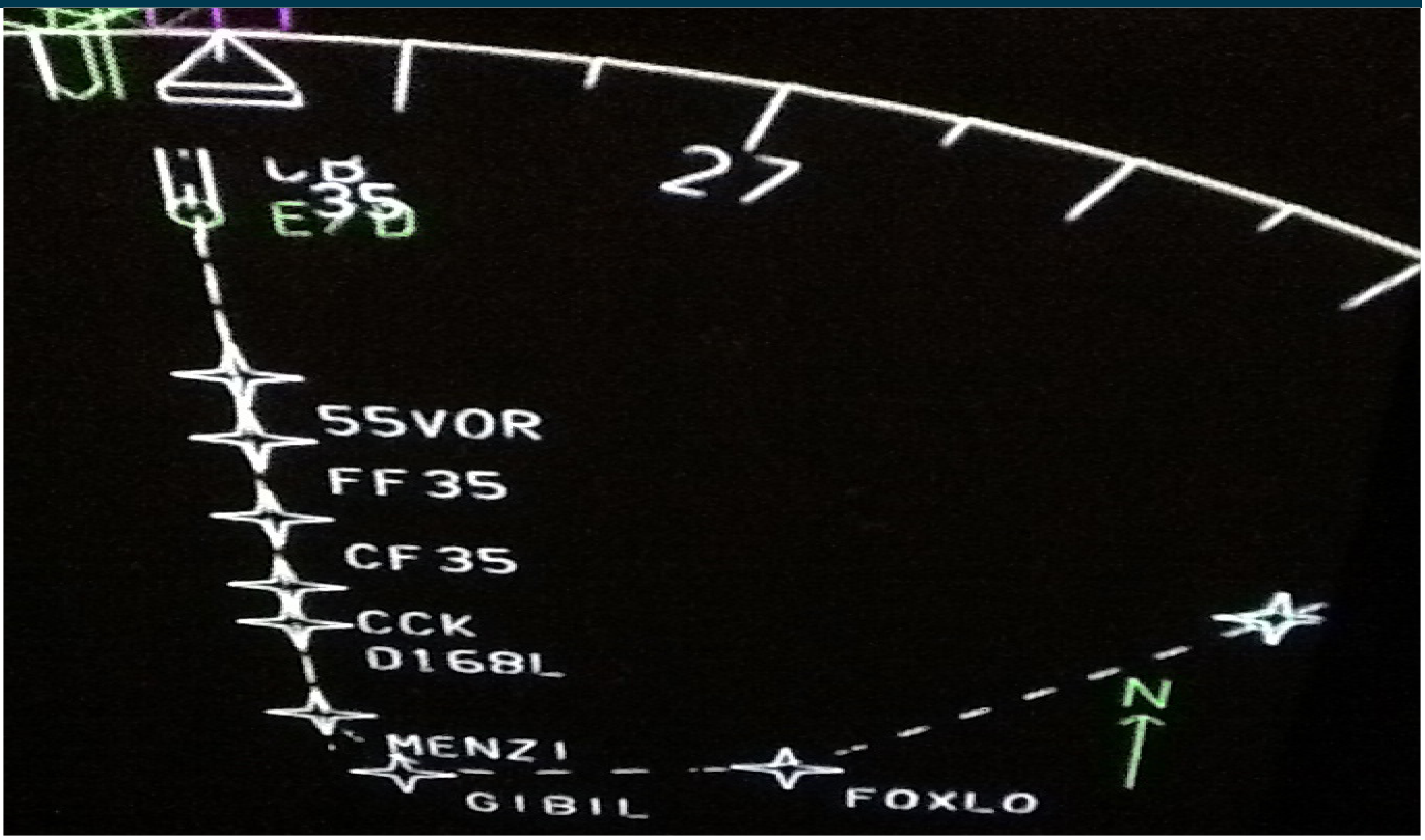
Australian Government
Australian Transport Safety Bureau

Descent below minimum safe altitude involving Boeing 737, VH-TJS

21 km south of Canberra Airport, Australian Capital Territory | 12 February 2012



Investigation

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Addendum

Page	Change	Date

Safety summary

What happened

On 12 February 2012, the flight crew of a Boeing 737 aircraft, registered VH-TJS and operated by Qantas Airways Limited, was conducting a scheduled passenger service from Sydney, New South Wales to Canberra, Australian Capital Territory. Due to scheduled maintenance the instrument landing system at Canberra was not available and the crew prepared for an alternate instrument approach that provided for lateral but not vertical flight path information. The flight was at night with rain showers and scattered cloud in the Canberra area.

