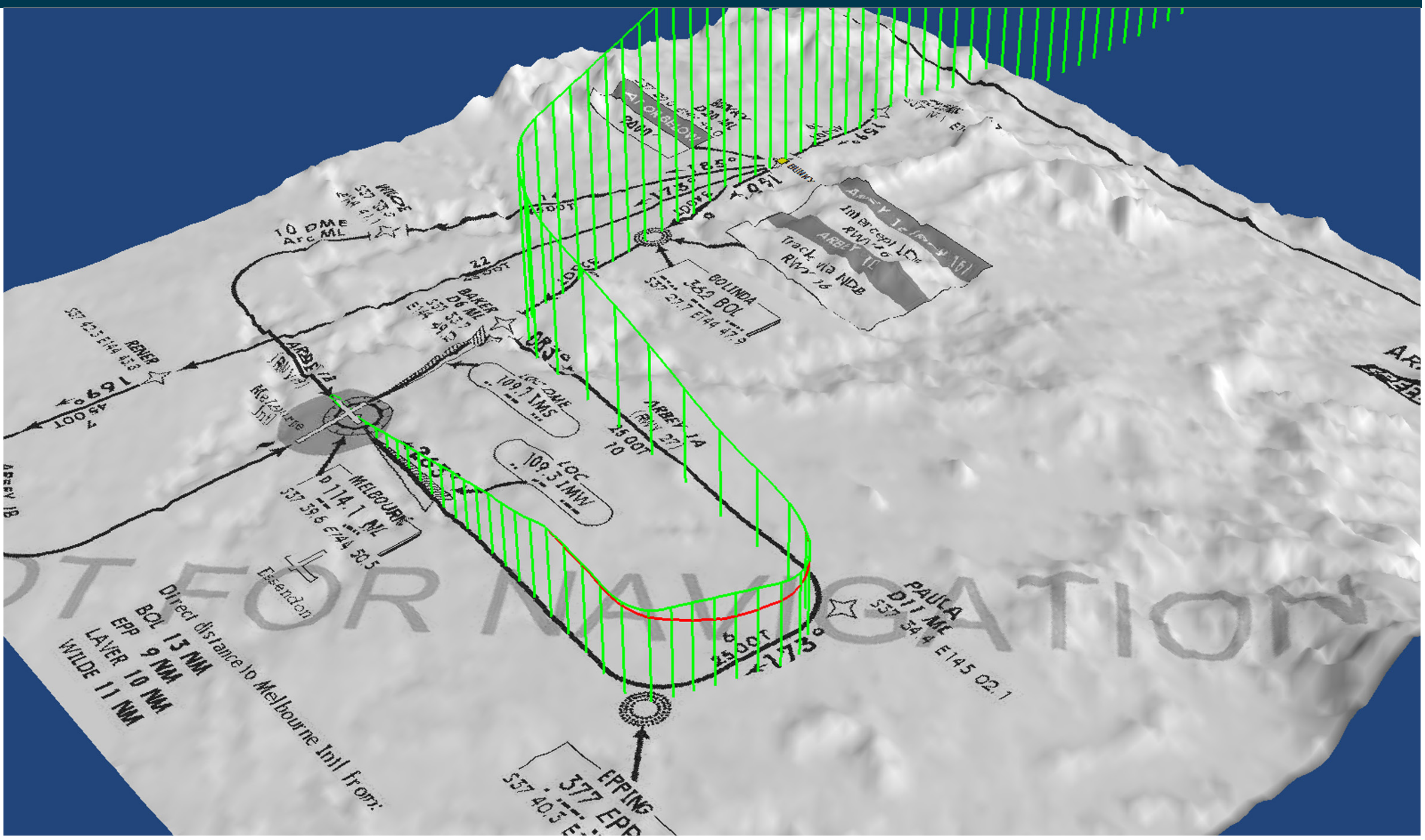
Australian Government
Australian Transport Safety Bureau

