Australian Government
Australian Transport Safety Bureau

Descent below segment minimum safe altitudes involving Airbus A320-232 VH-VQA

near Queenstown, New Zealand | 16 July 2012

Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation
AO-2012-103
Final – 13 March 2014

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

Publishing information

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Addendum

Page	Change	Date
18	Wording of safety issue made consistent with findings and safety action number corrected	12 Mar 2014
20	Occurrence type corrected	12 Mar 2014

Safety summary

What happened

On 16 July 2012 at about 0830 New Zealand Standard Time, an Airbus A320-232 aircraft, registered VH-VQA and operated by Jetstar Airways, was conducting an Area Navigation (Required Navigation Performance) approach to runway 05 at Queenstown, New Zealand. During the approach the aircraft descended below two segment minimum safe altitudes. Upon recognising the descent profile error, the crew climbed the aircraft to intercept the correct profile and continued the approach to land.

What the ATSB found

The ATSB found that, contrary to their intentions, the crew continued descent with the auto-flight system in open descent mode, which did not provide protection against infringing the instrument approach procedure's segment minimum safe altitudes. The ATSB also found that the crew were not strictly adhering to the operator's sterile flight deck procedures, which probably allowed the crew to become distracted.

The ATSB found that the operator's procedures did not specifically draw the crew's attention to unchanged auto-flight system modes during descent or prompt crew reconsideration of the most suitable descent mode at any point during descent. Additionally, the operator's procedures allowed the crew to select the altitude to which they were cleared by air traffic control on the Flight Control Unit altitude selector, irrespective of intervening altitude constraints. This combination of procedures provided limited protection against descent through segment minimum safe altitudes.

What's been done as a result

Following this occurrence, the operator included additional guidance material in its Flight Crew Training Manual regarding mode awareness. It also included a warning on its Queenstown approach charts to state that managed descent was required beyond the initial approach fix.

Safety message

The ATSB reminds operators and flight crew of the importance of continuous attention to active and armed auto-flight system modes. Equally, the ATSB stresses the importance of continually monitoring descent profiles and an aircraft's proximity to segment minimum safe altitudes, irrespective of any expectation that descent is being appropriately managed by the auto-flight system. For flight crew, this occurrence illustrates once again the fallibility of prospective memory and the potentially serious effects of pilot distraction. For operators, it highlights the importance to safe operations of robust management procedures for auto-flight systems.

Contents

The occurrence

On 16 July 2012, an Airbus A320-232 (A320) aircraft, registered VH-VQA and operated by Jetstar Airways, was conducting a flight from Auckland to Queenstown, New Zealand, with the captain as the pilot flying. At about 0815 New Zealand Standard Time[1] the crew commenced descent from their cruising altitude of flight level (FL)[2] 360. The crew was operating the auto-flight system in open descent mode during the descent.

Soon after 0823, when passing about FL 180, the crew was cleared by air traffic control (ATC) to make an RNAV (RNP) Z[3] approach to runway 05 at Queenstown, which in this case involved tracking via waypoint HAWEA (Figure 1). When cleared for the approach by ATC, the captain:

- selected the Vertical Intercept Point (VIP)[4] (waypoint CRNET) altitude of 6,300 ft on the Flight Control Unit (FCU) altitude selector in accordance with the operator's procedures
- selected approach mode[5] by pressing the approach (APPR) push-button on the FCU
- announced that 'approach nav, final blue' was displayed on the Flight Mode Annunciator (FMA).

The captain later reported[6] that they intended to switch from open descent mode to managed descent mode when approach mode was selected, but that action was unintentionally omitted on this occasion.

In open descent mode, the aircraft was in an unrestricted descent to 6,300 ft to intercept the final approach path, tracking laterally via the waypoints defined on the instrument approach procedure. Just before 0830, the aircraft infringed the 8,000 ft segment minimum safe altitude between waypoints CRIFL and QN436, and continued descent beneath the 7,300 ft segment minimum safe altitude between waypoints QN436 and VANGA (Figure 1).

At about 0831 and nearing 6,300 ft above mean sea level, the first officer was alerted by a sensation they described as 'going too fast'. They noticed the radio altimeter[7] indicating about 2,300 ft above ground level and a rate of descent at that moment of around 2,100 ft per minute, and alerted the captain accordingly. The captain checked the altimeter, realised the problem and commenced a climb using the auto-flight vertical speed mode.[8] The aircraft climbed to 7,300 ft above mean sea level near waypoint VANGA, which was the applicable minimum altitude at that

1 New Zealand Standard Time is Coordinated Universal Time (UTC) plus 12 hours.

2 At altitudes above 13,000 ft in New Zealand, an aircraft's height above mean sea level is referred to as a flight level (FL). FL 360 equates to 36,000 ft.

3 Area Navigation (Required Navigation Performance) (RNAV (RNP)) instrument approach procedures require the application of performance-based navigation specifications requiring specific standards of equipment and on-board navigation system monitoring capabilities. Required equipment includes a flight management system and advanced flight deck display systems.

4 The VIP is the point on an RNAV (RNP) procedure from which a constant angle vertical flight path is defined. The aircraft must be established on the correct vertical profile with the auto-flight system engaged in final approach mode before proceeding beyond the VIP.

5 Selecting approach mode sets the auto-flight system to intercept and follow the programmed final approach path.

6 Due to an administrative oversight, the operator did not report the occurrence to the ATSB until about 1 month after the occurrence. Due to this delay and its likely impact on the crew's recollections, the ATSB sought a copy of the operator's investigation report, which included information from the operator's interviews of the flight crew. These interviews were undertaken by the operator soon after the occurrence, on 18 July 2012. The operator's report was provided to the ATSB on 27 August 2012 and, given the level of detail provided in the operator's report, including of the flight crew's recollections of the occurrence, the ATSB elected not to re-interview the crew directly, instead using references to the crew's recollection of the occurrence as documented in the operator's report.

