



Australian Government

Australian Transport Safety Bureau

Landing on the left side of the runway strip involving British Aerospace AVRO 146, VH-NJW

Darlot Airport, Western Australia, 20 January 2017

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Addendum

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Landing on the left side of the runway strip involving British Aerospace AVRO 146, VH-NJW

What happened

On 20 January 2017, a British Aerospace AVRO 146-RJ85, registered VH-NJW, conducted a charter flight from Perth to Darlot, Western Australia (WA). There were four crew and 58 passengers on board the aircraft. The captain was the pilot flying (PF), seated in the left seat, and the first officer was the pilot monitoring (PM), seated in the right seat.¹

The aircraft departed from Perth Airport at about 0630 Western Standard Time (WST), and tracked towards Darlot. Prior to the top of descent, the flight crew obtained the local weather from Leinster Airport, situated about 28 NM (52 km) from Darlot. The Leinster aerodrome weather information service (AWIS)² indicated a strong easterly wind, so the PF positioned the aircraft to join a 5 NM (9.3 km) straight-in approach to runway 14.

Darlot Airport had an unsealed runway with no electronic approach path guidance with a published RNAV-Z (GNSS) runway 14 approach. The procedure for the crew to monitor their descent profile was to crosscheck the distance and altitude information from the published approach chart, which provides a 3° descent on final approach. Three white cones, located on the left and right side of the runway strip and 300 m in from the runway threshold, provided the pilot with their visual aiming point markers for the landing. Therefore, on short final, the PF would change their flight path guidance cue from distance and altitude to the aiming point markers for the aircraft landing.

When the aircraft joined the final approach leg, the PF noticed dust in the vicinity of the runway and commented to the PM that there could be a vehicle on the runway. At about 2.5 NM (4.6 km) from the runway, the PF concluded the dust was not from a vehicle and that it was a line of dust from the strong easterly wind, which extended the length of the runway strip,³ on the southern side of the runway. At about the same time, the PF visually identified the runway⁴ markers.⁵ On short final, the PF transitioned from the distance-altitude information to the aiming point markers located on the left side of the runway strip.

The aircraft landed without incident. However, as the aircraft slowed to taxi speed, the PF observed cones and runway lights on the right side of the aircraft, but only cones on the left side of the aircraft. The PF then noticed that the raised dust on the right side of the runway strip covered both the runway markers and runway strip (Figure 1). They had landed the aircraft on the graded area of the runway strip to the left of the runway. The PF manoeuvred the aircraft back onto the runway, taxied to the apron and shutdown without further incident. The aircraft was not damaged.

¹ Pilot Flying (PF) and Pilot Monitoring (PM): procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

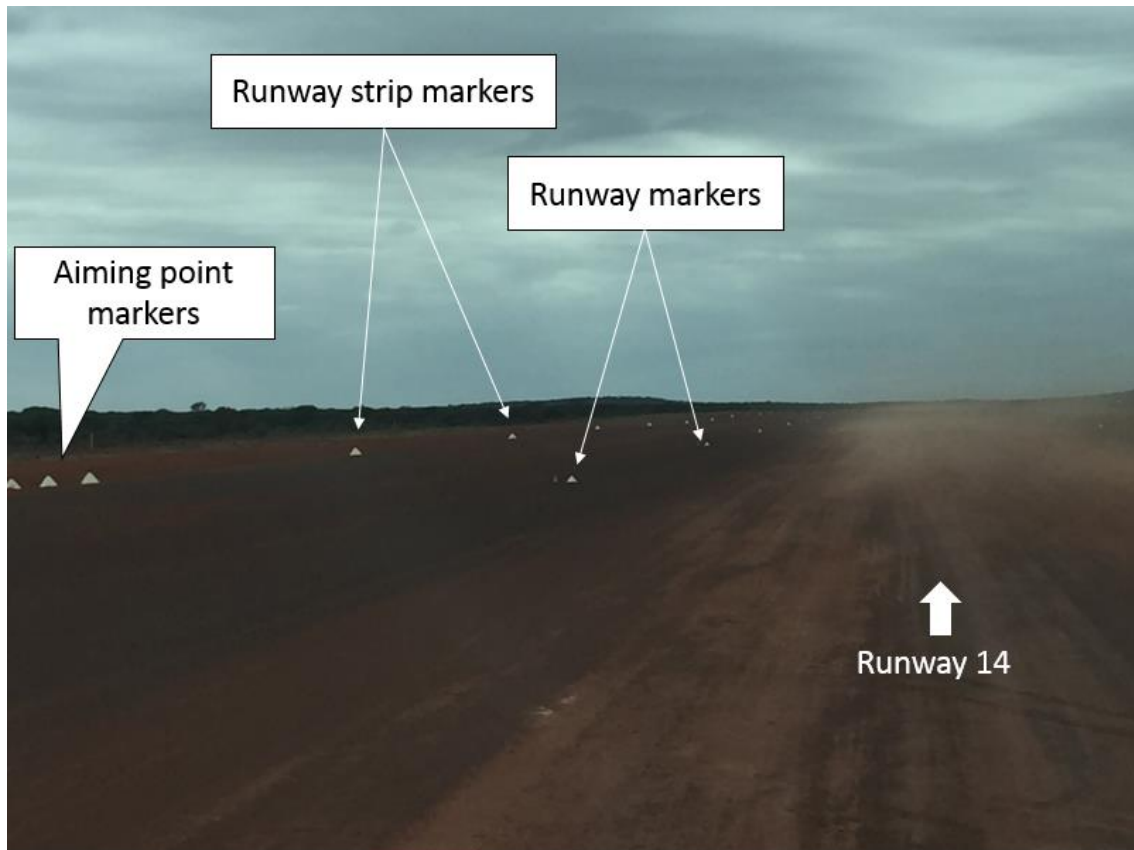
² Aerodrome weather information service (AWIS): actual weather conditions, provided via telephone or radio broadcast, from Bureau of Meteorology (BoM) automatic weather stations, or weather stations approved for that purpose by the BoM.