Operational non-compliance Airbus A320-232, VH-VNG

17 km ENE of Melbourne Airport, Victoria | 7 June, 2011



Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2011-070
Final

Australian Government

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ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation

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VH-VNG
Airbus A320-232

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

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SAFETY SUMMARY

What happened

At 2102 Eastern Standard Time on 7 June 2011, an Airbus A320 aircraft, registered VH-VNG and operated by Tiger Airways, was on an approach to runway 27 at Melbourne Airport, Victoria. Air traffic control (ATC) had cleared the aircraft to descend to 2,500 ft. Shortly after, ATC identified that the aircraft had descended to 2,000 ft, which was below the limiting altitude for that segment of the approach. ATC notified the flight crew of the deviation. The crew re-established the aircraft at 2,500 ft, then continued the approach and landed.

What the ATSB found

The ATSB found that the flight crew had based the descent profile on information displayed on the aircraft's Multipurpose Control and Display Unit (MCDU). The MCDU drew on information stored in the aircraft's flight management guidance system (FMGS). The FMGS information included data provided through a third party that had a missing altitude limitation; that limitation was, however, included in the paper charts also used by the crew. The data error was not identified by the crew during their preparation for the approach.

The ATSB also found there was an increased risk of inadvertent non-compliance with published instrument approach procedures because of the inconsistent application of the operator's safety management system to the identification and management of database anomalies. In addition, different assumptions by the data suppliers and the operator compromised the quality assurance of the navigational data.

The action by ATC to alert the flight crew triggered their recovery from the descent below the required flight profile.

What has been done as a result

In response to this occurrence, the operator implemented an auditable process for identifying and managing any navigational database anomalies in its aircraft fleet.

Safety message

This occurrence reinforces the safety benefits of a resilient safety management system and operator procedures in the management of safety-critical database and other information. The accurate application of those procedures by all key personnel is also important as a safety defence.

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THE 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 appropriate, or to raise general awareness of important safety information in the industry. 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 safety actions 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.

FACTUAL INFORMATION

History of the flight

On 7 June 2011, an Airbus A320 aircraft, registered VH-VNG and operated by Tiger Airways, was conducting a flight from Brisbane, Queensland to Melbourne, Victoria. The flight crew was cleared by air traffic control (ATC) to conduct an ARBEY ONE ALPHA arrival to land on runway 27 at Melbourne Airport.

About 10 minutes before commencing the descent, the pilot in command (PIC), who was flying the aircraft, handed control of the aircraft to the copilot in order to prepare for the approach. That handover was in accordance with the operator's standard operating procedures.

The PIC reported referring to the ARBEY ONE ALPHA arrival chart during that preparation. This and other relevant approach charts were supplied by Jeppesen[1] and available on the flight deck in paper format. Using these charts for reference, the PIC entered the ATC-stipulated arrival, approach and landing procedures into the aircraft's Flight Management Guidance System (FMGS)[2] via the aircraft's Multipurpose Control and Display Unit (MCDU)[3]. The FMGS calculated the required approach path for that procedure, drawing on information from an internal navigation database.

The PIC reported then briefing the copilot on the planned approach by reading out the details from the paper format charts, and that the copilot checked the details as displayed on the MCDU. The limiting altitude for this segment of the arrival procedure was 2,500 ft above mean sea level (AMSL). The paper format charts reflected this, while the data that was displayed on the MCDU, which was drawn from the FMGS internal navigation database, showed a limiting altitude of 2,000 ft (Figure 1). The flight crew did not notice this discrepancy.

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1 Jeppesen is an approved commercial provider of navigational data in paper and digital format for use when navigating aircraft.

2 The FMGS provides aircraft navigation, lateral and vertical guidance and aircraft performance functions along a pre-planned route that has been previously entered into the system by the flight crew.

3 The MCDU is the interface that the flight crew uses to insert flight planning details into the aircraft's flight management guidance computers and that displays various flight information.

Figure 1: MCDU display

Note: The yellow box (added for clarity) indicates the displayed limiting altitude.