7 The radio altimeter measures and displays the distance from the aircraft to the ground beneath.

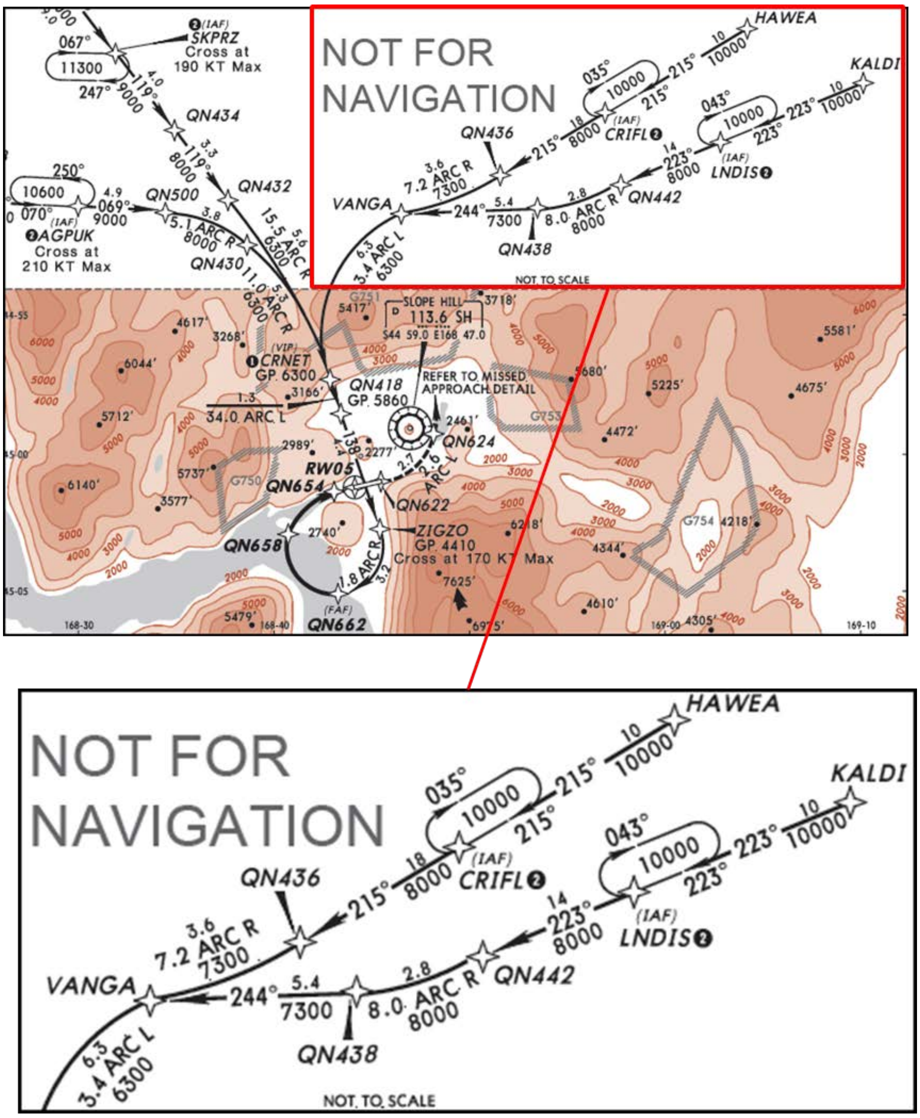
8 Vertical speed mode is an auto-flight vertical navigation mode that allows the crew to select a desired aircraft positive (climb) or negative (descent) vertical speed.

point. The auto-flight system momentarily captured 7,300 ft before the final approach mode[9] engaged and the approach continued normally.

The minimum recorded radio altimeter reading was 1,097 ft above ground level, just beyond waypoint QN436. The elapsed time between the point at which the captain intended to switch to managed descent mode and the point at which the descent profile was corrected was about 7 minutes. The aircraft was below the 8,000 ft and 7,300 ft segment minimum safe altitudes for a total time of just over 2 minutes.

Figure 2 shows the descent profile in relation to the procedure waypoints and published segment minimum safe altitudes, along with the auto-flight descent mode at each relevant stage of the descent and the radio altimeter indication.

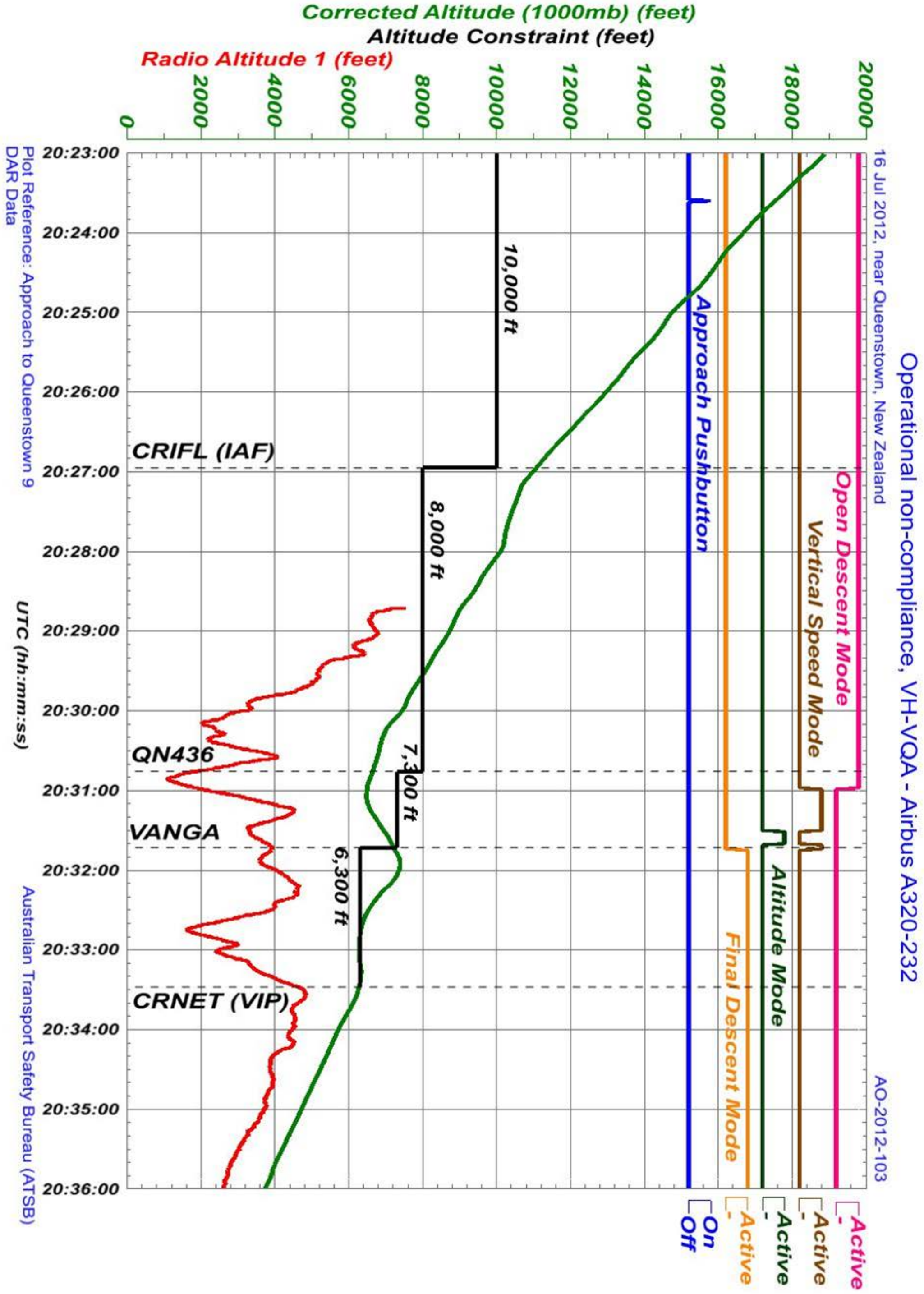
Figure 1: Excerpt from Queenstown RNAV (RNP) Z Runway 05 approach chart



