Australian Government
Australian Transport Safety Bureau

Loss of separation involving a Cessna 441, VH-JLT, and a Raytheon B200, VH-ZCJ

near Darwin Airport, Northern Territory, on 10 June 2015

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Addendum

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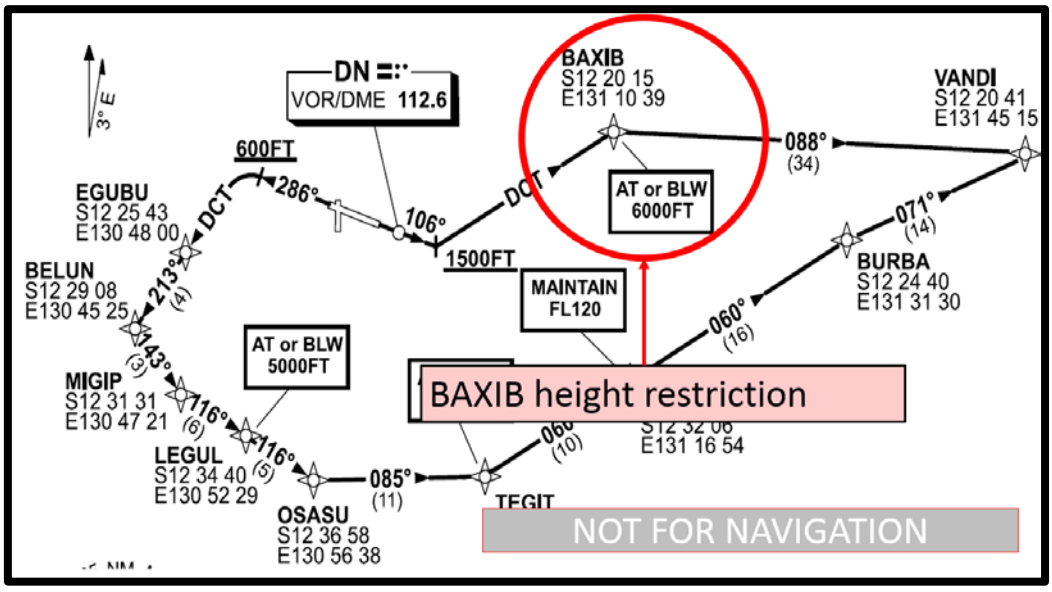
Loss of separation involving a Cessna 441, VH-JLT, and a Raytheon B200, VH-ZCJ

What happened

On 10 June 2015, the pilot of a Cessna 441 aircraft, registered VH-JLT (JLT), conducted pre-flight preparations for a charter flight from Darwin to Oenpelli, Northern Territory with 6 passengers. The pilot planned to track direct to Oenpelli, but on requesting an airways clearance, was advised by the clearance delivery controller that there was a requirement to plan via the VANDI ONE standard instrument departure (SID) (Figure 1). The pilot then reviewed the SID chart and noted the left turn on departure and the height limit of 6,000 ft at waypoint BAXIB. The pilot wrote '6,000' on the navigation log. As part of the airways clearance issued to JLT, the pilot was initially issued a clearance to climb to 3,000 ft. The pilot entered '3000' into the aircraft's altitude alerter.

Figure 1: Extract of VANDI ONE SID



Source: Airservices Australia – annotated by the ATSB

At about 0856 Central Standard Time (CST), a Raytheon B200 aircraft, registered VH-ZCJ (ZCJ), operating an aeromedical flight with a pilot, a flight nurse and four passengers on board, was approaching Darwin from Elcho Island, Northern Territory, on the GATOR THREE A standard arrival route (STAR) (Figure 2). The pilot had been advised to expect track shortening and a visual approach to runway 11. At 0856:16, the Darwin approach controller cleared ZCJ to descend to 7,000 ft.[1]