Once the briefing was complete, the PIC resumed control of the aircraft.

At 2042 Eastern Standard Time[4], the crew commenced a descent from flight level (FL) 380[5] to FL250 in accordance with their clearance from ATC. The flight crew were then progressively cleared by ATC to continue descent to 9,000 ft, 6,000 ft, 4,000 ft and finally 2,500 ft. The flight crew controlled the series of descents by setting the cleared limiting altitude on the aircraft's flight control unit (FCU)[6] in accordance with the operator's procedures.

The aircraft ceased the descent at 2,500 ft, shortly before the turn from downwind to base on the arrival procedure. The PIC reported that during this turn, he checked the planned altitude for descent by looking at the displayed information on the MCDU. That display showed a planned descent altitude of 2,000 ft and the PIC set that altitude on the FCU. This allowed the aircraft to descend to 2,000 ft. The PIC notified the copilot of that action by calling 'two thousand' and the copilot confirmed that the limiting altitude on the FCU was 2,000 ft. The descent to 2,000 ft was contrary to the ATC altitude clearance of 2,500 ft that had been issued to the flight crew.

As the aircraft descended from 2,500 ft to 2,000 ft between waypoint PAULA and the Epping Locator[7] (Figure 2), the copilot queried the limiting altitude on the FCU. The PIC verified that altitude by referring to the MCDU display. As the aircraft approached 2,000 ft, ATC advised the flight crew that '...you're below the lowest safe there climb to two thousand five hundred'.

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

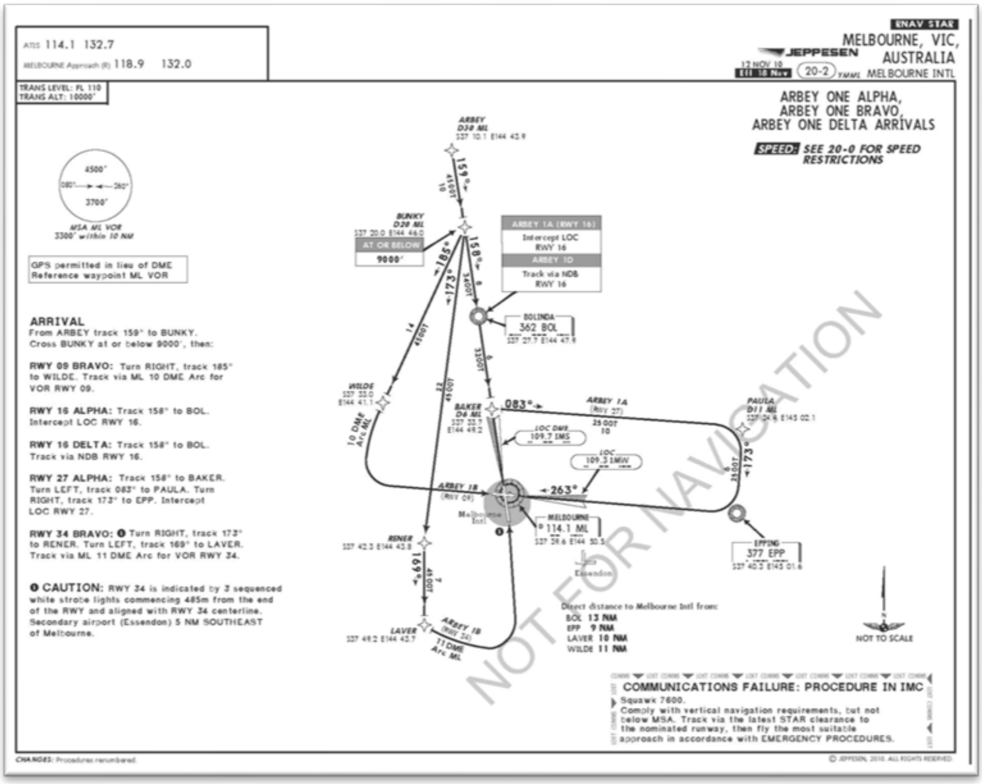
5 At altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 380 equates to 38,000 ft.

