the visual approach was valid given the captain had the airport in sight, the lack of associated descent planning meant that an altitude limit was not established for the descent. This negated any opportunity for the crew to recognise that the rate of descent required to avoid the cloud was greater than either anticipated, recognition of which may have prompted them to discontinue the descent and consider a different approach.

Instead, as the descent progressed, the captain remained focused on avoiding the cloud, and the FO was conducting various tasks and looking out as required to assess the cloud. During this time, the aircraft's descent rate increased to a maximum of around 1,900 ft/min; however, due to the crew's focus on avoiding the cloud and other tasks associated with the approach, this was not noticed in the available time. The continuation of the descent resulted in an undesired aircraft state, in that the aircraft was lower than desired without being correctly configured and with a high rate of descent.

Both crew reported that they did not intend to descend to around 500 ft AGL and neither believed that would be required to avoid the cloud. In the event, and consistent with the base of the cloud, the captain commenced levelling the aircraft at around 500 ft AGL. However, given the high rate of descent, this action was not sufficient to prevent the activation of the TAWS 'Terrain Ahead' alert.

## Guidance to crews

### *Decision making and communication guidance*

VARA's guidance to crew on decision making and communication, while of obvious benefit in the identification and management of threats, was dependent on the time available. In this instance, the captain made a quick decision to commence the descent and simultaneously communicated the intent to the FO. This negated any chance to consider alternatives or discuss or challenge the decision and limited the effectiveness of the communication and decision-making process. In addition, while the communication guidance provides a mechanism for dealing with a developing situation, the intervention is based on the respective crewmembers' levels of concern with the safety of the aircraft. The FO reported that at no stage did they have a concern about the safety of the aircraft, nor did they believe the captain was incapacitated.

The guidance in the flight operations policy and procedures manual identified deviation from the standard operating procedures (SOP) as a trigger for increased safety risk that should prompt crews to take action to resolve the issue. However, on this occasion the decision to descend occurred quickly without reference to the SOPs and was not part of a considered decision-making process. In addition, the crew reported that the SOP requirement to maintain 1,500 ft in the circuit was guidance rather than a mandatory height, as information contained in the Aeronautical Information Publication Australia allowed them to descend lower. This misunderstanding that the 1,500 ft AGL circuit height was not a hard circuit altitude limit may have negated one of the intended triggers by the operator for crews to initiate a go-around. Additionally, had the flight operations policy and procedures manual contained information about the operator's document hierarchy, and included reference to external documents such as the AIP, the crew may have been be less likely to operate to the less restrictive visual approach requirements outlined in that publication.

### *Action in response to a TAWS alert*

VARA guidance in the case of a TAWS alert specified that a go-around shall be initiated when the cause of such alerts could not be identified immediately. Analysis of similar occurrences across a number of aircraft types and operators shows that it is common for crew to continue an approach when they can see the terrain, even when they are unsure of why a 'Too Low Terrain' alert activated.

In this occurrence, the crew were able to proceed with the approach in accordance with the operational guidance as they were in visual conditions and knew why the warning had activated. However, it is important for crews to go around if there is any uncertainty as to the reason for a TAWS ground proximity warning system alert.

# Findings

From the evidence available, the following findings are made with respect to the TAWS activation involving an ATR-GIE Avions de Transport Regional ATR72-212A, registered VH-FVR, near Moranbah Airport, Queensland on 15 May 2013. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

**Safety issues, or system problems, are highlighted in bold to emphasise their importance.** A safety issue is an event or condition that increases safety risk and (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.

## Contributing factors

- Approaching the circuit, the captain assessed that a descent below the standard circuit height was necessary to avoid cloud, but did not communicate this to the first officer in a timely manner, thereby preventing identification of a descent limit or appropriate approach alternatives.
- Due to the crew's focus on avoiding the cloud, the high rate of descent at a lower than normal altitude was not identified and corrected by the crew in the short time available, resulting in the terrain awareness warning system 'Terrain Ahead' and 'Too Low Terrain' alerts.
- Despite briefing the intent to conduct a visual approach, descent in visual conditions was not assured and the crew did not discontinue the approach. This resulted in an undesired aircraft state and subsequent terrain awareness warning system alerts.

