Australian Government

Australian Transport Safety Bureau

Breakdown of separation – Boeing 737-438 VH-TJS and Fairchild SA227 VH-MYI

28 km E of Melbourne Airport, Victoria

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Final

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Breakdown of separation – Boeing 737-438 VH-TJS and Fairchild SA227 VH-MYI

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FACTUAL INFORMATION

On 21 June 2012, at 1718:53 Eastern Standard Time[1], a breakdown of separation (BOS) occurred between a Qantas Airways Boeing Company 737-438 (B737), registered VH-TJS (TJS) and a Sharp Aviation Fairchild SA227, registered VH-MYI (MYI) near Melbourne Airport, Victoria.

TJS had earlier departed Sydney, New South Wales for Melbourne Airport, with the first officer as the flying pilot, while MYI was operating from Orange, New South Wales to Essendon Airport. Essendon Airport was located about 5 NM (9 km) south-east of Melbourne Airport. Both aircraft were conducting scheduled passenger services.

The captain of TJS reported that they were initially issued arrival instructions for runway 34 however the arrival runway was later changed to runway 27. TJS was subsequently issued with a series of radar vectors and speed control instructions by Air Traffic Control for sequencing with other aircraft, including MYI.

At 1717:44, the approach controller (controller) instructed TJS to turn right to a heading of 230˚. At 1717:55, the controller instructed TJS to '...descend to three thousand you're cleared ILS[2] runway 27 approach'. At that time, MYI was inbound to Essendon Airport and located about 6 NM to the south-south-east of TJS (Figure 1).

Figure 1: Relative positions of TJS and MYI at 1717:55

Source: Airservices Australia

Both TJS and MYI were subsequently issued further speed reductions and at 1718:45, TJS was approaching the runway 27 localizer (Figure 2). The separation between the two aircraft at this time was 3.1 NM horizontal and 1,200 ft vertical. However, instead of intercepting the runway 27 localizer, TJS continued through the localizer and, at 1718:53, the controller asked TJS if they were turning right to intercept final. The separation between the two aircraft at that time had reduced to 2.9 NM horizontal and 1,100 ft vertical. In an attempt to maintain the required

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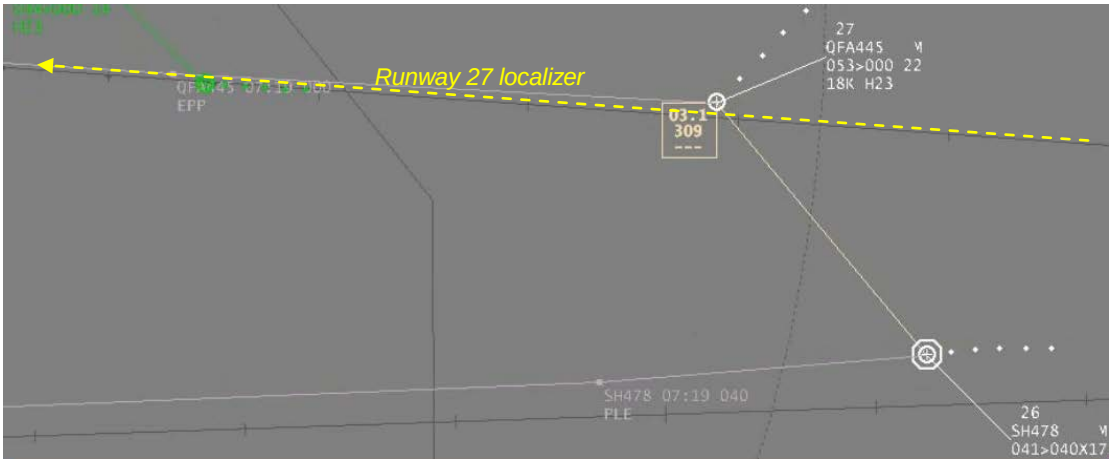
1 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

2 A standard ground aid to landing, comprising two directional radio transmitters: the localizer, which provides direction in the horizontal plane; and the glideslope, for vertical plane direction, usually at an inclination of 3°. Distance measuring equipment or marker beacons along the approach provide distance information.

separation of 3NM horizontal or 1,000 ft vertical, the controller then reiterated that he needed TJS to turn right and issued MYI with a traffic alert and an instruction to turn left heading 180˚.