6 The FCU is located on the glareshield in front of the flight crew and allows the crew to make short-term inputs into the FMGS.

7 A non-directional beacon that can be used to fix an aircraft's position during an instrument approach.

The flight crew climbed the aircraft to 2,500 ft before continuing the approach and landing. There were no aircraft Terrain Awareness Warning System (TAWS) alerts during the approach and landing.

Figure 2: ARBEY ONE ALPHA arrival procedure



Personnel information

Pilot in command

The PIC had 15,500 hours total flight time and 300 hours on type.

The PIC had flown about 4 hours on two sectors on the day of the occurrence and about 8 hours on four sectors on the day before the occurrence. The PIC had been free of duty for the 2 days prior to that.

Copilot

The copilot had 5,000 hours total flight time and 320 hours on type.

The copilot had flown about 4 hours on two sectors on the day of the occurrence and had been free of duty on the previous 2 days.

Operator’s procedures

The operator’s procedures defined the processes to be used by its flight crew during a flight. In respect of an approach briefing, these procedures included that:

> The Approach briefing should follow a chronological sequence covering current tracking, top of descent, reviewing topography en-route, general weather, CTA steps and constraints.
>
> The PF[8] will brief with reference to the appropriate charts while the PM ‘follows through’ on the FMGC[9] referencing the ND [navigational display] in Plan Mode with constraints selected to ensure programming and constraints are in agreement with the published procedure.

Navigational database

Administrative arrangements

Suppliers of digital navigational databases come under similar regulatory arrangements in Europe and the United States (US). In both cases they are classified as either ‘Type 1’ or ‘Type 2’ providers as described in US Federal Aviation Administration (FAA) Advisory Circular AC 20-153 (now superseded by AC 20 153A, issued 20 September 2010).

Type 1 providers aggregate navigational information from the Aeronautical Information Services (AIS)[10] of various countries into generic databases. These databases are not tailored to specific aircraft systems and cannot be released directly to end users. Type 1 providers receive letters of acceptance from the relevant regulator (the FAA or the European Aviation Safety Agency (EASA)). These letters of acceptance indicate that providers meet specified standards for data integrity (see the later section *DO-200A – Standards for processing aeronautical data*).

Type 2 providers process either State AIS data or a generic database into a format compatible with specific airborne navigation equipment, such as the FMGS in an Airbus A320. In the case of Type 2 providers, letters of acceptance indicate both that the provider meets data integrity standards and that its products are compatible with specified aircraft systems. Type 2 providers can supply navigation databases directly to end users/operators.

Despite these arrangements, the ultimate responsibility of ensuring that the data meets the quality for its intended application rests with the end-user of that data. This responsibility can, to a large extent, be met by obtaining data from a Type 2 supplier accredited through a letter of acceptance.

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8 Pilot flying (PF) and pilot monitoring (PM) are 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, when the PM flies while the PF performs other duties.

9 Part of the aircraft’s flight management guidance system (FMGS).

10 Chapter 3.1.1 (a) of International Civil Aviation Organization Annex 15 titled *Aeronautical Information Service* requires contracting States to provide an aeronautical information service.

Source of navigational data

The FMGS in VH-VNG included two copies of a digital navigational database that was provided by a United States-based Type 2 data supplier. The database was updated on a 28-day cycle as part of scheduled aircraft maintenance and was current for the flight. The Type 2 data supplier held an appropriate letter of acceptance from the FAA, consistent with the FAA's Advisory Circular AC 20-153 titled *Acceptance of aeronautical data processes and associated navigation databases*. This letter of acceptance indicated that the supplier's data was compliant with the Radio Technical Commission for Aeronautics design objective DO-200A (DO-200A) *Standards for Processing Aeronautical Data*.[11]

The Type 2 data supplier relied on data that had been gathered and collated from national AIS providers by a United Kingdom-based Type 1 data supplier. This data is initially provided by States in a national aeronautical information publication or notice to airmen[12] format.