Shortly after becoming established on the final approach course with the aircraft's automatic flight system engaged, the flight crew descended below the minimum safe altitude for that stage of the approach. The crew identified the deviation and levelled the aircraft until the correct descent profile was intercepted, then continued the approach and landed. No enhanced ground proximity warning system alerts were generated, as the alerting thresholds were not exceeded.

What the ATSB found

The ATSB found that at the time of the occurrence the automatic flight system was in the level change mode rather than the vertical navigation mode specified by the operator for such approaches. While in that mode the flight crew had selected an altitude lower than the applicable minimum safe altitude, with the effect that unless the crew intervened, the aircraft would descend to that lower altitude. The flight crew then allowed the aircraft to continue descending in the level change automatic flight mode through the segment minimum safe altitude, reflecting a temporary loss of situation awareness.

Safety message

During those phases of flight when terrain clearance is unavoidably reduced, such as during departure and approach, situation awareness is particularly crucial. Any loss of vertical situation awareness increases the risk of controlled flight into terrain. This occurrence highlights the importance of crews effectively monitoring their aircraft's flight profile to ensure that descent is not continued through an intermediate step-down altitude when conducting a non-precision approach.

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The occurrence

On 12 February 2012 a Qantas Airways Limited Boeing 737-400 aircraft, registered VH-TJS, was being operated on a scheduled passenger service from Sydney, New South Wales to Canberra, Australian Capital Territory. The flight crew consisted of a captain and a first officer with the captain designated as pilot flying. Both crew members were appropriately qualified to conduct the flight and had considerable experience operating the aircraft type. The flight crew were on day three of a four-day pattern and recalled they were adequately rested prior to commencing duty in Adelaide, South Australia at 1145 Central Daylight-saving Time[1] that day. The four-sector day was described as long and particularly busy due to widespread thunderstorm activity. The last sector, from Sydney to Canberra, was of a short duration and required en route diversions around weather.

The crew was aware, prior to departing Sydney, that the Canberra runway 35 instrument landing system (ILS) was not available for their arrival due to scheduled maintenance. Consequently, the captain expected a very high frequency omnidirectional radio range (VOR) instrument approach, a procedure using the VOR navigation aid that provided lateral but not vertical flight path information.

While en route, air traffic control cleared the crew to conduct the Razzi Eight Alpha arrival procedure (Appendix A), with the expectation of a VOR Runway 35 approach. The captain reported that he and the first officer were tired after the busy day and that the possible implications for the approach were discussed as part of the approach brief.

The crew chose to fly the approach using the aircraft’s automatic flight system in the lateral navigation and vertical navigation (VNAV) modes. Based on navigational information stored in the flight management computer, those modes provided lateral and vertical control to maintain the required track and descent profile. The operator’s procedures for conducting a non-ILS approach at night required that the aircraft be configured with landing gear down and landing flap selected prior to commencing the approach.

At 2140 Eastern Daylight-saving Time[2] the Canberra approach controller cleared the crew to descend to 7,000 ft above mean sea level. The controller asked the crew if they were ‘happy’ to intercept the 168 radial (bearing from the VOR) at the MENZI waypoint for the VOR approach. The crew accepted and at 2145 were cleared to descend to 6,000 ft, intercept the Canberra VOR 168 radial at MENZI, and conduct the VOR Runway 35 approach (Appendix B).

At 2149, the aircraft was approaching the arrival waypoint FOXLO at an airspeed of 242 kt in the VNAV mode. At about that time the crew noticed an unexpected tailwind was affecting the aircraft, prompting the captain to select the level change mode. This mode commands a pitch attitude to maintain the airspeed selected in the speed window on the mode control panel with idle thrust. The crew assessed that level change mode would more likely maintain the optimum descent profile while decelerating to comply with a 205 kt airspeed restriction at the next waypoint, GIBIL. The crew’s intention was to revert to VNAV once the airspeed restriction had been met. As the aircraft decelerated the crew started to configure the aircraft for landing with the initial selection of Flap 5.

Although the tailwind component on the FOXLO to GIBIL segment resulted in an average groundspeed of 232 kt, as the aircraft approached GIBIL it was on the correct descent profile at an airspeed of 180 kt. At that point, the aircraft’s rate of descent was about 1,150 ft/min, and it was configured with landing gear down and Flap 15. At 2150, as the aircraft turned onto the short

[1] Central Daylight-saving Time (CDT) was Coordinated Universal Time (UTC) + 10.5 hours.