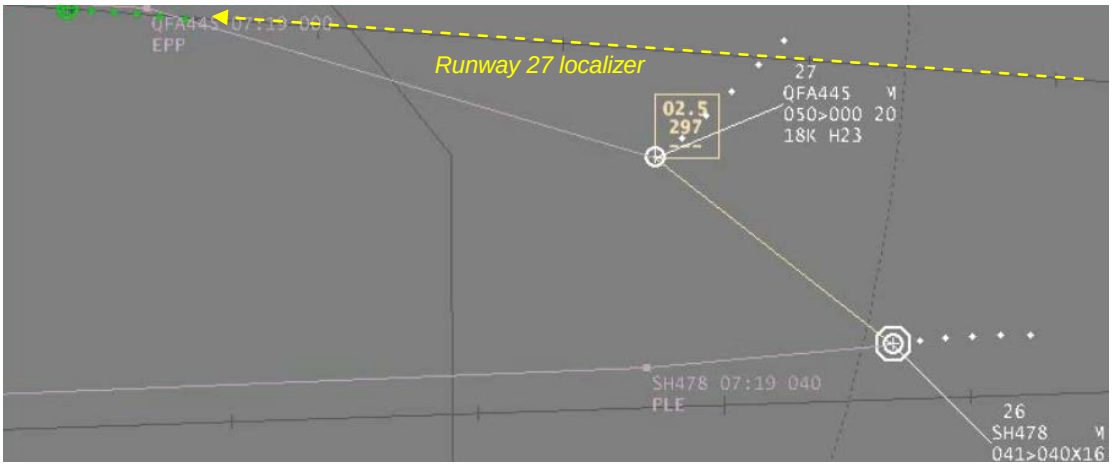
Figure 2: Relative positions of TJS and MYI at 1718:45



Source: Airservices Australia

At 1719:10, the controller issued TJS with a traffic alert for MYI and instructed TJS to turn right to a heading of 300˚ to intercept final from the left. TJS was now located about 1 NM to the south of the runway 27 localizer. Separation with MYI had reduced to 2.5 NM horizontal and 900 ft vertical (Figure 3).

Figure 3: Relative positions of TJS and MYI at 1719:10



Source: Airservices Australia

TJS subsequently intercepted the localizer from the left and landed at Melbourne Airport. MYI received additional radar vectors before returning to land at Essendon Airport.

Approach clearance

Following radar vectors, standard approach clearance phraseology includes advice regarding the aircraft's relative position, a suitable heading and intercept instruction, and a clearance to conduct the approach. As an example, the preceding aircraft was issued with the instruction, '...you're two and a half miles north of the localizer, turn right heading two three zero to intercept, cleared ILS runway 27 approach...'.

The controller reported that, while consideration was given to using a shallower intercept heading for TJS, the heading of 230˚ had worked well for the preceding aircraft and that it suited the sequence. Although the instructions issued at 1717:43 and 1717:55 did not include the aircraft's

relative position or an instruction to intercept, they did include a clearance to conduct the ILS approach.

Approach controller information

The controller's operational experience included about 4 years as an approach controller, and 5 years as a tower controller. The controller reported that on the day of the occurrence, the winds were from the north and quite strong. The controller noted that high winds from the north impacted workload due to their effects on aircraft speeds. Aircraft arriving from the north would have tailwinds while aircraft arriving from southerly directions would have headwinds. As a result, a lot of aircraft required radar vectors and speed control for sequencing.

TJS Flight crew information

Both flight crew members of TJS had attained considerable experience operating the B737. The captain had been with the aircraft operator for about 20 years and had spent the majority of that time on the B737, while the first officer had been on the aircraft type for about 10 years.

The flight crew noted that the flight was delayed out of Sydney and reported that there were numerous calls en-route to the operator relating to passengers and connecting flights. They reported that they had discussed the approach clearances, noting that they were 'unusual' in that they did not include their aircraft's relative position or an instruction to intercept the localizer. However, despite their 'unusual' nature, the flight crew had understood the intent of the clearances and had intended to intercept the runway 27 localizer.

About 1-2 NM north of the localizer, the captain recalled noting that VOR/LOC[3] was not armed and thought that the first officer had subsequently armed it. However, the first officer could not recall if the VOR/LOC was armed or observing any movement of the course deviation indicator (CDI) prior to crossing the localizer.

The first officer remembered being 'loaded up' while complying with the latest speed reduction, and considered that this and the conversation about the non-standard ILS clearance may have contributed to them going through the localizer. When questioned by the controller as to why they went through the localizer, the captain replied that '...it didn't capture and (that) it was late notice (the approach clearance)...'

The first officer reported that the 737-400 could be slow to intercept the localizer, particularly with a tail wind. This was usually overcome by manually reducing the intercept angle as they approached the localizer.

Recorded information

Information from the aircraft's quick access recorder (QAR) was downloaded and analysed by the Australian Transport Safety Bureau. That information, in conjunctions with information from Airservices Australia, was used to develop the following sequence of events (Table 1).