Source: Jeppesen

9 In final approach mode the auto-flight system follows an FMGS-programmed descent path (and lateral path), similar in some respects from a pilot perspective to the glideslope associated with instrument landing system procedures.

Figure 2: Descent profile and auto-flight descent modes[10]



Source: ATSB

[10] The approach push-button parameter indicates a pressing of the APPR push-button on the FCU. This has the effect of arming the autopilot and/or flight director to capture approach guidance.

Context

Flight crew

Captain

The captain had over 14,000 hours flying experience, including about 6,000 hours on Airbus A319/320 aircraft, and commenced operations into Queenstown in May 2012. The captain was on leave in the days prior to 16 July 2012, although they prepared for the occurrence flight during the day on 15 July 2012. They did not report any fatigue-related concerns associated with the occurrence flight.

First officer

The first officer had about 9,500 hours flying experience, including about 2,500 hours on Airbus A320 aircraft. They had operated into Queenstown regularly for about 3 years, including twice during the day prior to the occurrence, and were very familiar with Queenstown operations.

The first officer had conducted flights over the previous 3 days, with the duty period the previous day ending at 1723. This allowed more than a 12-hour break prior to starting duty at 0600 on the day of the occurrence. The first officer did not report any fatigue-related concerns associated with the occurrence flight.

Operational environment

Queenstown Airport is located in a basin, surrounded by mountainous terrain in all directions. Local weather can present challenging flying conditions, particularly when strong winds generate windshear and turbulence. At the time of the occurrence, the in-flight conditions were fine and clear, and the captain reported that there was a 40 kt tailwind during the initial part of the descent. The 0758 Queenstown Automatic Terminal Information Service[11] broadcast indicated that arriving aircraft could expect a visual approach to runway 05, with the wind from 350 °M at 7 kt, a visibility of 70 km and few[12] clouds with a base at 4,000 ft above the airport.

The occurrence flight was unaffected by other air traffic during the arrival phase. The first officer described the occurrence flight as 'routine' in contrast to other occasions when inclement weather, delays, speed control and traffic sometimes complicated the operational environment.

There was no radar or terrain alerting capability available to Queenstown ATC at the time of the occurrence. Wide area multilateration[13] surveillance coverage was available in the Queenstown basin, but this system was intended as a situation awareness tool for ATC, not to facilitate aircraft separation or to support a terrain alerting function.

Aircraft information

Auto-flight descent modes

Managed descent mode

Flight crews normally control the descent of an Airbus A320 using the aircraft's auto-flight system in either managed descent mode or a selected descent mode. With the managed descent mode

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[11] An automated pre-recorded transmission indicating the prevailing weather conditions at the aerodrome and other relevant operational information for arriving and departing aircraft.

[12] Cloud cover is normally reported using expressions that denote the extent of the cover. The expression Few indicates that up to a quarter of the sky was covered

[13] A multilateration (MLAT) surveillance system tracks transponder-equipped aircraft and vehicles using multiple remote sensors. MLAT systems provide improved coverage in mountainous terrain compared to ground-based radar surveillance systems.

engaged, the aircraft follows a descent profile computed by the Flight Management Guidance System (FMGS)[14] based upon the flight plan and descent conditions entered by the crew. This mode is only available if the aircraft follows a programmed lateral track. During descent in managed descent mode, the FMGS optimises the descent profile and ensures compliance with all programmed altitude constraints without crew intervention.

Depending on the nature of the approach, the FMGS either maintains priority to idle thrust, flight path following or speed constraint. This may result in limited speed excursions within displayed minimum or maximum values and/or slight deviations from a pre-computed flight path when the aircraft is subjected to unexpected wind variations during descent.

Selected descent modes

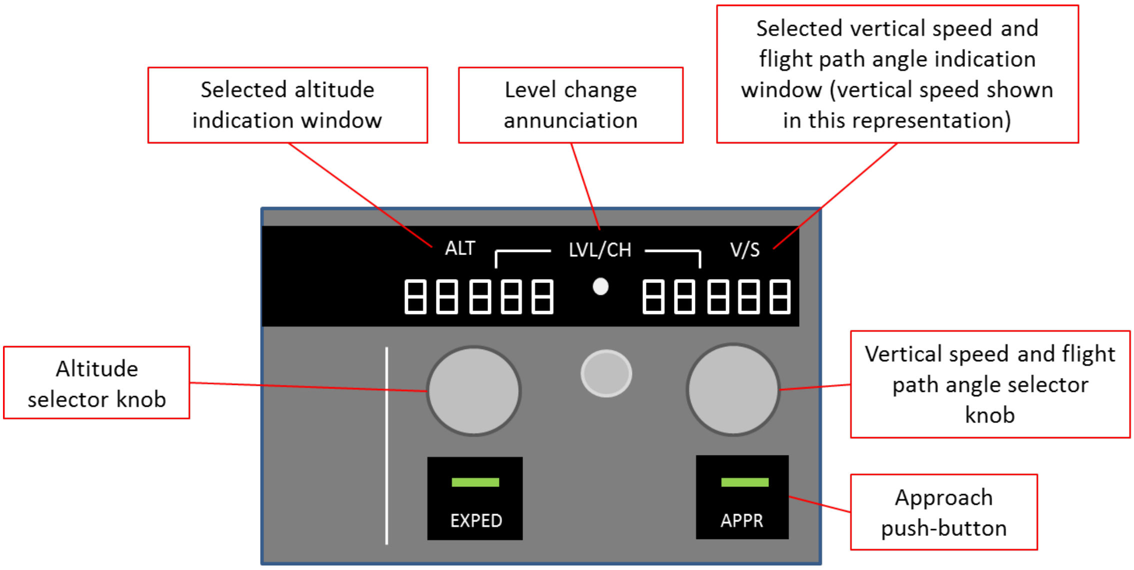
In a selected descent mode, the flight crew controls the aircraft descent by making appropriate selections on the FCU. Selected descent modes include open descent, vertical speed (V/S) and flight path angle (FPA).