[2] Eastern Daylight-saving Time (EDT) was Coordinated Universal Time (UTC) + 11 hours. EDT is referenced in the remainder of this report.

segment toward MENZI, the effect of the tailwind was reduced. Recorded data showed that the rate of descent during that segment increased to about 1,600 ft/min (Appendix C).

Both crew members reported that the period of time between waypoints GIBIL and MENZI was ‘time compressed’ due to the effect of the tailwind and the operator’s requirement to have the aircraft fully configured for landing prior to descent in the VOR approach. The operator’s flight crew training manual suggests that it requires 3 NM to decelerate from 250 kt to approximately 210 kt at average gross weights. Recorded data showed that the crew configured the aircraft for landing and reduced the airspeed from 242 kt to165 kt over the 7 NM between FOXLO and MENZI. The captain recalled that as the aircraft was approaching waypoint MENZI and converging on the 168 radial, he experienced a brief period of uncertainty about their position in relation to the radial. That might have been in part, a result of the published VOR approach procedure not depicting waypoint MENZI. He requested verification of their tracking with the first officer, who confirmed they were on the correct radial with a manual check of raw data on his electronic horizontal situation indicator.

Just after passing waypoint MENZI at 2151:19, the aircraft was established on the final approach course at an airspeed of 165 kt and with a rate of descent around 1,800 ft/min. The crew selected Flap 30 for landing then completed the stipulated checklist items and radio calls. Recorded data showed a temporary increase in pitch attitude and resultant decrease in rate of descent to 700 ft/min as the flap setting took effect. Around that time, at an undetermined point after passing 15.5 NM, the captain selected 4,000 ft in the mode control panel and was acknowledged by the first officer. Limitations of the flight data recording meant that the precise moment this was done could not be determined. However, it was standard operating procedure when flying non-ILS approaches to perform a continuous descent during the final approach. That required the crew to select the next segment minimum safe altitude (or ‘step’) prior to the current step being reached, to prevent unwanted autopilot altitude captures and level-offs. At that stage of the approach, the published segment minimum safe altitude was 5,100 ft until passing the next waypoint at 12 NM.

Passing 13.7 NM at 2151:47, the aircraft descended through the segment minimum safe altitude of 5,100 ft at a descent rate of 1,750 ft/min. At about the same time, the first officer was completing a radio call to Canberra Tower. He then crosschecked distance against altitude and identified a significant deviation below the optimum descent profile. The crew then realised that the flight management system was selected to level change mode rather than VNAV as intended. The captain promptly commenced levelling the aircraft as it was passing 4,600ft altitude, which was 18 seconds after descending below the 5,100 ft segment minimum safe altitude. There were no enhanced ground proximity warning system alerts triggered, as the alerting thresholds were not exceeded, and once the correct profile had been re-intercepted VNAV was engaged and the approach continued.

Context

Aircraft navigation

The Boeing 737-400 automatic flight system (AFS) consists of the autopilot flight director system (AFDS) and the autothrottle. The crew control the AFS by use of the mode control panel, located on the glareshield above the instrument panel, and the flight management computer. The crew use the mode control panel to select and activate AFDS modes, and to select altitudes, speeds and climb/descent profiles. Selection of lateral navigation mode and/or vertical navigation (VNAV) mode results in optimised lateral and vertical flight paths that reflect speed and altitude constraints at waypoints along the flight management computer flight planned route.

The aircraft's descent flight path can also be automatically controlled by additional AFDS modes, including level change mode, which coordinates flight control inputs at idle thrust to descend to the preselected altitude at the selected airspeed. This mode does not interface with the flight management computer and relies solely on crew selections on the mode control panel. Consequently, in level change mode, any altitude constraints in the flight management computer are not applied to the aircraft's flight path.

With the autopilot engaged, the aircraft would automatically change from a vertical mode to altitude hold mode to capture and maintain the altitude selected on the mode control panel. The smooth transition from vertical mode to altitude hold is achieved automatically by the altitude acquire mode.

The operator's 737 *Flight Crew Training Manual* contained information regarding the conduct of non-ILS instrument approaches using the aircraft's automatic flight system, including that:

- VNAV is the preferred method for accomplishing non-ILS approaches that have an appropriate vertical path defined in the flight management computer
- the pilot flying is required to select or verify the selection of VNAV approximately 2 NM prior to the instrument approach descent point.

The aircraft is equipped with an electronic flight instrumentation system. This consists of an electronic attitude director indicator (EADI) and an electronic horizontal situation indicator (EHSI) for each pilot. In addition to aircraft attitude information, the EADI incorporates a flight mode annunciator that displays the engaged or captured AFDS modes in large green letters, such as VNAV and level change.