The Type 1 data supplier held an appropriate letter of acceptance from EASA consistent with EASA's *Conditions for the issuance of letters of acceptance for navigation database suppliers*. This letter of acceptance indicated that the supplier's data was compliant with DO-200A or the equivalent European standard (EUOCAE 035/ED-76 – *Standards for Processing Aeronautical Data*).

There was no requirement under Australian civil aviation legislation for the providers of digital navigational data to comply with DO-200A or a comparable standard. Although providers were approved in writing by the Civil Aviation Safety Authority under Civil Aviation Order 20.18.9.A.4, the order did not specify what, if any, requirements had to be met in order to obtain that approval.

Civil Aviation Safety Regulation Part 175 titled *Aeronautical Information Services* is planned to require data service providers to comply with DO-200A. At the time of writing, Part 175 was in the process of being drafted (see Notice of Proposed Rule Making – NPRM 0901AS at http://www.casa.gov.au/scripts/nc.dll?WCMS:PWA::pc=PC_93425).

DO-200A – Standards for processing aeronautical data

DO-200A described a system for specifying and managing the quality of navigational data from source to end user. This included guidelines for managing data changes and anomalies. Under DO-200A, procedures to maintain the integrity of the navigational data included initial end-user determination of their data quality requirements and subsequent end-user assurance that the quality requirements were maintained. The end-user's assurance responsibilities could be discharged by ensuring that the data supplier was accredited against the DO-200A standard.

The system also relied on end-users determining what action was to be taken in the event of their discovery of an error or inconsistency in the data. The operator did

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11 DO-200A is equivalent to European standard EUROCAE ED-76. Compliance with either standard is acceptable for the issue of a letter of acceptance under FAA AC 20-153.

12 A Notice to Airmen advises personnel concerned with flight operations of information concerning the establishment, condition or change in any aeronautical facility, service, procedure, or hazard, the timely knowledge of which is essential to safe flight.

not have a documented procedure to manage and correct any identified error or inconsistency in the data.

Operator data management

The operator had an approved safety management system (SMS) that included a formal process for managing safety deficiencies. The operator also had a system for providing operational information to flight crew by using ‘operations notices’ that had to be checked by flight crew at the start of each flying duty.

There was no operations notice advising the operator’s flight crews of the altitude anomaly until after this occurrence. The combined ARBEY ONE ALPHA arrival/runway 27 ILS approach was commonly used by the operator’s aircraft for a runway 27 landing. A number of the operator’s pilots indicated an awareness of this and other data anomalies but the means of notifying these anomalies to the operator varied.

The Australian Transport Safety Bureau (ATSB) reviewed all database anomaly notifications in the operator’s SMS, and the resulting operations notices for the 18-month period before the occurrence. This review found that the SMS procedures for managing and rectifying identified database anomalies had been applied inconsistently and that identified database anomalies had not always been notified to flight crew and/or rectified.

There was no formal record in the operator’s notification system of an anomaly in respect of the ARBEY ONE ALPHA arrival/runway 27 ILS approach.

The means by which other operators flying similar aircraft maintained navigational database integrity at the time of the occurrence was not examined.

Instrument approach entry altitude

A standard terminal arrival route procedure is a published Instrument Flight Rules arrival procedure that links an en route cruise track to a position fix, often at the start of an approach. An instrument approach is a series of predetermined manoeuvres with reference to flight instruments that provides specified protection from obstacles for the last few miles from that position to a landing on a specified runway or airport. If a landing is not completed, the aircraft is manoeuvred to a position where holding or en route obstacle clearance criteria apply.

The ARBEY ONE ALPHA arrival procedure described the specific criteria for descent and routing for an approach to runway 27 at Melbourne. The runway 27 Instrument Landing System (ILS)[13] approach normally started at 3,000 ft as an aircraft overflew the Epping Locator. However, a runway 27 ILS approach from the ARBEY ONE ALPHA arrival allowed flight crews to turn as required to intercept the ILS approach at 2,500 ft (Figure 2 and overlaid on a terrain map at Appendix A). This provided for a minimum of 1,000 ft vertical clearance from the highest obstacle during that segment of the arrival procedure.