In open descent mode the auto-flight system adjusts the aircraft pitch attitude to maintain a set speed (selected by the crew on the FCU or programmed into the FMGS) with engine thrust at idle. The aircraft descends to the altitude selected by the crew on the FCU, disregarding any intervening FMGS-programmed altitude constraints. Flight crews sometimes prefer to use open descent mode to facilitate a more active approach to descent profile management and to avoid undesirable speed variations sometimes associated with managed descent mode.

Descent mode selection and annunciation

Open descent mode is engaged by pulling the altitude selector knob on the FCU. The switch from open descent mode to managed descent mode is made by pushing the altitude selector knob. Figure 3 provides a representation of the vertical mode management panel of the FCU.

Figure 3: Representation of FCU vertical mode management panel



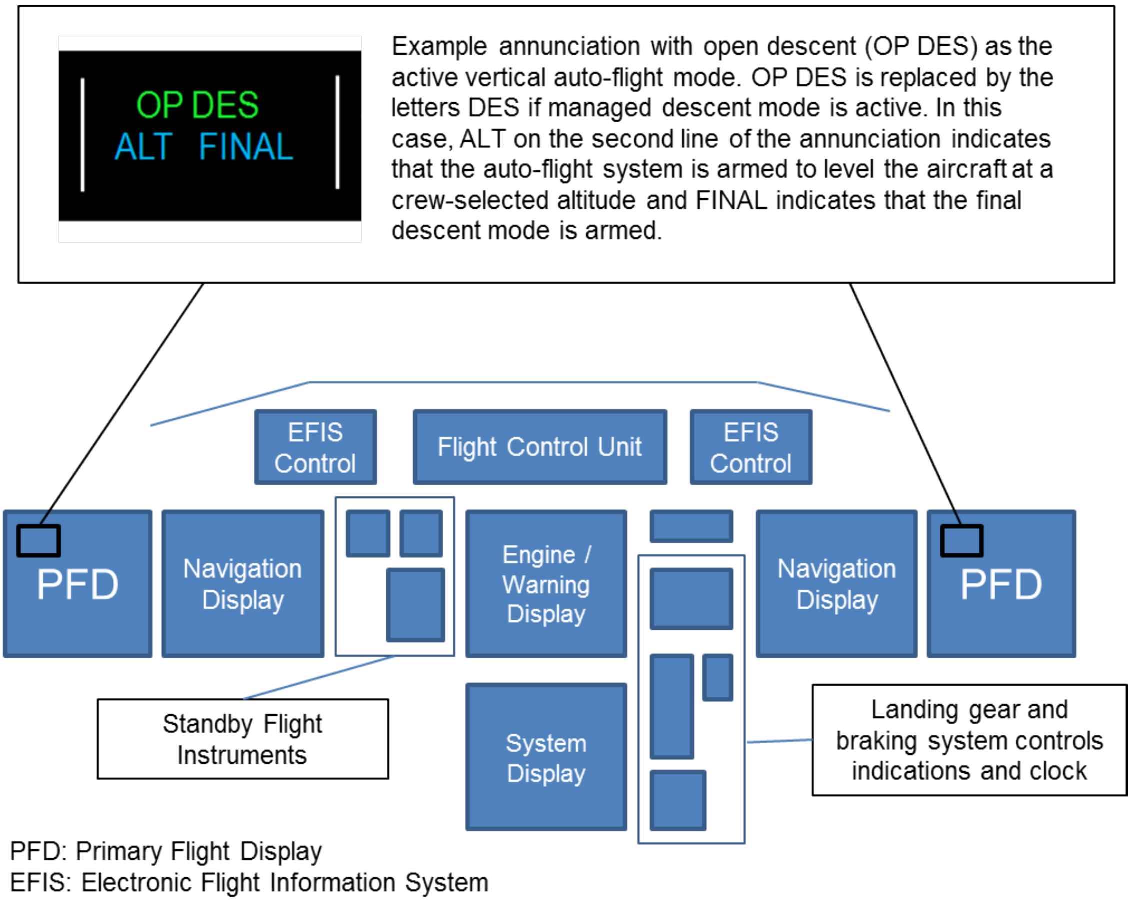
Source: Airbus modified by the ATSB

The descent mode selected by the crew is annunciated on the FMA located at the top of each pilot's Primary Flight Display (PFD). The FMA informs the crew of the status of the auto-flight system by displaying a range of information. The active vertical auto-flight mode is displayed in green lettering on the top line of the FMA, bordered on the left by the speed/auto-thrust mode, and

[14] The FMGS performs a range of functions including lateral and vertical aircraft navigation and automated flight guidance. The crew interfaces with the FMGS using either the FCU (typically for short-term changes to flight parameters) or the Multipurpose Control and Display Unit (described later).

on the right by the auto-flight lateral mode. Managed descent mode is annunciated by 'DES' and open descent mode is annunciated by 'OP DES'. The armed mode is annunciated on the second line of the FMA to inform the crew of the mode to which the auto-flight system will next sequence. A white box is displayed around new annunciations for 10 seconds when the FMA changes. Figure 4 shows the location of the FMA and an example FMA vertical mode annunciation.