The EHSI's provide the crew with a pictorial display of the aircraft's track, and can be selected to a variety of modes to provide optimum information relating to a particular phase of flight. Additionally, the EHSI displays vertical information to the crew as follows:

- in any descent mode, a vertical deviation scale and pointer presents the aircraft's vertical deviation from the flight management computer determined descent path
- based on the aircraft's vertical speed and groundspeed, an altitude range arc indicates the approximate map position where the altitude, as set on the mode control panel is expected to be reached.

The *Flight Crew Training Manual* indicated that prior to final approach, the mode control panel altitude should be set at the appropriate altitude constraint (normally that for the next waypoint) to assure compliance with the respective segment minimum safe altitudes for the approach. To prevent unnecessary level-offs while descending in VNAV, the altitude selector should be reset to the next waypoint altitude constraint before the automatic transition to altitude capture. However, this was to be actioned when compliance with the waypoint altitude restraint is assured. The crew stated that the normal way to confirm that the mode control panel altitude constraint will be complied with is to check that the position of the altitude range arc on the EHSI in map mode. If the altitude range arc is located beyond the next waypoint, and provided the aircraft rate of descent and groundspeed is relatively stable, the altitude constraint will be complied with.

Canberra instrument arrival and approach

At the time of the occurrence, the published Razzi Eight Alpha arrival procedure did not specifically link to the Canberra VOR Runway 35 approach but did link to the ILS Runway 35 approach. Shortly after, but unrelated to this incident, the arrival procedure was amended to incorporate both the ILS and the VOR approaches to runway 35, with the VOR approach chart depicting waypoint MENZI as the start of the approach.

The chart used by the flight crew for the Canberra VOR Runway 35 approach depicted a series of descending steps (Appendix B), designed as a series of segment minimum safe altitudes down to the minimum descent altitude. A fix, defined by a distance from a Canberra navigation aid, was located at each point where critical obstacles had been passed and it was safe to continue descent to the next altitude.

Meteorological information

The aircraft's flight management computer has the capability for crews to enter forecast descent winds for up to three different altitudes. With VNAV engaged, the descent profile is adjusted accordingly. The forecast winds for the period of the occurrence flight indicated light westerly winds for the descent; however, during the later stages of the descent moderate winds with an easterly component were experienced.

The Canberra Airport weather information available to the crew reported wind from the east at 15 kt (28 km/h), rain showers in the area, layers of scattered[3] cloud at 1,800 ft, 2,500 ft and 3,500 ft, and visibility greater than 10 km. The crew reported that visual meteorological conditions existed below layers of cloud and that they were visual with Canberra from about waypoint FOXLO (Appendix A).

Operational considerations

Workload has been defined as 'reflecting the interaction between a specific individual and the demands imposed by a particular task.'[4] An individual has a finite set of mental resources they can assign to a set of tasks. The resources available to an individual can change given the experience and training they have had or the level of stress and fatigue they are experiencing. An individual will seek to perform at an optimum level of workload by balancing the demands of their tasks.

When workload becomes excessive, the individual must shed tasks. An individual can shed tasks in an efficient manner by eliminating performance on low priority tasks or they can shed tasks in a non-efficient fashion by abandoning tasks that should be performed.[5] The crew reported that the workload during the transition from the arrival procedure to the approach was higher than normal.

Situation awareness is a human perceptual state in which information is gained from the environment through a number of processes. These processes are believed to be the perception of environmental elements, the comprehension of their meaning and the projection of their status

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[3] Cloud cover is normally reported using expressions that denote the extent of the cover. The expression Scattered indicates that cloud was covering between a quarter and a half of the sky.

[4] Orlady, H.W., & Orlady, L.M. (1999).*Human factors in multi-crew flight operations.* Ashgate: Aldershot, UK p.203.

[5] Wickens, C.D. & Hollands, J.G. (2000). *Engineering psychology and human performance, 3rd Edition.* Prentice Hall: New Jersey.

following a change in a variable (such as time).[6] It is having an accurate understanding of what is happening around you and what is likely to happen in the near future.

Prospective memory is the intention to perform an action in the future, coupled with a delay between recognising the need for action and the opportunity to perform it.[7] A distinguishing feature of prospective memory is the need for an individual to remember that they need to remember something. Researchers have identified that prospective memory issues may result in a failure to return to a task or procedure that has been interrupted, even when the task or procedure is habitual. In addition, performance on cognitive functions, such as memory, is affected by factors such as fatigue and workload. These factors can combine to increase a crew's vulnerability to error, increasing the risk of a prospective memory-related event.[8]

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6 Endsley, M.R. (1995). Toward a theory of situation awareness in dynamic systems. *Human Factors,* vol. 37(1), pp 32-64.