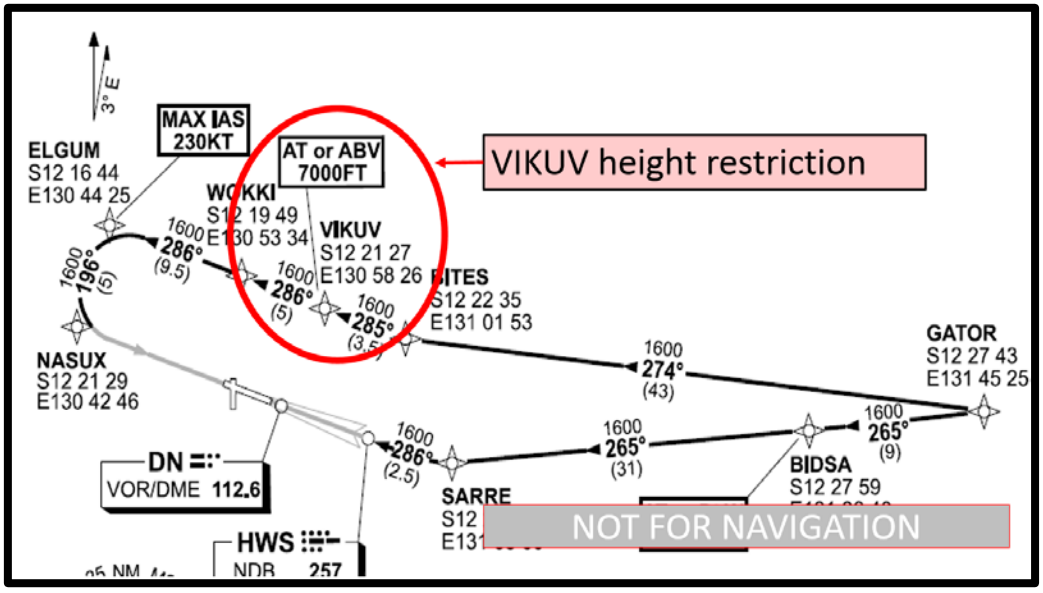
At about 0859, JLT took off. The pilot conducted a left turn as required by the SID, and the Tower controller directed the pilot to contact Approach. At 0859:52, the pilot of JLT contacted the approach controller and advised that they were conducting a VANDI SID, and passing 1,000 ft on climb to 3,000 ft. About 20 seconds later, the pilot of ZCJ reported that they were visual and were then passing about 8,400 ft on descent.

[1] The Australian Defence Force provides the air traffic control services in Darwin.

At 0900:44, the approach controller cleared JLT to climb to flight level (FL) 130.[2] The pilot then selected 13,000 in the altitude alerter. The controller did not cancel any requirements, hence JLT was still required to be at or below 6,000 ft at waypoint BAXIB in accordance with the SID. Shortly after that communication, the pilot of JLT inadvertently selected Brisbane Centre frequency (on COM1), and was no longer able to hear Darwin Approach frequency.

At 0901:00, the approach controller cleared ZCJ, which was then passing about 7,700 ft, to descend to 3,000 ft. In accordance with the STAR, that could only be complied with after passing waypoint VIKUV at or above the 7,000 ft height restriction published for that point on the STAR.

Figure 2: Extract of GATOR THREE A STAR



Source: Airservices Australia – annotated by the ATSB

About 13 seconds later, the approach controller observed ZCJ approaching 7,000 ft. The controller asked the pilot of ZCJ to confirm they were aware that the level restriction at VIKUV still applied, and to expect track shortening after VIKUV. The pilot responded 'roger'. The radar display indicated the aircraft then descended below 7,000 ft to 6,800 ft, which was still within the specified tolerances (+/- 200 ft) of the level restriction. At 0901:41, the radar display showed the ZCJ at 6,700 ft, and the controller asked the pilot to confirm they were maintaining 7,000 ft, and the pilot responded 'affirm'.[3] JLT was then about 11 NM away, and there was still about 3,100 ft vertical separation between the aircraft at that time.

At about 0902, ZCJ was approaching waypoint BITES at 7,000 ft, JLT was at 5,000 ft and the aircraft were about 6 NM apart (Figure 3). The controller then issued JLT as traffic to the pilot of ZCJ, and advised that JLT had been assigned FL130 and had a 6,000 ft requirement at BAXIB. The pilot of ZCJ acknowledged the traffic and could see it on the aircraft's traffic collision avoidance system (TCAS). The pilot of JLT did not hear that communication as they were not listening on the approach frequency at that time.