³ A runway strip, for a runway without an instrument approach, includes a graded area around the runway and stopway, intended to: (1) to reduce the risk of damage to aircraft running off a runway; and (2) to protect aircraft flying over it during take-off or landing operations.

⁴ The runway is a defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

⁵ An aerodrome marker is an object displayed above ground level in order to indicate an obstacle or delineate a boundary.

Figure 1: Darlot Airport runway 14



Source: Pilot, annotated by ATSB. Image depicts Darlot Airport runway 14 and left side of runway strip as viewed from the right seat of the aircraft with white frangible cones used as markers. Raised dust extends from the centre of the runway across the southern side of the runway strip.

Aerodrome markers

The Manual of Standards (MOS) Part 139 – [Aerodromes](#), provided the standard for aerodrome markers. In accordance with MOS 139 paragraph 8.2.1.1, ‘markers must be lightweight and frangible; either cones or gables.’

Runway markers

Darlot Airport used identical white frangible cones as markers for both the runway and the runway strip. The runway was 30 m wide and 1,969 m long. The runway strip was 90 m wide. Therefore the lateral spacing of the cones for the runway and the runway strip either side of the runway were equidistant.

Aiming point markers

In accordance with MOS 139 paragraph 8.3.7, on sealed runways, aiming point markers are conspicuous stripes painted on the runway surface. If a visual approach slope indicator system (VASIS) is used, then the VASIS is located within the runway strip and the beginning of the aiming point marking must coincide with the origin of the visual approach slope.

Where aiming point markers are not required, such as on unsealed runways, the airport operator can elect to ‘implement an aiming point marking by providing an appropriate marking.’ Darlot Airport used three frangible white cones, either side of the runway on the edge of the runway strip, as aiming point markers (Figure 1).

Objects on runway strips

MOS 139 paragraph 6.2.24 stated ‘A runway strip must be free of fixed objects, other than visual aids for the guidance of aircraft or vehicles. All fixed objects permitted on the runway strip must be of low mass and frangibly mounted.’

Location of aiming point markers

The aircraft operator provided services to three other airports with unsealed runways. Following this incident, the operator reviewed the other airports and found that at two airports the aiming point markers were located inside the runway strip (one used gable markers and the other cones), either side of the runway (Figure 2), and at the third airport the aiming point markers had been removed. Therefore, the aiming point markings were inconsistent between all four airports.

Figure 2: Gable aiming point markers within the runway strip (different airport used by the operator)



Source: Aircraft operator

In 2015, the Darlot Airport operator consulted with the Civil Aviation Safety Authority about the position of the aiming point markers. It was determined that they were not standard markings. Therefore, the airport operator could request a dispensation from MOS 139 to place them in the runway strip next to the runway, or alternatively, place the markers outside the runway strip without a dispensation. The airport operator passed this information on to the aircraft operator and it was agreed to place them outside the runway strip, in lieu of requesting a dispensation.