7 Dismukes, K. (2006). *Concurrent task management and prospective memory: pilot error as a model for vulnerability of experts.* In Proceedings of the Human Factors and Ergonomics Society 50th Annual Meeting – 2006, 909-913.

8 Loukopoulos, L.D., Dismukes, R.K., and Barshi, I. (2009). *The multitasking myth: Handling complexity in real-world operations.* Ashgate: Aldershot.

Safety analysis

During the instrument approach the aircraft was allowed to descend below the applicable minimum safe altitude for 37 seconds. In that period the clearance from local terrain reduced to a minimum of 1,100 ft. Although the consequences were not serious, any deviation from instrument approach procedures increases operational risk. In this case, the crew identified the noncompliance and took immediate action to resolve it. The following analysis discusses the factors contributing to the descent below minimum safe altitude.

In accordance with common and accepted practice the flight crew was using the automatic flight system to guide the aircraft along the prescribed instrument approach flight path. This was normally accomplished with the lateral navigation and vertical navigation (VNAV) modes active. In this case, with a higher-than-anticipated tailwind affecting the arrival procedure, the crew selected the level change mode instead of VNAV to facilitate airspeed control. In level change mode the aircraft was set up to descend at idle thrust at the mode control panel-selected airspeed until the crew-selected altitude was reached, which in this case was lower than the minimum safe altitude for that part of the approach.

In the absence of the electronic profile guidance provided by an instrument landing system, flight crew manage the descent profile during a very high frequency omnidirectional radio range (VOR) instrument approach, including the monitoring of aircraft altitude relative to minimum safe altitudes. In this case, the crew allowed the automatic flight system in level change mode to descend the aircraft through the applicable minimum safe altitude.

The flight crew didn’t realise that the aircraft was still in the level change mode when the VOR approach was commenced. Although the crew had intended to re-select the more appropriate VNAV mode, the higher-than-normal workload associated with the transition from the arrival to the approach and possibly tiredness had an adverse effect on the crew’s prospective memory. There was an operator procedure for the selection or confirmation of VNAV prior to an instrument approach, but the crew missed the opportunity to reselect that mode.

As the instrument approach was about to commence, the aircraft’s rate of descent was temporarily but significantly reduced when Flap 30 was set. Around that brief but crucial period it is likely that the altitude range arc on the crew’s electronic horizontal situation indicator did not give a true representation of the predicted descent profile. This potentially influenced the crew’s decision to set the mode control panel altitude to the next lower segment minimum safe altitude 4,000 ft, believing that the predicted descent profile did not infringe the 5,100 ft altitude requirement.

Once the aircraft was established on the approach in level change mode, the flight crew relied on scanning the instrumentation to identify any deviation from the required profile. For a period of time the crew became distracted from the monitoring task and missed some cues such as the vertical deviation pointer, the flight mode annunciation, and the high rate of descent during the initial stage of the approach. This was associated with a loss of situation awareness.

Other than the high workload and possible tiredness, a factor in the crew initially not recognising the altitude deviation was probably their expectation that the automatic flight system was correctly controlling the descent profile in VNAV, conforming to the flight management computer waypoint altitude constraints. Once the flight crew resumed a crosscheck of distance against altitude it became apparent that the aircraft was low on profile and corrective action was taken.

During those phases of flight when the terrain clearance is unavoidably reduced, such as during departure and approach, situation awareness is particularly crucial. Any loss of vertical situation awareness increases the risk of controlled flight into terrain. This occurrence highlights the importance of crews effectively monitoring the flight profile to ensure that descent is not continued through a segment minimum safe altitude when conducting a non-precision approach.

Findings

From the evidence available, the following findings are made with respect to the descent below segment minimum safe altitude near Canberra Airport, Australian Capital Territory on 12 February 2012 involving Boeing 737 aircraft, registered VH-TJS and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- While descending on the Canberra runway 35 VOR instrument approach with the automatic flight system in the level change mode rather than vertical navigation mode specified by the operator for such approaches, the flight crew selected an altitude lower than the applicable segment minimum safe altitude.
- The flight crew allowed the aircraft to continue descending in the level change mode through the segment minimum safe altitude, reflecting a temporary loss of situation awareness.

Other key finding

- During the period that the aircraft was below the applicable segment minimum safe altitude, the minimum clearance from terrain was 1,100 ft and the enhanced ground proximity warning system alerting thresholds were not exceeded.