[3] In this case, if VOR/LOC mode was armed, the aircraft should have intercepted and tracked via the runway 27 localizer. Alternatively in approach (APP) mode, the aircraft would intercept both the localizer and glide slope.

Table 1: Sequence of events

Time (EST)	Event	AFDS[4] mode/s	Heading (approx)	Separation	CDI[5] dots
1717:44	TJS was instructed to turn right heading 230	HDG SELECT[6]	190˚		
1717:55	TJS was cleared for the runway 27 ILS approach	HDG SELECT	230˚	5.8 NM 400 ft	
1718:24	TJS was instructed to reduce to final approach speed	HDG SELECT	230˚	3.8 NM 1,400 ft	3.7 R
1718:45	TJS is approaching the runway 27 localizer and should be turning right	HDG SELECT	230˚	3.1 NM 1,200 ft	0.7 R
1718:50	TJS intersected the runway 27 localizer	HDG SELECT	230˚	3.0 NM 1,100 ft	0
1718:53	The controller asks TJS if they are turning right for final	HDG SELECT	230˚	2.9 NM 1,100 ft	0.7 L
1718:59	CWS[7] is selected and the aircraft begins to turn right	CWS	230˚	2.7 NM 1,000 ft	1.5 L
1719:10	TJS was instructed to continue the right turn heading 300 to intercept final from the left	CWS and HDG SELECT	270˚	2.5 NM 900 ft	3.0 L
1720:00	Approach (APP) mode engages	APP and CWS	285˚		1.7 L
1720:07	VOR/LOC mode engages	APP, CWS and VOR/LOC	295˚		1.2 L
1720:52	The aircraft intercepts the glideslope (G/S)	G/S and VOR/LOC	275˚		0

ATSB comment

The breakdown of separation occurred at a time when both the approach controller and the flight crew were experiencing an elevated workload. The approach controller's use of non-standard phraseology had the potential to induce a degree of uncertainty and may have increased the flight crew's workload further. While the approach clearance did not include all of the standard elements, the flight crew stated that they had understood the intent of the clearance and that they had intended to intercept the runway 27 localizer.

The passage of the aircraft through the localizer was consistent with neither the VOR/LOC nor APP modes being armed at that time and may have been a consequence of the higher than usual flight crew workload. The subsequent intercept from the left, when APP and subsequently VOR/LOC modes engaged, was consistent with normal operation of the system.

Although the separation between the two aircraft reduced to below the required standard, the approach controller's recovery actions ensured the separation standard was quickly restored.

Safety message

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4 Auto pilot flight director system

5 In this case, the course deviation indicator (CDI) provided a visual indication to the flight crew of the localizer's position relative to the aircraft in 'dots' left (L) or right (R). At the occurrence distance, 1 'dot' was equal to about 0.3 NM (555 m).

6 In this case, in HDG SELECT mode, the aircraft will fly the flight crew selected heading.

7 In this case, control wheel steering (CWS) mode indicates that the pilot is manually manipulating the aircraft's flight control column to make adjustments to the aircrafts heading.

Standard phraseology is designed to ensure that communications between air traffic controllers and flight crews are clear and concise. Communications that do not adhere to the accepted standard have the potential to cause confusion, radio congestion and adversely affect the workload of both pilots and controllers.

While automation can greatly reduce flight crew workload, the need to constantly monitor the aircraft's flight path, particularly during critical stages of flight, is paramount. As the level of automation increases, so does the dependency and expectation that it will perform as expected.

Whereas this occurrence appears to be an isolated incident, there have been other instances that have provided examples of how a breakdown in the flight crew/automation interface can affect flight safety. Additional information about those occurrences can be found in the US Federal Aviation Administration publication, *The Interfaces Between Flight crews and Modern Flight Deck Systems* and the Fight Safety Foundation article on *Automated Cockpit Guidelines (OGHFA BN)*.

- The Interfaces Between Flight crews and Modern Flight Deck Systems www.faa.gov/aircraft/air_cert/design_approvals/csta/publications/media/fltcrews_fltdeck.pdf
- Automated Cockpit Guidelines www.skybrary.aero/index.php/Automated_Cockpit_Guidelines_(OGHFA_BN)

Aircraft details

Manufacturer and model:	VH-TJS: Boeing 737-438 VH-MYI: Fairchild SA227	
Operator:	VH-TJS: QANTAS VH-MYI: Sharp Aviation	
Registration:	VH-TJS VH-MYI	
Type of operation:	VH-TJS: Air transport –high capacity VH-MYI: Air transport –low capacity	
Location:	28 km E of Melbourne Airport	
Occurrence type:	Breakdown of separation	
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau 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 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.

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.