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2 In Australia, altitudes below 10,000 ft are reference the local or area QNH and are referred to as feet (ft). When operating at altitudes above 10,000 ft an aircraft's height above mean sea level is referred to as a flight level (FL) and is reference a standard pressure setting of 1013.2 HPa.

3 The radar has a predictive capability due to a 5 second refresh rate so if an aircraft is approaching an assigned altitude with a high rate of descent the radar read out will effectively 'predict' the attitude in five seconds time. The pilot reported the aircraft indicated about 6,900 ft, but the radar indicated 6,700 ft.

At 0902:41, as the two aircraft converged, an Australian Defence Air Traffic System (ADATS) predicted conflict alert (PCA) activated on the controller's situational display (Figure 4). The controller advised the supervisor, as required following a PCA activation, that vertical navigation 'strategic' separation was in place (see right). JLT was then at 6,100 ft, above the level restriction of 6,000 ft, and ZCJ at 7,000 ft with less than 2 NM between the aircraft. At 0903:07, 1.6 NM and 800 ft existed between the aircraft, and the pilot of ZCJ reported that they had JLT in sight. The approach controller confirmed that the pilot of ZCJ was able to maintain separation with JLT. The pilot of ZCJ then received a TCAS 'TRAFFIC TRAFFIC' alert and disconnected the autopilot in anticipation of taking avoiding action. The approach controller quickly attempted to contact JLT, advising that ZCJ was maintaining separation with them and to confirm they were complying with the level restriction, but did not receive a reply; JLT continued to climb. The controller then advised the pilot of ZCJ that the aircraft had climbed through the 6,000 ft level restriction and issued a requirement to the pilot of ZCJ to maintain separation with that aircraft. By the time the controller had completed that transmission, the two aircraft had passed. The approach controller then cancelled ZCJ's level restrictions, and cleared the aircraft to descend to 4,000 ft. ZCJ continued to descend in accordance with the STAR route and the pilot did not take any avoiding action.

At 0903:36, the approach controller again called JLT and received no response. At 0903:55, the approach controller received an ADATS conflict alert (CA), with the closest proximity according to the radar reducing to 400 ft vertically and 0.3 NM between the two aircraft. The pilot of ZCJ estimated the proximity between the aircraft to be about 200 ft vertically and 100-200 m horizontally. The controller stated that 'surveillance passing' separation standard was in place (see right). .

The pilot of JLT sighted ZCJ slightly above, to their left, and closer than normal. The pilot realised the radio was selected to Brisbane Centre frequency and switched it to the Darwin Approach frequency. After two more unsuccessful attempts to contact JLT on the Darwin frequency, Brisbane Centre advised the controller that JLT was with them. The pilot of JLT, then back on Darwin Approach frequency, asked the approach controller whether they had been trying to contact them. The approach controller advised the pilot that the aircraft had climbed through a level restriction, and the pilot asked the controller to confirm they had been cleared to FL130. The controller said yes, but in accordance with the SID. The controller then handed JLT off to Brisbane Centre. ZCJ landed on runway 11 without further incident.

Separation Standards

According to the Manual of Air Traffic Services (MATS), separation is the concept of ensuring aircraft maintain a prescribed minimum from another aircraft (or object), whilst meeting the associated conditions, and requirements of the standard. A separation standard is a prescribed means to ensure separation between aircraft using longitudinal, lateral, vertical and visual standards.