Visual illusions

According to the Flight Safety Foundation, visual illusions occur ‘when conditions modify the pilot’s perception of the environment relative to his or her expectations, possibly resulting in spatial disorientation or landing errors.’ The key factors and conditions which result in visual illusions are the airport environment, runway environment and weather conditions.

Further information on visual illusions is available from the Flight Safety Foundation approach-and-landing accident reduction tool kit [Briefing Note 5.3 - visual illusions](#).

Safety analysis

The PF advised that the final approach to land at Darlot, was a period of high workload because the aircraft was flown manually with cross-checks of distance and altitude used to manage the descent profile. On the incident flight, the PF’s attention was initially captured by raised dust, which indicated to the PF that there could be a vehicle on the runway. About halfway down the final approach, the PF discounted the presence of a vehicle, but then incorrectly identified the left

runway strip markers as the left runway markers because the right runway and runway strip markers were obscured by the raised dust. This was confirmed in their mind by the presence of the aiming point markers on the left side of the runway strip. The PF was seated in the left seat and therefore used the aiming point markers on the left side as their visual guidance cue for the aircraft landing.

The siting of aiming point markers at airports with unsealed runways used by the aircraft operator was not standardised with respect to the type of markers used or the position of the markers relative to the runway. The pilot had experience, from operating into other unsealed runways, of aiming point markers positioned in the runway strip next to the runway. Therefore, the position of the aiming point markers on the left side of the runway strip markers was not recognised by the PF as an indicator that the aircraft was landing to the left of the runway.

ATSB comment

On approach to land, the PF must scan between the near end and far end of the runway for their visual judgement of flare height and alignment of the aircraft with the runway centreline. A greater amount of visual processing is dedicated to the central region of the retina (fovea) than to the peripheral regions of the retina. Consequently, central portions of a visual image are seen to a higher resolution than peripheral portions.

For a pilot focused on the runway centreline, the aiming point markers will move from central vision to peripheral vision at three times the distance for markers laterally displaced 45 m in lieu of 15 m from the runway centreline.

The ATSB notes that the aiming point markers are a visual guidance cue for the PF. Increasing the lateral displacement of the markers from the runway may divert the PF's scan further from the runway centreline at a critical stage of flight.

Findings

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

- The PF landed the aircraft in the runway strip to the left of the runway due to raised dust obscuring the markers on the right side of the runway and runway strip.
- Aiming point markers were employed in a non-standard manner at the unsealed runways used by the operator, which may have contributed to the PF landing the aircraft left of the runway.

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.

Operator

As a result of this occurrence, the aircraft operator has advised the ATSB that they have taken the following safety actions:

Internal investigation and review

The operator has conducted their own internal investigation of the incident, which included a review of the unsealed runways they operate the AVRO 146 into.

Discussion paper

The operator submitted a discussion paper to the Civil Aviation Safety Authority on the provision of aiming point markers for unsealed runways. The paper proposes the standardisation of aiming

point markers in accordance with the system previously tested by the United States Federal Aviation Administration.

The results of the testing can be found in 'Marking and Lighting of Unpaved Runways – Inservice Testing': [DOT/FAA/CT-84/11](#).

Safety message

Following the incident the pilot reported that, in hindsight, the raised dust they observed on the runway strip should have led to a go-around manoeuvre, but their visual cues led them to believe they were aligned to land on the runway. The Flight Safety Foundation briefing note 5.3 provides strategies for pilots and operators to mitigate the risk of a visual illusion incident during approach and landing.

General details

Occurrence details

Date and time:	20 January 2017 – 0735 WST	
Occurrence category:	Incident	
Primary occurrence type:	Depart/Approach/Land wrong runway	
Location:	Darlot Airport, Western Australia	
	Latitude: 27° 52.42' S	Longitude: 121° 16.30' E

Aircraft details

Manufacturer and model:	British Aerospace PLC AVRO 146-RJ85	
Registration:	VH-NJW	
Serial number:	E2329	
Type of operation:	Charter – passenger	
Persons on board:	Crew – 4	Passengers – 58
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

About the ATSB

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; and fostering safety awareness, knowledge and action.

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

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

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

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.