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13 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, locators or marker beacons along the approach provide distance information.

The Type 1 data supplier stated that the first altitude limit in the digital database for a runway 27 ILS approach following an ARBEY ONE ALPHA arrival was 2,000 ft about 5 NM (9 km) from the runway threshold. The supplier advised that an aircraft conducting a runway 27 ILS would be on profile at that time, and that the 2,000 ft altitude limit had been in the database since 2007. However, this ‘digital’ altitude limit was not reflected in the paper documentation, having been included by the Type 1 supplier as an extra en route protection during the approach. It also contrasted with the minimum entry altitude of 2,500 ft for the 27 ILS approach from an ARBEY ONE ALPHA arrival, which was maintained until the aircraft was established on the ILS.

The ATSB found that the data anomaly in the Type 1 supplier’s database resulted from the incorrect interpretation by the supplier’s encoding staff of the aeronautical information that was provided by the Australian AIS provider. The encoding of the ARBEY ONE ALPHA arrival was subsequently accepted as being correct during a review by the Type 1 data supplier.

The Type 1 data supplier and the operator each stated that the Type 1 data supplier had not been notified of the altitude anomaly until after this occurrence.

Human factors

A common type of error within the human factors discipline is known as a slip. Slips generally relate to the conduct of skills-based activities. These activities suggest actions that have become so rehearsed and automatic that the individual does not closely monitor each stage in a sequence of actions as they would if the task was less familiar or unknown. This reduced monitoring can result in the individual not realising that they have carried out an incorrect action.

Expectancy can influence a flight crew’s ability to detect errors when conducting checks of a system. To check a value, an individual may look at it but not be able to verify its relevance or accuracy – that is, they may ‘see’ the value but not notice the error, because they are expecting a different value. This highlights the difference between automatically ‘checking’ something and verifying its accuracy and may be influenced by what the individual expects to see.

ANALYSIS

Introduction

On approach to runway 27 at Melbourne Airport, Victoria the flight crew descended the aircraft below the air traffic control (ATC)-cleared altitude of 2,500 ft (which was also the limiting altitude for that segment of the arrival procedure and the lowest safe altitude).

A number of risk controls were available to ensure that the aircraft maintained the correct flight profile during the arrival and instrument approach. This analysis examines the factors that contributed to some of these risk controls not having effect.

Operator's navigational database integrity

It was apparent that the imposition of ATC requirements and application of operational procedures by the operator's flight crews had previously concealed the risk associated with the ARBEY ONE ALPHA arrival database anomaly within the operator's fleet. In this occurrence, the anomaly became evident once the ATC requirements were not followed by the crew.

The inconsistent application of the operator's safety management system to the identification of database anomalies reduced the likelihood that any identified anomalies would be satisfactorily reported or managed. The intermittent notification by the operator of identified data anomalies to its flight crews increased the risk of inadvertent flight crew non-compliance with published arrival and instrument approach procedures. A more reliable operator process to manage any anomalies would increase the likelihood of the anomalies being correctly identified and rectified in a timely manner.

Although compliance with DO-200A *Standards for Processing Aeronautical Data* was not mandated in Australia, among other things, the integrity of the database effectively relied on the compliance of all parties (Type 1 and Type 2 data providers and operators) with its content. In this context, DO-200A called for an operator to document the corrective action in response to any anomalies or errors in the database and to monitor them until satisfied that they had been corrected. The Type 1 data provider assumed in its management of the data that the operator was operating to the standard. However, the operator's unawareness of the Type 1 data provider's assumption meant that the quality of the data being used by the operator was not assured.