General details

Occurrence details

Date and time:	12 February 2012 EDT
Occurrence category:	Incident
Primary occurrence type:	Operational noncompliance
Type of operation:	Air transport – high capacity
Location:	21 km south of Canberra Airport, Australian Capital Territory

Aircraft details

Manufacturer and model:	Boeing Company 737-476
Registration:	VH-TJS
Operator:	Qantas Airways Limited
Serial number:	24444

Crew flight and duty times

	Captain	First officer
Total flight hours:	20,300	7,762
Flight hours on B737:	7,000	3,300
Flight hours last 7 days:	20	24
Flight hours last 30 days:	88	72
Flight hours last 365 days:	850	652
Duty hours last 14 days:	74	74

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- operator and flight crew of VH-TJS
- Bureau of Meteorology
- Airservices Australia (Airservices).

Submissions

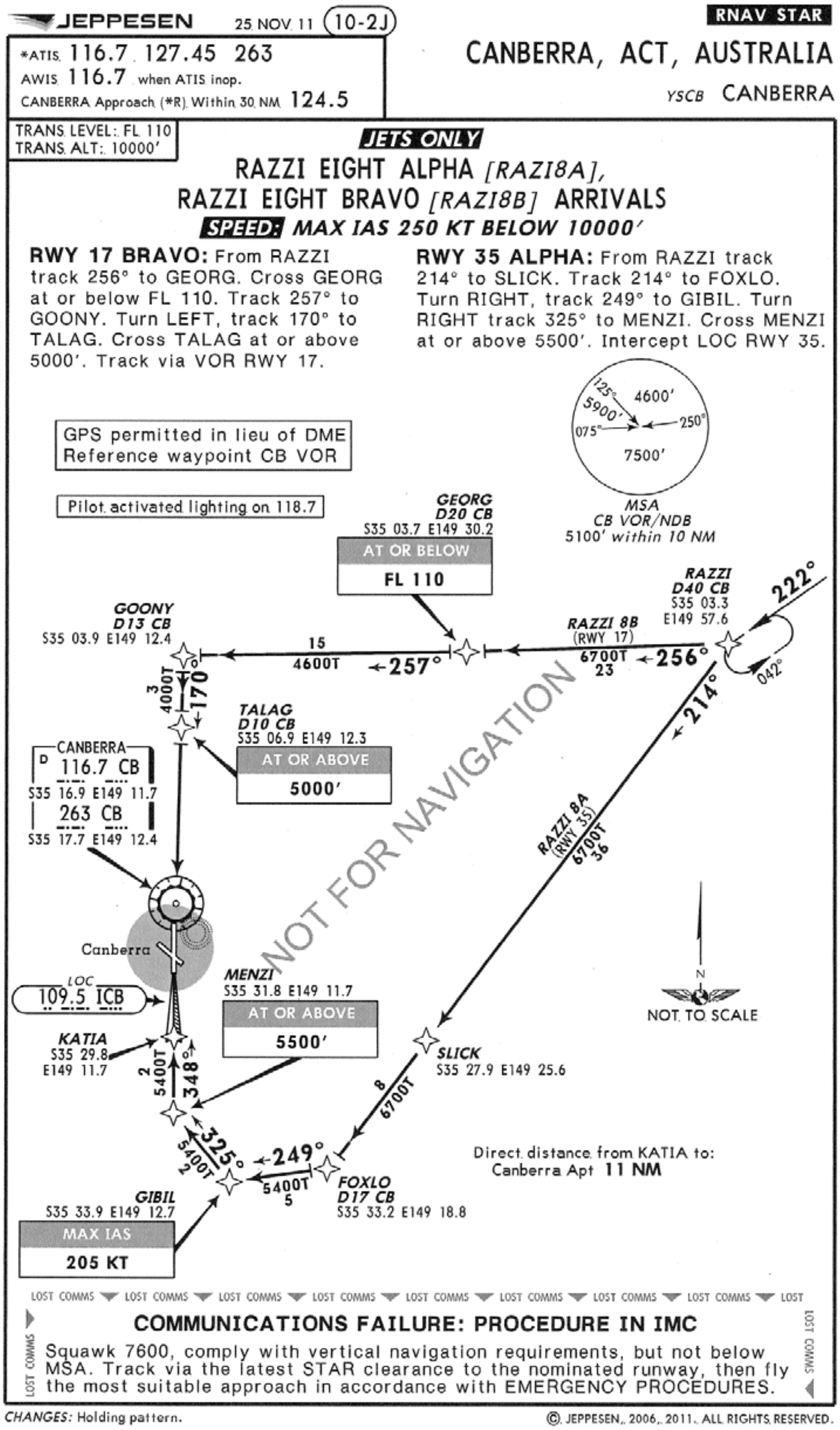
Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act 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 aircraft operator, the flight crew of VH-TJS, the Civil Aviation Safety Authority (CASA) and Airservices.