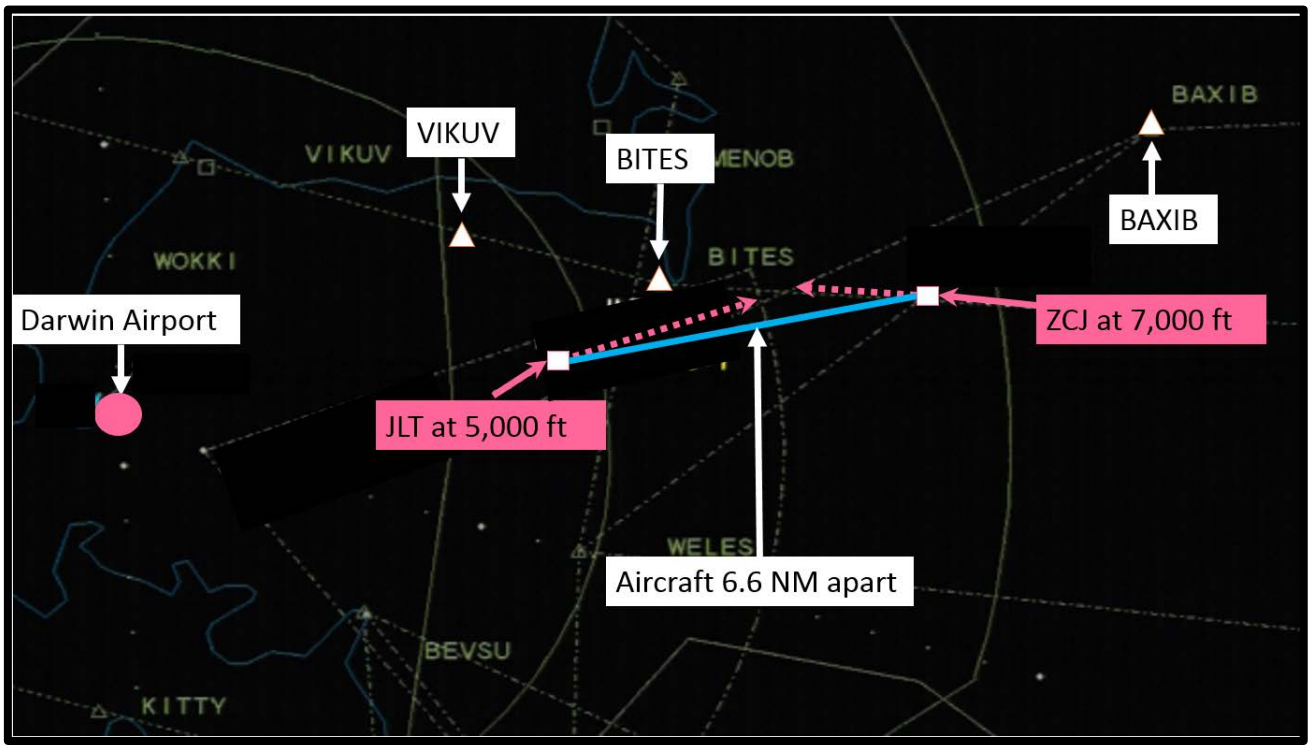
Strategic Separation

Strategic separation is achieved by designing flight paths that minimise conflictions between arriving and departing aircraft. Tactical separation is achieved by changing an aircraft's speed, altitude or direction, including requiring aircraft to proceed at specific times to preserve separation.