Figure 4: Representation of relevant flight deck displays and example FMA annunciation



Source: ATSB

Other indications of descent mode

Although the FMA is the only direct and authoritative indication of the active auto-flight mode, other displays provide a less direct indication of the active descent mode. Examples of indirect indications of the active descent mode include:

- The white level change (LVL/CH) dot on the FCU illuminates when the auto-flight system is in managed descent mode to a selected altitude (Figure 3). In open descent mode, this dot is extinguished.
- The navigation display includes a range of symbols, some of which may provide an indirect indication of the active descent mode.
- The altitude bug (when visible) and target altitude on the altitude scale of each pilot's PFD are colour-coded in a manner that provides an indirect indication of whether the active descent mode is managed or selected.
- The aircraft's descent progress relative to the FMGS-computed descent profile is displayed by a symbol adjacent to the altitude scale. The symbol moves above the central position as the aircraft descends beneath the FMGS-computed profile, and below the central position as the aircraft deviates above the FMGS-computed descent profile. Deviation from the FMGS-computed descent profile is also presented as digital value on the Progress page of the

Multi-purpose Control and Display Unit (MCDU).[15] Significant and sustained deviation from the FMGS-computed descent profile may in some circumstances provide an indirect indication that the aircraft is in a selected rather than managed descent mode.

Flight Control Unit altitude selector

The flight crew use the FCU altitude selector to enter a target altitude, which is displayed in the corresponding window (Figure 3). When a target altitude is selected, 'ALT' appears in blue as the armed auto-flight system mode on the second line of the FMA to indicate that descent will continue to that altitude, at which point the auto-flight system will level the aircraft to maintain that altitude. During descent to a selected altitude, the selected altitude itself also appears in blue figures beneath the altitude scale on each pilot's PFD.[16]

Enhanced Ground Proximity Warning System

The aircraft was fitted with an Enhanced Ground Proximity Warning System (EGPWS). The EGPWS considers a range of data and in-flight parameters, and provides a distinctive warning to flight crew if the aircraft enters a potentially hazardous position in relation to the earth's surface. No EGPWS warnings were triggered during this occurrence.

Operator information

Queenstown operations

At the time of the occurrence, the operator was approved to conduct RNAV (RNP) approaches by the Australian Civil Aviation Safety Authority (CASA) under Instrument number CASA 314/11. This Instrument outlined instructions and conditions relevant to the conduct of RNAV (RNP) operations.

The operator's Queenstown flights were restricted to specifically qualified pilots. The captain and first officer were specifically trained and approved for Queenstown operations. Such pilots were selected based upon a range of considerations including experience, a history of sound operational performance and good communication and teamwork skills. Selected pilots were also required to participate in a Queenstown-specific training and checking program, which included emphasis on the conduct of RNAV (RNP) operations.

Relevant operational procedures

Auto-flight descent mode management procedures[17]

The operator's *A320/A321 Flight Crew Operating Manual OM4A* (FCOM) and *A320/321 Flight Crew Training Manual OM18A* (FCTM) discussed descent management in a number of sections. They described the nature of each auto-flight descent mode in detail, along with the associated annunciations and display indications, and the characteristics of each mode.

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15 Two MCDUs are installed on the centre pedestal to enable pilots to enter and display data, including flight plan, vertical and lateral trajectory, and speed information.

16 The letters ALT on the FMA and the figure beneath the altitude scale on the PFD appear in blue if the auto-flight system will level the aircraft at the altitude selected by the crew on the FCU. The same letters on the FMA and the figure beneath the altitude scale appear in magenta if the auto-flight system will level the aircraft at an FMGS-programmed altitude constraint (which requires that managed descent mode is the active auto-flight descent mode).

17 Note that this section deals with vertical auto-flight modes used during the descent phase of flight before the auto-flight system sequences to final approach mode. During an RNAV (RNP) approach, the operator's procedures required that final approach mode be active before the final approach fix, or earlier defined point, which in this case was the approach procedure Vertical Intercept Point (VIP). In final approach the auto-flight system follows a defined lateral and vertical path.

Guidance provided by the operator suggested that when following an FMGS-programmed lateral track, managed descent mode is generally the preferred descent auto-flight mode. The FCOM stated:

> The normal method of initiating the descent is to select DES mode at the FMGS computed top of descent.

Under the heading of Descent Monitoring, the FCOM made the more prescriptive statement:

> When flying in NAV[18] mode, use DES mode.

With regard to descent mode selection, the FCTM stated:

> ... the crew can use either the managed descent mode (DES) or the selected descent modes (OP DES or V/S).

The FCTM suggested that open descent and vertical speed modes could be used for 'pilot tactical interventions', indicating that they could be used where a more active approach to descent management was required.

Broadly interpreted, although managed descent mode was the normal and generally preferred descent mode, the operator's manuals acknowledged that a selected descent mode may be appropriate in some circumstances. The manuals made frequent reference to the fact that programmed altitude constraints were disregarded when a selected descent mode such as open descent mode was engaged.

Operations Manual OM2A Route Manual Supplement A320/A321/A330

The operator's Operations Manual OM2A *Route Manual Supplement A320/A321/A330* provided direction and guidance to pilots with respect to specific destinations, including Queenstown. A range of information concerning Queenstown operations was provided, including the comment:

> A high level of awareness is required with respect to proximity with terrain...

The Queenstown information also included the following caution in highlighted text:

> Approach charts specify minimum segment altitudes prior to the VIP. Managed descent mode provides protection against infringing these minimum altitudes. If selected vertical modes are used, pilots must exercise caution in complying with these altitudes. It is strongly recommended that pilots use managed descent mode in preference to selected vertical modes. Especially when re-intercepting the vertical path from above prior to the VIP.

The captain and first officer indicated that they were aware of the operator's recommendations regarding descent mode selection. Both also indicated that it was not uncommon for the operator's pilots to initiate descent in open descent mode. The operator advised that it conducted a special purpose audit of its Queenstown operations in February 2012. During the three observational flights conducted during this audit, it was noted that the aircraft's speed and configuration was in line with OM2A and the aircraft was flown 'fully managed' for the entire approach.

Descent monitoring procedures

The operator's procedures provided guidance regarding descent monitoring. This included the reference to appropriate pages on the MCDU and the use of vertical profile information on the PFD where applicable.

FMA-related procedures

The operator's procedures required the pilot flying to 'announce' the FMA following the initiation of the descent, and for the pilot not flying to check that annunciation. This requires the pilot flying to state the auto-flight mode change annunciated on the FMA associated with the commencement of descent, and the pilot not flying to check the annunciation and respond by stating 'checked'. The

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18 NAV (navigation) mode means the auto-flight system will follow the FMGS-programmed lateral track.