## Other factors that increased risk

- **There was a significant underreporting by Virgin Australia Regional Airlines Pty Ltd of ATR72 terrain awareness warning system-related occurrences. [Safety issue]**

# Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

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

## Virgin Australia Regional Airlines Pty Ltd TAWS underreporting

| | |
|---|---|
| Number: | AO-2013-085-SI-03 |
| Issue owner: | Virgin Australia Regional Airlines Pty Ltd |
| Operation affected: | Aviation - Air transport – Large aeroplanes |
| Who it affects: | Virgin Australia Regional Airlines flight crew |

### *Safety issue description:*

There was a significant underreporting by Virgin Australia Regional Airlines Pty Ltd ATR72 terrain awareness warning system-related occurrences**.**

#### *Response to safety issue by Virgin Australia Regional Airlines Pty Ltd*

In response to this occurrence, the flight operations section directed crew, through Memo FOG 1932.13, to submit occurrence reports for all terrain awareness warning system (TAWS) and ground proximity warning system (GPWS) occurrences. In addition, the processes for reporting GPWS (TAWS) events have been added to the flight operations policy and procedures manual and supporting internal processes have been developed to ensure all reports are reviewed by the safety department and passed to the ATSB as applicable. Safety department data since these actions shows that the reporting rate of these occurrences from Virgin Australia Regional Airlines Pty Ltd (VARA) to the ATSB has increased to the industry standard.

#### *ATSB comment/action in response*

The ATSB notes VARA's additional guidance to crew regarding the reporting of all GPWS (TAWS) occurrences and changes to its internal reporting procedures. The increased reporting rate from the airline indicates that these changes have addressed this issue.

#### *Current status of the safety issue*

Issue status: Adequately addressed.

Justification: The ATSB is satisfied that the safety action by VARA has increased its TAWS reporting rates to the industry standard for similar aircraft models flown by similar Australian operators.

## Additional safety action

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.

### *VARA*

VARA advised the ATSB that following this occurrence:

- their ATR fleet has been incorporated into the company cyclic recurrent check programme
- safety promotion briefings have been provided to all company pilots
- safety publications have been produced that alert crew to the inherent defences in the application of standard operating procedures and threat and error management.

# General details

## Occurrence details

| | | |
|---|---|---|
| Date and time: | 15 May 2013 – 0730 EST | |
| Occurrence category: | Incident | |
| Primary occurrence type: | Operational – Ground proximity alert/warnings | |
| Location: | 5 km south-east of Moranbah Airport, Queensland | |
| | Latitude: 22° 03.47' S | Longitude : 148° 04.65' E |

## Aircraft details

| | |
|---|---|
| Manufacturer and model: | ATR-GIE Avions de Transport Regional ATR72-212A |
| Year of manufacture: | 2012 |
| Registration: | VH-FVR |
| Operator: | Virgin Australia Regional Airlines Pty Ltd |
| Serial number: | 1058 |
| Type of operation: | Air Transport – high capacity |

# Sources and submissions

## Sources of information

The sources of information during the investigation included:

- the flight crew of VH-FVR
- the aircraft's Digital Flight Data Recorder
- Virgin Australia Regional Airlines Pty Ltd (VARA)
- GIE Avions de Transport Regional
- Aviation Communications & Surveillance Systems
- the Bureau of Meteorology
- the Bureau of Infrastructure, Transport and Regional Economics.