Surveillance Passing

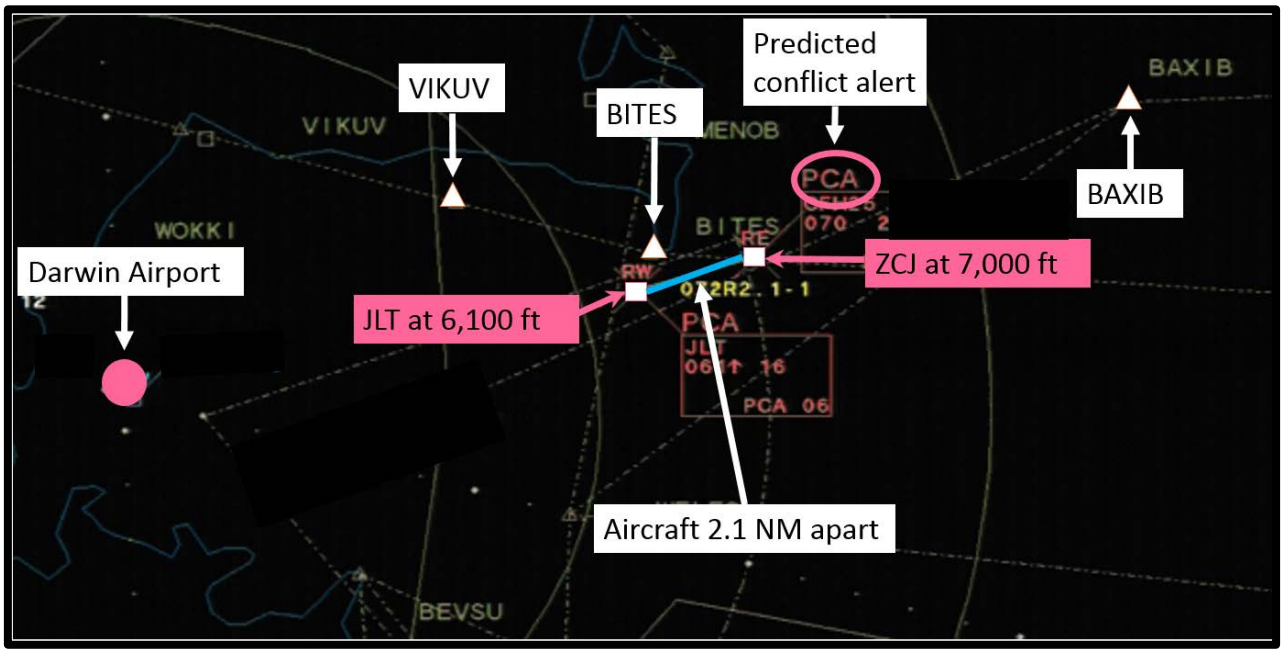
The 'surveillance passing' standard applies to aircraft on reciprocal tracks (within 45° of each other's track), when aircraft are observed by an air traffic surveillance system to have definitely passed and their position symbols are not touching.

Figure 3: Situation display showing JLT at 5,000 ft and ZCJ at 7,000 ft



Source: Defence air traffic control – annotated by the ATSB

Figure 4: Situation display showing the predicted conflict alert, with JLT at 6,100 ft and ZCJ at 7,000 ft



Source: Defence air traffic control – annotated by the ATSB

New traffic management plan (TMP) for Darwin Airport

A new traffic management plan (TMP) for Darwin Airport came into effect on 28 May 2015. This was the result of about two years of design and development, and included consultation with industry. Traffic management planning regulates the flight profiles of arriving and departing aircraft to improve the traffic flow. The new procedures consisted of a number of vertical navigation requirements, with intermediate level restrictions. Several notices to airmen (NOTAMs) were

promulgated by Airservices Australia advising of the new TMP, commencing in December 2014. Local operators were asked to provide feedback on the plan.

An Airservices Air Traffic Management (ATM) specialist reported that the new TMP was based on fulfilling a requirement from the Civil Aviation Safety Authority (CASA) to reduce controller workload. Removing the need to assign levels to each aircraft, also reduces the number of radio transmissions. The new procedures meant that the controllers would not be required to issue as much tactical separation, as the new procedures provided strategic separation. The TMP was designed to be of most benefit during busy periods, when Darwin can have up to 45 aircraft on frequency at the same time, including military jet aircraft. Controllers would then have more time to process and communicate with aircraft that are not captured in the TMP.

Since the implementation of the new plan, there had been a significant number of non-compliance events with the vertical navigation requirements. Darwin was one of the few airports in Australia with vertical navigation requirements on SIDs and STARs, and has more of them than any other airport in Australia.

Controller comments

The approach controller provided the following comments:

- The duty runway was runway 11.
- In accordance with the TMP, ZCJ was inbound on the GATOR THREE STAR, and JLT outbound on the VANDI ONE SID. With the vertical requirement for that STAR and SID, there was a 1,000 ft buffer between the planned routes of the two aircraft.
- All communications and clearances were issued in accordance with the current Airservices Australia Aeronautical Information Package (AIP). Phraseology published in the AIP refers to cancellation of STAR level restrictions but not SID level restrictions. Consequently, the controllers had been advised to cancel the waypoint level restriction on a SID using the phrase, for example, ‘cancel BAXIB level restriction’.
- The new TMP included changes to the departure and approach procedures design and charts, radiotelephony, and was a significant change to the airspace and their mode of operations. The controllers had been directed to issue full climb and descent clearances, which was consistent with Airservices operations in other locations where intermediate level restrictions existed.
- The controller did not, and was not required to issue a safety alert to ZCJ, and believed that to do so would increase risk. The controller did not issue a safety alert to JLT and assigned separation responsibility to the pilot of ZCJ. The pilot of ZCJ had JLT in sight and if the controller had issued a heading or climb instruction to the pilot of ZCJ, the pilot may have looked inside at the instruments to follow the instruction, instead of keeping JLT in sight.
- The controller’s initial response was to attempt to communicate with the pilot of JLT and confirm they were maintaining 6,000 ft, but the pilot did not respond. The controller wanted to issue a safety alert to the pilot of JLT as they had not been issued ZCJ as traffic. However, on receiving no response from the pilot of JLT, the controller immediately assigned safety recovery to ZCJ, and then confirmed the aircraft had passed each other.
- The controller was also the senior training officer in Darwin, and because of the significant number of VNAV restrictions in the new TMP, the controller created maps and diagrams, and clearly depicted the restrictions on SIDs and STARs, and placed them on the console as a situational awareness tool for the controllers.
- Prior to a controller operating under the new TMP, they had completed two simulator sessions. The scenarios included common and predicted conflictions and multiple aircraft not tracking via SIDs and STARs, and aircraft not in compliance with the TMP requirements.

Immediate actions

Following the incident, the pilots of both aircraft participated in a briefing with the controllers. They viewed the radar tapes and discussed the TMP. The aim was to educate the pilots, as local operators, and discuss the TMP with the aim to prevent further incidents from occurring.

The operator of JLT attended this briefing. They were surprised that the controllers had assumed the Cessna 441 was equipped with a traffic collision avoidance system (TCAS) and a flight management system (FMS). It was not fitted with either. The operator also stated that the same applies to most of the general aviation aircraft operating in and out of Darwin Airport.

Pilot comments

Pilot of VH-JLT

The pilot of JLT provided the following comments:

- The pilot should have reviewed the en route section of the Jeppesen for the planning. The new Jeppesen charts only arrived the day before the new TMP came into effect.
- The Planner advised that four other pilots had also flight planned direct to Oenpelli that morning (instead of via the VANDI ONE SID).
- They had never had altitude restrictions before on the SIDs. It was the first time the pilot had ever been cleared to an altitude above a level restriction. The STARs have intermediate level restrictions, but prior to the new TMP, the pilot had only ever been cleared to an altitude lower than the restriction when also cancelling the height restriction (for example ‘descend to 4,000 cancel STAR level restriction’).

Pilot of VH-ZCJ

The pilot of ZCJ stated that the flight management system (FMS) calculated the top of descent point based on the track of the STAR. As the pilot had been advised to expect track shortening and a visual approach, they had to commence the descent earlier. The aircraft was slightly above the normal approach path and at a slightly higher rate of descent than normal, when approaching 7,000 ft. The pilot had vertical navigation (VNAV) mode selected, with VPATH in the flight mode annunciator, and ALTV armed, therefore the FMS follows the STAR profile programmed and captured the approach level restriction (of 7,000 ft).

In addition, the pilot commented that the company had sent emails and a flight operations notice to company flight crew highlighting the changes and new procedures for Darwin, prior to the commencement of the new TMP. There were NOTAMs issued months beforehand about the new SIDs and STARs to ensure the pilots were aware of the new procedures.

Operator comments – operator of VH-JLT

The operator of JLT advised that the auto-flight system of JLT was unserviceable on the incident flight. That unserviceability led to increased pilot workload, therefore reducing the pilot’s spare capacity to maintain situational awareness.

The operator believed that the change management process prior to the airspace changes was insufficient. The number of incidents that occurred immediately following the implementation of the new TMP supported that belief. The operator suggested that face-to-face briefings with the local pilots would have been more effective than just issuing NOTAMs.

The Jeppesen Charts with the new procedures were only released the day before the changes were implemented. Additionally, the associated GPS software was not available until 10 hours after the new procedures commenced at midnight.

Safety actions

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 actions in response to this occurrence.