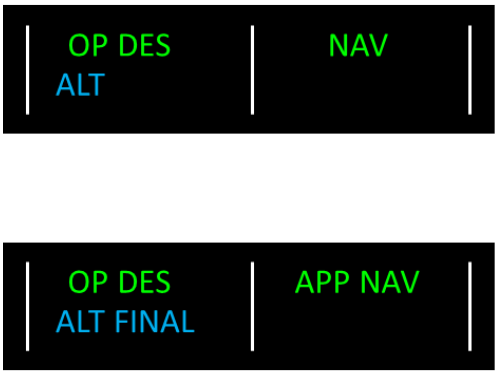
intent of this procedure was to confirm that descent had commenced in the mode intended by the crew, and that both crew members were aware of the status of the auto-flight system. The descent procedure also required the descent to be monitored.

The operator’s procedures stated that the pilot flying should announce any FMA changes, including all armed modes and their associated colour and all active modes without the associated colour. The procedures also stated that the pilot not flying should check all FMA changes called out by the pilot flying and respond. This check ensured that any change in the status of the auto-flight system was mutually acknowledged by both pilots, and confirmed that the auto-flight system was set to control the aircraft in the manner intended by the pilot flying.

The captain reported that, after the crew were cleared for the approach and had selected the APPR push-button, they announced the FMA changes as ‘approach nav, final blue’. This announcement would have reflected the active lateral mode (approach) and armed vertical mode (final) annunciations that would both have changed when the approach mode was selected. A representation of the FMA vertical and lateral mode changes that would have been apparent when the approach mode was selected is included in Figure 5. The FMA changes would also have been surrounded by a white box for 10 seconds following the change. There was no specific requirement for the captain to announce or check the active descent mode at that point as it was unchanged.

The captain indicated that it was their normal practice to ensure that managed descent mode was the active descent mode when approach mode was selected, but it was overlooked on this occasion. The first officer also commented that although it was their normal practice to check that managed descent mode was selected when approach mode was selected, and the check was something they were trained to do, it was unintentionally omitted on this occasion.

Figure 5: Representation of FMA vertical and lateral modes before and after the approach mode was selected (APPR push-button pressed)



FMA vertical and lateral modes before approach mode was selected.

OP DES: Open descent mode.
ALT: Auto-flight system armed to level the aircraft at the crew-selected altitude.
NAV: Auto-flight system in lateral navigation mode tracking FMGS-programmed waypoints.

FMA vertical and lateral modes after approach mode was selected (APPR push-button pressed).

OP DES: Open descent mode (unchanged).
ALT FINAL: Auto-flight system armed to level the aircraft at the crew-selected altitude and intercept final descent path.
APP NAV: Auto-flight system in lateral approach navigation mode tracking FMGS-programmed approach waypoints. If the auto-flight system is in NAV mode, APP NAV immediately becomes the active lateral mode when the approach mode is selected (APPR push-button pressed).

Source: ATSB

The importance of mode awareness when operating advanced aircraft auto-flight systems is well documented. Airbus has published a series of Flight Operations Briefing Notes, one of which was titled *Operations Golden Rules*. One ‘golden rule’ is ‘Know your guidance at all times’. This was mirrored in the operator’s FCTM, which included ‘Know your FMA at all times’ as an ‘Operational Golden Rule’. The operator advised that the golden rules were embedded in its operation and regularly emphasised throughout its flight crew training. In addition, mode awareness was also specifically discussed during its flight crew initial and recurrent training programs.

FCU altitude selection procedures

The operator's procedures allowed a crew to select the VIP altitude on the FCU altitude selector during an RNAV (RNP) approach when appropriately cleared for the approach by ATC, irrespective of any intervening altitude constraints. There was no specific requirement to check the descent mode when the VIP altitude was selected.

During the investigation, Airbus stated that when selecting the open descent mode, the flight crew must be aware that this mode disregards all the altitude constraints and that the aircraft's altitude target will be the selected FCU altitude. Airbus advised that, in the framework of effectively managing threats and errors, the selection of open descent with the selected FCU altitude below the applicable segment minimum safe altitude should be avoided.

Sterile flight deck procedures

The captain and first officer advised that they were engaged in conversation of a non-operational nature during the period when the incident occurred, and they were not strictly adhering to the operator's sterile flight deck procedures.

Sterile flight deck procedures are intended to restrict fight deck conversation during the safety-critical and high workload phases of flight to important operational matters, thereby reducing the likelihood of unnecessary pilot distraction. United States Federal Aviation Regulations 121.542 and 135.100 mandate sterile flight deck procedures, which prohibit non-essential conversation by pilots during critical phases of flight. For the purposes of those regulations, descent below 10,000 ft is considered a critical phase of flight.

Although there were no specific Australian regulatory requirements, the operator of VH-VQA required that sterile flight deck procedures be adopted during specific phases of flight. During descent, the operator's policy required that pilots observe sterile flight deck procedures from the time the public address announcement 'Cabin crew prepare the cabin for landing' was made by the flight crew on passing 20,000 ft, until arrival at the terminal.

The operator's Operations Manual OM1 (*Administration A320/A321/A330*) stated:

> ... activities, conversations, comments, radio communications and the like shall be strictly confined to matters directly associated with the operation of the aircraft during these phases of flight.

The outcomes of a 2009 Line Operations Safety Audit (LOSA) by Jetstar Airways suggested that the incidence of non-adherence to sterile flight deck procedures was relatively rare, although when they did occur they were usually not corrected by the other flight crew.

Related occurrences

Mode awareness occurrences

Ineffective auto-flight system mode awareness has been identified as a contributing factor in many occurrences since the introduction of complex auto-flight systems (Federal Aviation Administration 1996). A recent report into operations of flight path management systems (PARC/CAST Flight Deck Automation Working Group 2013) stated:

> The 1996 FAA report identified insufficient autoflight mode awareness as an important vulnerability area…
>
> Since that report was published, some changes to flight deck equipment design have been made in new aircraft to address this vulnerability area (e.g., only showing selected target values or modes on the PFD, to foster the pilots reviewing the information on the mode annunciator display rather than on the mode selection panel).
>
> In addition, the issue has been addressed in training through increased emphasis on mode awareness and in some operators' flightcrew procedures by having the pilots call out all mode changes. However, other operators find this use of callouts to be too burdensome and a potential distraction.

> These mitigations are only partially successful. The data analysis reveals that autoflight mode selection, awareness and understanding continue to be common vulnerabilities…

The report made several broad recommendations to address this and related concerns.