Pre-descent risk controls

When the pilot in command (PIC) entered the arrival and approach data into the Multipurpose Display and Control Unit (MCDU), he did not notice the discrepancy between the altitude on the paper-based approach plate and that drawn from the digital database and displayed on the MCDU. This was a missed opportunity to identify the anomaly.

The action by the copilot to check the PIC's briefing against the information displayed on the MCDU may have been affected by the expectation that the figures would match, in part due to the frequent nature of this task. In addition, and based on an expectation of seeing 2,500 ft, the copilot may have 'seen' the figure of 2,000 ft but not comprehended that it was incorrect against the PIC's briefed chart figure of 2,500 ft. Had this verification process been successful, it would have identified the database anomaly at this point.

The two separate crosschecks of the paper/Flight Management Guidance System (FMGS) data would have provided the flight crew with confidence as to the validity of the data displayed on the MCDU.

Risk controls during the descent

The PIC's check of the FCU setting when the aircraft stopped descending at 2,500 ft was referenced against the MCDU display instead of the ATS-cleared altitude. As a result of this slip, the PIC incorrectly changed the FCU altitude to 2,000 ft, negating the 2,500 ft limiting altitude as cleared by ATC as a safety defence.

The slip by the PIC happened during a period of high workload as the aircraft simultaneously stopped descending and started to turn right at PAULA. The PIC did not detect the slip during the highly rehearsed task.

The check by the copilot of the displayed altitude on the FCU against the PIC's altitude call was a data entry check only, and was not intended to verify that the correct altitude had been set. The copilot's subsequent query of this revised altitude, and the PIC's check against the same incorrect height constraint on the MCDU effectively negated this action as a safety defence. As a result, both pilots remained unaware that the descent was too low until alerted by ATC.

Had ATC not intervened, or the crew not subsequently noticed the incorrect 2,000 ft limiting altitude, the anomalous FMGS data would have resulted in the aircraft intercepting the instrument landing system glideslope at 2,000 ft instead of the 2,500 ft as stipulated on the approach chart. During the intervening period at 2,000 ft, the aircraft would have had a minimum of 500 ft clearance from obstacles instead of the intended 1,000 ft.

Once alerted by ATC, the flight crew re-established the correct flight profile. The aircraft's Terrain Awareness Warning System, which was a further risk control, was not activated.

FINDINGS

From the evidence available, the following findings are made with respect to the flight profile deviation, and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The aircraft's Flight Management and Guidance System database included incorrect data for the ARBEY ONE ALPHA arrival/runway 27 Instrument Landing System approach, increasing the risk that crews would descend below the published minima for the approach.
- The flight crew's pre-descent procedures did not identify the incorrect flight profile in the aircraft's Flight Management Guidance System.
- The pilot flying based the descent limit for the approach on the incorrect descent profile displayed on the Multipurpose Display and Control Unit, instead of the descent clearance that was provided by air traffic control (ATC), negating the ATC input as a safety defence.
- The inconsistent application of the operator's safety management system to the identification and rectification of database anomalies, and intermittent notification of these anomalies to crews increased the risk of inadvertent flight crew non-compliance with published instrument approach procedures. *[Significant safety issue]*
- The operator's lack of awareness of the data providers' assumption that the operator was complying with DO-200A *Standards for Processing Aeronautical Data*, which was not mandated in Australia, meant that the quality of the data was not assured. *[Significant safety issue]*

Other key finding

- Air traffic control intervened to alert the flight crew of their descent below minima, allowing them to re-establish their aircraft at the cleared altitude.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety 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.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Tiger Airways

Database content

Although no organisational or systemic issue was identified in respect of the compilation of the database by the Type 1 provider, the operator, in collaboration with its database suppliers has modified the navigational database. This modification ensures that aircraft will not descend below 2,500 ft on the ARBEY ONE ALPHA arrival/runway 27 Instrument Landing System (ILS) approach until intercepting the ILS glideslope at Melbourne Airport, Victoria if the aircraft is operated in the correct flight mode in compliance with the standard operating procedures (Figure 3).