## Submissions

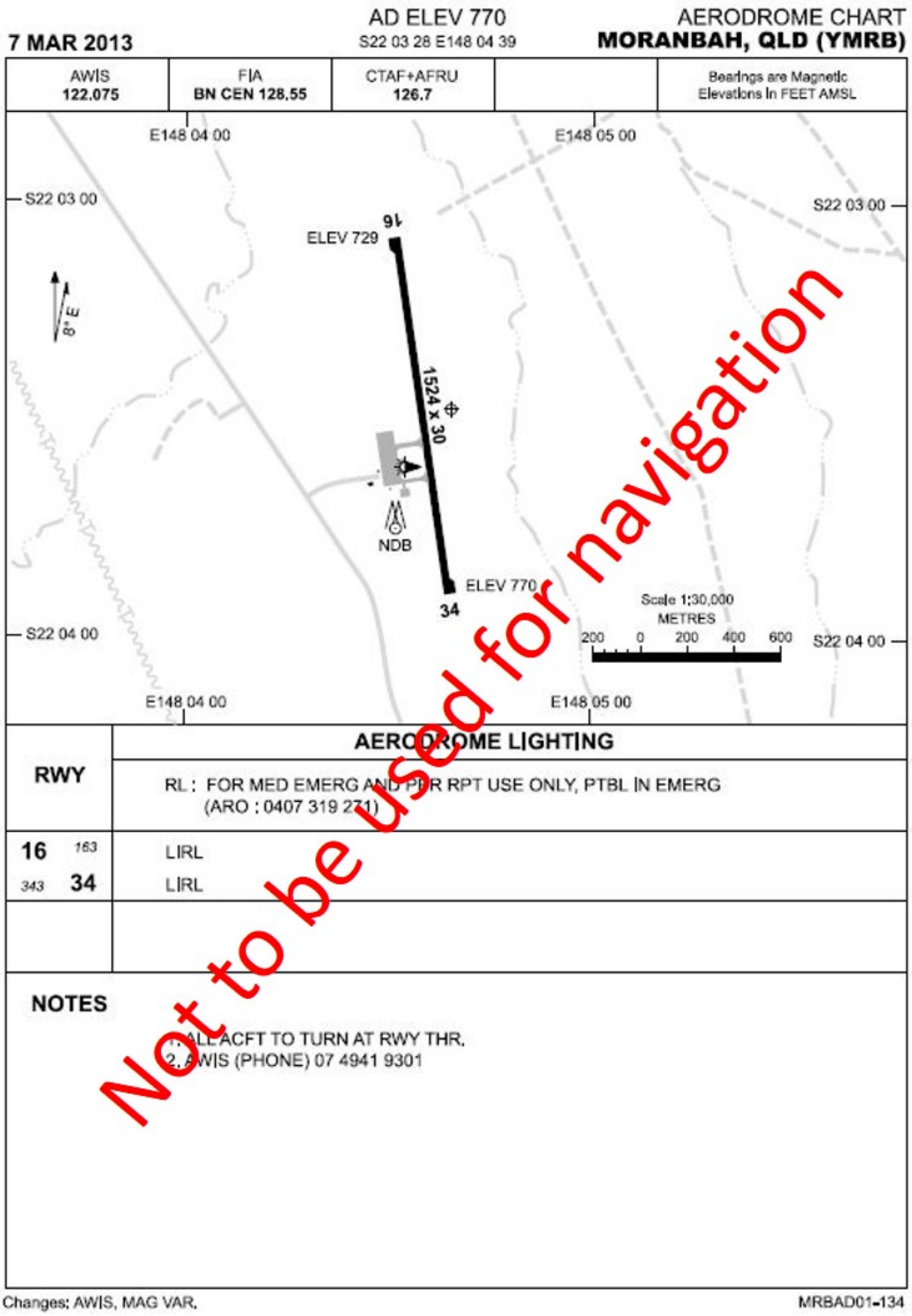
Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report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

A draft of this report was provided to the flight crew of VH-FVR, VARA, the Civil Aviation Safety Authority and the Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA).

Submissions were received from VARA and the Civil Aviation Safety Authority. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