The operator was not aware of any other occurrences where one of its flight crews had intended to switch to a particular mode at a later point in a flight but unintentionally omitted to make the change. The aircraft manufacturer could also not recall any previous occurrences that were directly similar to the 16 July 2012 occurrence involving VH-VQA.

The ATSB is aware of two recent occurrences on scheduled passenger transport flights where a flight crew intended to switch from one mode to another mode a short time later but unintentionally overlooked the intended mode change. These involved different operators and a different aircraft type to the occurrence involving VH-VQA, but the fundamental nature of these occurrences is similar (see www.atsb.gov.au).

ATSB investigation AO-2012-040[19]

On 12 February 2012, the flight crew of a Boeing 737 aircraft 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 a VOR[20] approach to runway 35. 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.

The ATSB found that at the time of the occurrence the automatic flight system was in level change (LVL CHG) mode rather than the vertical navigation (VNAV) mode specified by the operator for such approaches. In LVL CHG mode, the aircraft descended to the altitude selected by the crew on the mode control panel, ignoring flight management computer altitude constraints. VNAV mode is similar to the A320 managed descent mode.

The crew had selected LVL CHG mode to account for the influence of an unexpected tailwind earlier during the arrival, believing that LVL CHG mode would be more effective in maintaining the optimum descent profile while decelerating to comply with a procedure speed restriction. The crew intended to reselect VNAV mode following compliance with the speed restriction, which would have ensured continued descent in compliance with segment minimum safe altitudes, but overlooked that re-selection. While in LVL CHG mode the flight crew had selected an altitude lower than the applicable segment minimum safe altitude, with the effect that the aircraft continued descent in LVL CHG mode through that altitude.

ATSB investigation AO-2013-041[21]

On 4 January 2013, a Boeing 737 aircraft was on a scheduled passenger service from Launceston, Tasmania to Melbourne, Victoria. Soon after take-off, the auto-flight system was selected to LVL CHG mode. In LVL CHG mode, the aircraft climbed at a constant airspeed to about flight level FL 260, when the auto-flight system sequenced automatically to continue the climb at a constant Mach number. The flight crew, who were experiencing a relatively high workload at the time associated with the short sector, intended to switch to a different vertical

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19 ATSB investigation report AO-2012-040 *Descent below minimum safe altitude involving Boeing 737, VH-TJS* dated 5 July 2013.

20 VHF Omnidirectional Radio Range. A ground-based navigation aid that emits a signal that can be received by appropriately-equipped aircraft and represented as the aircraft's bearing (called a 'radial') to or from that aid.

21 ATSB investigation AO-2013-041 has yet to be published. The information included in this report is taken from an ATSB web update released on 21 May 2013.

mode during the climb that would have accelerated the aircraft in accordance with a programmed speed schedule. However, they overlooked that selection and unintentionally continued to climb in LVL CHG mode.

As the aircraft continued to climb at a constant Mach number, the airspeed slowly reduced. The crew did not detect the reducing airspeed until the aircraft was approaching the minimum manoeuvre speed at about FL 350. In responding to the low speed condition and attempting to accelerate, the crew reduced the aircraft pitch attitude to the point that the aircraft entered a shallow descent. Soon after, the crew was able to establish an accelerated climb to the intended cruising level.

Safety analysis

Introduction

During descent into Queenstown, New Zealand on 20 July 2012, the Airbus A320 infringed two segment minimum safe altitudes because the active auto-flight open descent mode descended the aircraft directly to the altitude selected by the crew on the Flight Control Unit (FCU) without regard to any intervening instrument approach procedure minimum altitudes. The captain had intended to switch the auto-flight system to managed descent mode, which would have controlled the descent profile in a manner that ensured compliance with the segment minimum safe altitudes, but overlooked that selection on this occasion. As a consequence, the aircraft continued descent in open descent mode until external visual cues, the radio altitude and the vertical speed alerted the first officer to the descent profile anomaly.

Although descent continued beneath the two segment minimum safe altitudes for just over 2 minutes, a collision with terrain was highly unlikely given the fine and clear in-flight conditions and other risk controls such as the aircraft's Enhanced Ground Proximity Warning System (EGPWS). Nevertheless, the occurrence highlighted important information regarding auto-flight mode selection during descent, mode awareness and related procedures.

Use of open descent mode

The operator's procedures generally encouraged the use of managed descent mode during descent, and strongly recommended the use of managed descent mode for descents into Queenstown, to ensure terrain clearance. The operator advised that during the regulatory approval process for its Queenstown operations, it had discussed with the Australian Civil Aviation Safety Authority (CASA) whether to mandate the use of managed descent mode at Queenstown. However, the operator settled on 'strongly recommended' in order to 'provide flight crew with flexibility and discretion in managing their flight profile in accordance with prevailing conditions and traffic status'.

During the occurrence flight, the captain was conscious of a 40 kt tailwind early in the descent and was concerned with the importance of arriving at the Vertical Intercept Point (VIP) on the correct profile to intercept the final descent path. They elected to use open descent as a more active approach to managing the descent profile. Both the captain and first officer reported that the decision to initiate descent in open descent mode was not uncommon in such circumstances. The aircraft manufacturer noted that the managed descent profile takes into account the wind data entered by the crew into the Multi-purpose Control and Display Unit. Entering the 40 kt tailwind and using managed descent would allow the flight management system to guide the aircraft to the VIP while respecting any relevant altitude constraints.

Prompts for switching to managed descent mode

In electing to initiate descent in open descent mode, the captain was relying on their memory to draw attention to the requirement to switch to managed descent mode. The captain's intended prompt was clearance for the approach by air traffic control (ATC), which was accompanied by selecting 6,300 ft on the FCU altitude selector, selecting approach mode by pressing the APPR push-button on the FCU, and announcing the auto-flight mode changes on the Flight Mode Annunciator (FMA) ('approach nav, final blue'). The captain reported successfully using clearance for the approach as the prompt to change to managed descent mode on previous flights. Similarly, the first officer also reported that it was their normal practice to confirm that managed descent mode was active when the captain selected approach mode and called the FMA annunciations.