Figure 3: Multipurpose Control and Display Unit

The yellow box indicates the displayed limiting altitude.

Inconsistent application of the operator's safety management system

Significant safety issue

The inconsistent application of the operator's safety management system to the identification and rectification of database anomalies, and intermittent notification of these anomalies to crews increased the risk of inadvertent flight crew non-compliance with published instrument approach procedures.

Data integrity

Significant safety issue

The operator's lack of awareness of the Type1 data providers' assumption that the operator was complying with DO-200A *Standards for Processing Aeronautical Data*, which was not mandated in Australia, meant that the quality of the data was not assured.

Action taken by Tiger Airways

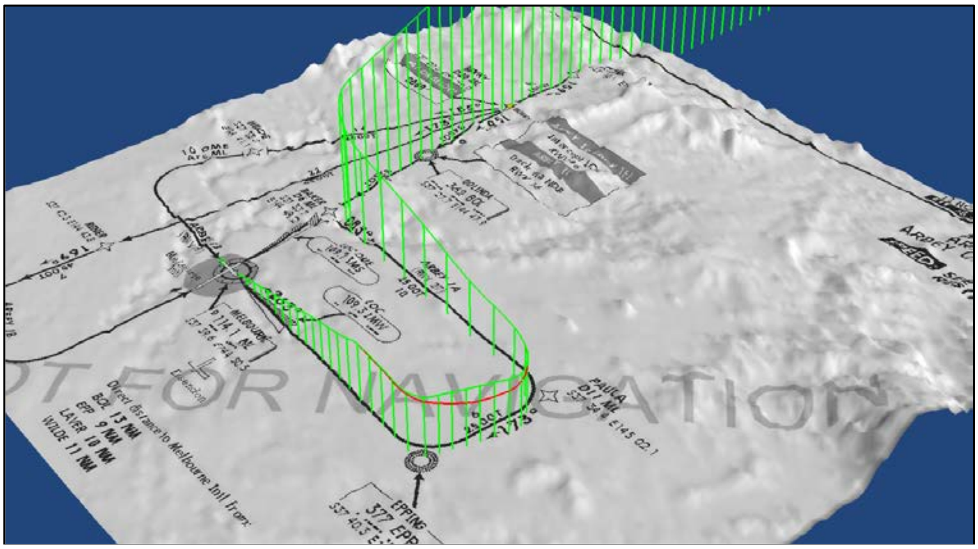
In response to these safety issues, the operator has enhanced its safety management system in respect of its data management. These auditable enhancements include the:

- Introduction of a controlled system and designated manager to ensure the consistent notification by flight crew of identified data anomalies.
- Requirement for the immediate management of reported data anomalies and their notification to all flight crew.
- Establishment of an anomaly rectification process that records actions and notifies the data supplier.
- Requirement to validate any updated database notifications prior to their use.
- Acquittal of rectified data anomalies and their notification to flight crew.

ATSB assessment of response/action

The ATSB is satisfied that the action taken by Tiger Airways will adequately address these safety issues.

APPENDIX A: MELBOURNE ARBEY ONE ALPHA ARRIVAL/RUNWAY 27 INSTRUMENT LANDING SYSTEM APPROACH[14]



The descent profile from the ARBEY ONE ALPHA arrival/runway 27 Instrument Landing System approach chart has been overlaid in green on a depiction of the terrain. The orange/red line depicts the altitude change (descent to and recovery from 2,000 ft) during the occurrence flight.

14 Reproduced courtesy of Jeppesen.

APPENDIX B: SOURCES AND SUBMISSIONS

Sources of information

The sources of information during the investigation included the:

- flight crew
- Types 1 and 2 data providers
- aircraft operator.

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 flight crew, the operator, the Types 1 and 2 data providers and the Civil Aviation Safety Authority. A submission was received from the aircraft operator. The submission was reviewed and where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
Operational non-compliance - Airbus A320-232, VH-VNG,
17 km ENE of Melbourne Airport, Victoria

AO-2011-070
Final