Submissions were received from CASA and the flight crew of VH-TJS. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.

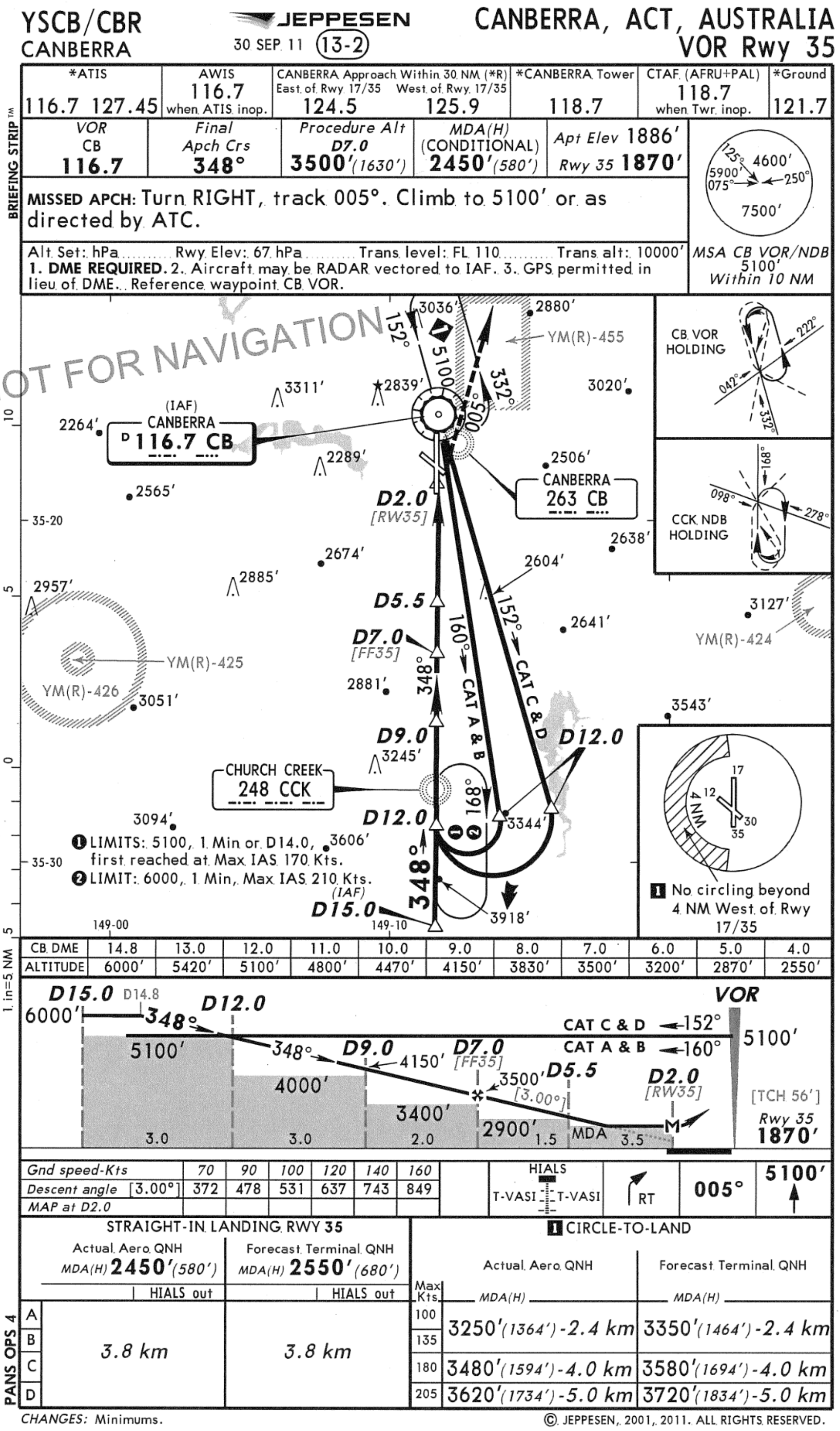
Appendices

Appendix A – Canberra RAZZI EIGHT ALPHA arrival



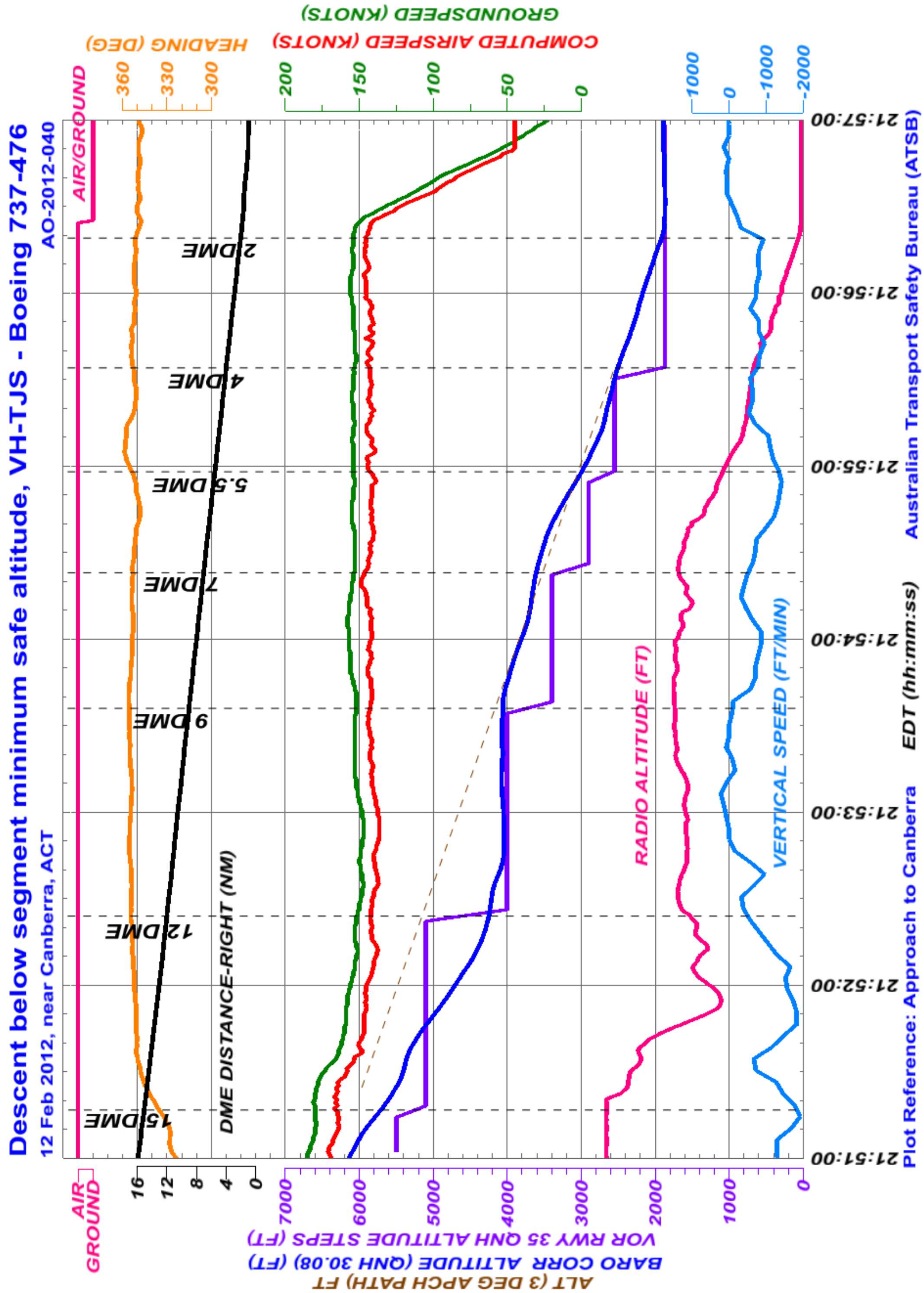
Source: Jeppesen

Appendix B – Canberra runway 35 VOR approach



Source: Jeppesen

Appendix C – Selected parameters from the quick access recorder



Australian Transport Safety Bureau

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; 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 safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

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.

Terminology used in this report

Occurrence**:** accident or incident.

Safety factor**:** an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

Contributing safety factor**:** a safety factor that, had it not occurred or existed at the time of an occurrence, then either: (a) the occurrence would probably not have occurred; or (b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or (c) another contributing safety factor would probably not have occurred or existed.

Other safety factor**:** a safety factor identified during an occurrence investigation which did not meet the definition of contributing safety factor but was still considered to be important to communicate in an investigation report in the interests of improved transport safety.

Other key finding**:** any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which 'saved the day' or played an important role in reducing the risk associated with an occurrence.

Safety issue**:** a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Risk level**:** The ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of action taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

Critical safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.

Significant safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.

Minor safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

Safety action**:** the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

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Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

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