# Appendices

## Appendix A – Moranbah aerodrome diagram and approach charts

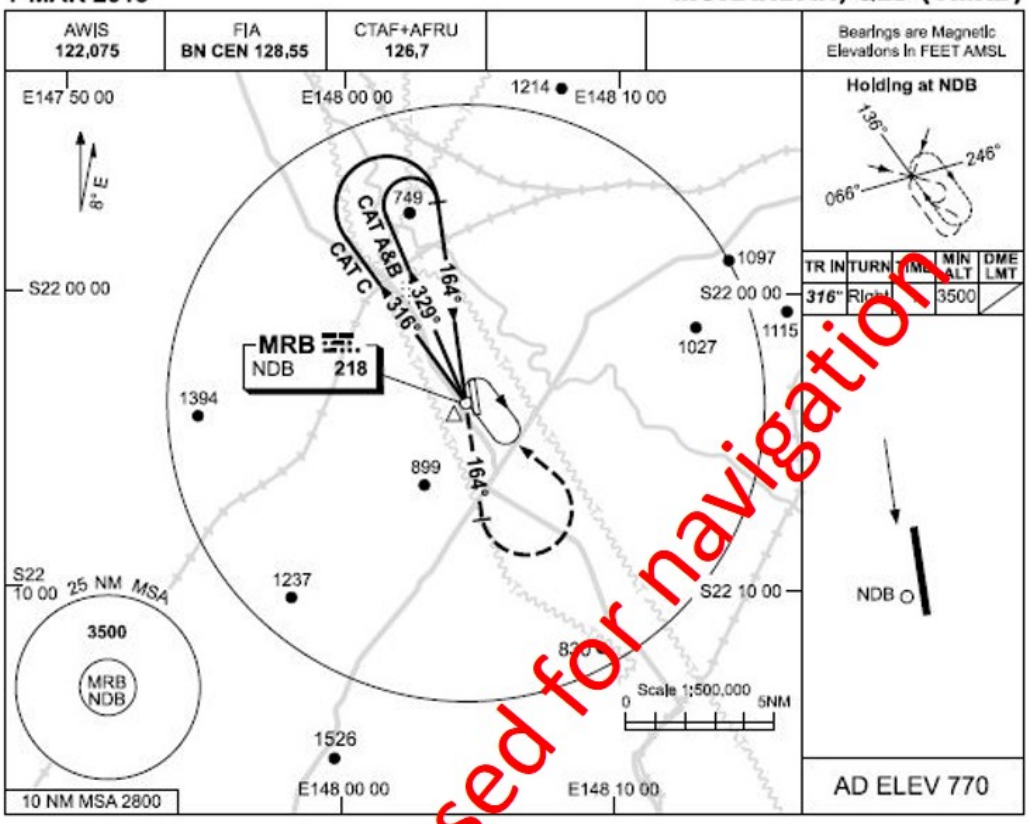


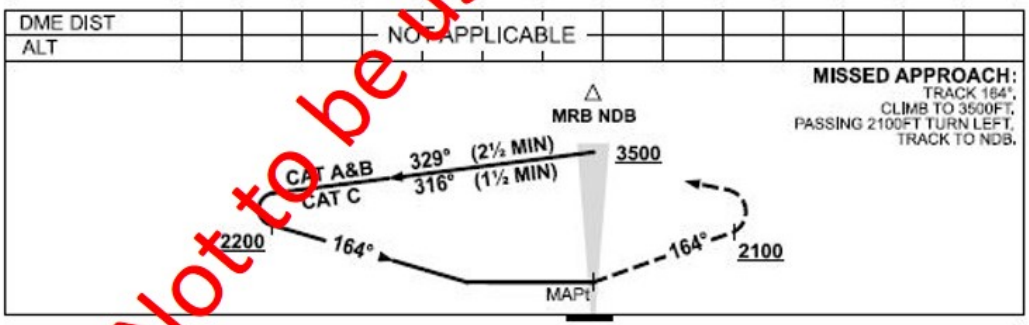
USE QNH

NDB-A

7 MAR 2013

**MORANBAH, QLD (YMRB)**






**NOTES**

1. MAX IAS:
   INITIAL:
   CAT A&B 140KT.
   CAT C 180KT.
2. AWIS (PHONE)
   07 4941 9301

| CATEGORY | A | B | C | D |
|---|---|---|---|---|
| | | | | NOT APPLICABLE |
| | | | | |
| CIRCLING | **1570** (800-2,4) | | **1600** (830-4,0) | |
| ALTERNATE | (1300-4,4) | | (1330-6,0) | |

Changes: AWIS.

MRBNB01-134



airservices

# Australian Transport Safety Bureau

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

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

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

## Purpose of safety investigations

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

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

## Developing safety action

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

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

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

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

**Australian Transport Safety Bureau**

**Enquiries** 1800 020 616
**Notifications** 1800 011 034
**REPCON** 1800 011 034
**Web** www.atsb. gov.au
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Investigation

**ATSB Transport Safety Report**
Aviation Occurrence Investigation

TAWS alert involving ATR-GIE Avions de Transport Regional ATR72-212A, VH-FVR, Moranbah Airport, Queensland, 15 May 2013

AO-2013-085
Final – 12 March 2015