Aircraft operator – VH-ZCJ

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

Education email from Defence air traffic control (ATC)

An email from Defence ATC was sent by CASA to the operator of ZCJ, who then distributed the email to company pilots operating out of Darwin. The email advised that since the new TMP came into effect on 28 May, there had been nine occurrences of pilots failing to comply with the VNAV requirements of the SIDs and STARs. The email directed pilots to the relevant sections of the AIP. These stated that when ATC issues climb clearances to an aircraft on a SID, or descent clearances to an aircraft on a STAR, the aircraft must comply with all level restrictions or requirements published on the SID or STAR charts unless ATC explicitly cancels the restrictions or requirements.

Safety bulletin

A safety bulletin was issued to all flight crew operating out of Darwin. The bulletin advised flight crew of the recent violations of SID and STAR altitude restrictions under the new TMP. Pilots were reminded to maintain extra vigilance and situational awareness while briefing and approaching the new level restrictions. The bulletin noted that as evidenced by this incident, other aircraft may not comply with the restrictions. Flight crew were directed to engage VNAV with active vertical mode where available. In aircraft without VNAV capability, the Altitude Selector was to be set to the limiting altitude and the cleared level written down until the SID or STAR restriction had been passed.

Critical to Safety Operations notice

A ‘Critical to Safety Operations’ notice was issued to all flight crew operating out of Darwin. The notice reiterated the need to comply with level restrictions unless explicitly cancelled. The notice also provided directives regarding the use of VNAV and the FMS to conduct SIDs and STARs in Darwin.

Flight operations manual update

The Flight operations manual is being updated with further guidance on the new Darwin procedures.

Local airspace briefing

The local airspace briefing presentation for new pilots has been updated to incorporate the new Darwin TMP procedures.

Aircraft operator – VH-JLT

As a result of this occurrence, the operator of JLT has advised the ATSB that they are taking the following safety actions:

Training information for flight crew

Company flight crew have been reminded of the importance of adhering to standard operating procedures and regulatory requirements.

Traffic control facility training

The operator will participate in training sessions in the Air Traffic Control Facility with Defence ATC Darwin, to develop understanding of the issues that flight crew and air traffic control personnel identify with the airspace.

Safety newsletter

A safety newsletter will be sent to all company flight crew to remind them of the importance of understanding the SID and STAR chart requirements.

Air traffic control

New procedure implemented

With immediate effect, Darwin ATC implemented a new procedure following this incident. If a VNAV restriction is in place and one aircraft has not complied, the controller is to immediately resort to tactical separation until that confliction is cleared.

Training and awareness

Materials designed to enhance awareness of the requirements and implications of the new traffic management plan will be promulgated to local aviation operators.

Incident briefings

Defence ATC provided briefings with other local operators at the ATC Facility showing this incident, discussing the TMP and the need for compliance of VNAV on the SID's and STARs.

Safety message

For controllers, this incident highlights the need to monitor aircraft after issuing a full climb or descent, where an intermediate level restriction applies. If an aircraft appears not to be complying with a level restriction, apply tactical separation.

For pilots, this incident provides a reminder to become familiar with published standard departure and arrival procedures and charts, particularly those with intermediate level restrictions, and the associated phraseology used by air traffic controllers and pilots.

General details

Occurrence details

Date and time:	10 June 2015 – 0910 CST	
Occurrence category:	Incident	
Primary occurrence type:	Loss of separation	
Location:	near Darwin Airport, Northern Territory	
	Latitude: 12° 24.88' S	Longitude: 130° 52.60' E

Aircraft details: VH-JLT

Manufacturer and model:	Cessna Aircraft Company, 441	
Registration:	VH-JLT	
Serial number:	441-0138	
Type of operation:	Charter – Passenger	
Persons on board:	Crew – 1	Passengers – 6
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

Aircraft details: VH-ZCJ

Manufacturer and model:	Raytheon Aircraft Company, B200	
Registration:	VH-ZCJ	
Serial number:	BB-1853	
Type of operation:	Aerial Work – EMS	
Persons on board:	Crew – 2 (1 Pilot, 1 Flight nurse)	Passengers – 4
Injuries:	Crew – Nil	Passengers – Nil
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 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.