The crew's omissions on the occurrence flight were consistent with prospective memory failure, which is recognised as normal variance in human behaviour. Prospective memory relates to an intention to perform an action at a later time, and a delay between forming the intention and acting on it. It is known to be vulnerable to failure, and has been associated with many aviation accidents and incidents (Dismukes 2006). Conditions that increase this vulnerability include the delay between the intention to do a task and the execution of the task being filled with other activities, an interruption to a task sequence, and the cues or prompts to retrieve the intention from memory not being explicit.

Although the actions associated with being cleared for the approach had previously been successful in prompting the crew to switch to managed descent mode, they were not an explicit or clearly-defined prompt, and were subject to significant variation in how and when they occurred during a flight. The first officer reported previously identifying cases where a pilot flying had not switched to managed descent mode by this stage of a flight, further indicating the limitations of the informal procedure of using this prompt.

Research has shown that pilots do not spend much time scanning the FMA or other auto-flight mode indications (Sarter and others 2007), which is not unexpected given that the modes do not change frequently. However, the same research also showed that pilots do not always scan their instrumentation when a change is expected, and do not always detect mode changes even when they do fixate their scan on the FMA, particularly if the changes were unexpected. In efforts to increase pilots' mode awareness, aircraft manufacturers have recommended that pilots call out mode (or FMA) changes, and many operators have incorporated this recommendation into their procedures. However, research has shown that, even when flight crews are required to call out auto-flight mode changes, they do not always do so and sometimes call out changes without scanning the FMA (Björklund and others 2006). Goteman and Dekker (2006) also found that FMA call-outs were shed when pilots were under a higher task load, and that compliance with the required call-outs was higher when the operator only required a selected set of mode changes to be called out.

Despite these limitations, the procedure for calling out FMA changes is important and was adopted by the operator of VH-VQA. However, as previously stated, this procedure focusses on FMA changes. As such, the operator's procedures did not specifically require the crew to review unchanged auto-flight modes during descent, to confirm that existing active modes remained appropriate to the circumstances. However, introducing a specific checklist item requiring review of the active descent mode provides no guarantee with respect to continuing appropriate mode selection. Similarly, a checklist item that requires a review of the active descent mode at a specific point during descent would only be valid at the moment the check was performed. The crew may subsequently change that mode to account for changing operational circumstances, essentially negating the relevance and effectiveness of an earlier check. Checklist items requiring a review of the active descent modes at specific points may also limit the flexibility with which pilots can safely adapt to variations in the operational environment.

The absence of specific procedural defences against continued descent in an unintended mode is offset to some extent by emphasising the importance of auto-flight system mode awareness throughout the manufacturer's and operator's operational and training documentation. In this occurrence, each of these references highlighted the need for deliberate and continuous auto-flight system mode awareness through pilot monitoring.

Dismukes and Berman (2010) have shown that although checklists and flight crew monitoring are important defences that in the vast majority of cases are performed appropriately, they do not always catch flight crew errors and equipment malfunctions. They also noted:

> …even though automation has enhanced situation awareness in some ways, such as navigation displays, it has undercut situation awareness by moving pilots from direct, continuous control of the aircraft to managing and monitoring systems, a role for which humans are poorly suited. Also, the very reliability of automation makes it difficult for pilots to force themselves to "stay in the loop". Research is needed to develop ways to help pilots stay in the loop on system status, aircraft configuration, flight path, and energy state. These new designs must be intuitive and elicit attention as needed, but

minimize effortful processing that competes with the many other attentional demands of managing the flight.

Descent monitoring

The vertical deviation symbol on the Primary Flight Display and the corresponding digital value on the Progress page of the Multi-purpose Control and Display Unit would have provided an indication to the crew that the aircraft was below the optimised descent profile, as computed by the Flight Management Guidance System. The deviation would also have been evident if aircraft altitude had been crosschecked with the relevant segment minimum safe altitude information presented on the instrument approach chart as descent progressed. Although indicators were available, they were not necessarily salient, and the indicators needed to be regularly scanned and interpreted by the flight crew. On some aircraft types, vertical situation displays are now available to present a pictorial representation of the aircraft's vertical position along an approach and relative to altitude constraints. Such displays provide a more salient indication of the aircraft's position with respect to the desired vertical profile.

Non-adherence to the operator's sterile flight deck procedures probably allowed the crew to be distracted and contributed to ineffective monitoring of the status of the auto-flight system and the aircraft's vertical position. This distraction, combined with an expectation that the auto-flight system was in managed descent mode, probably also explains why the crew did not detect the infringement of the instrument approach procedure's segment minimum safe altitudes. The crew's non-adherence to sterile flight deck procedures was probably due in part to the fine in-flight conditions, routine nature of the operational environment at the time, and the first officer's familiarity with Queenstown operations. Had the aircraft been in less favourable in-flight conditions, the crew would probably have been more focused on auto-flight system management, and the descent profile and segment minimum safe altitudes, and less likely to have been engaged in conversation of a non-operational nature.

Descent continued for about 7 minutes between the point at which the captain intended to switch to managed descent mode and the point at which the first officer alerted the captain, who then initiated a correction to the descent irregularity. Throughout this time, the FMA would have been displaying open descent mode as the active vertical auto-flight mode, instead of the intended managed descent mode. Other less prominent displays provided an indirect indication that descent was continuing in the unintended open descent mode, but none of these attracted the attention of either pilot.

Non-adherence to sterile flight deck procedures leading to conversation of a non-operational nature is one source of crew distraction. Equipment problems, communications problems, passenger-related problems and weather can present similar flight crew distraction. In 2005, the ATSB published a report that examined accidents and incidents involving pilot distraction in Australia between 1997 and 2004.[22] The report defines pilot distraction as a process, condition or activity that takes a pilot's attention away from the task of flying and surmises that an effect of pilot distraction is the interruption of pilot control. The report elaborates on the many forms and characteristics of pilot distraction, and among other things, suggests that 'pilots should exercise discretion in engaging in conversation with other people on board the aircraft, particularly during pre-flight checks and critical phases of flight'.

FCU altitude selection

The operator's procedures allowed the crew to select the VIP altitude on the FCU altitude selector during descent into Queenstown for the RNAV (RNP) approach when cleared for the approach by ATC, irrespective of the intervening altitude constraints. This approach to FCU altitude selector

[22] ATSB Aviation Safety Investigation B2004/0324 *Dangerous Distraction* is available on the ATSB website (http://www.atsb.gov.au/publications/2005/distraction_report.aspx).

management is founded on a principle of setting the auto-flight system appropriately, then monitoring auto-flight system performance during descent. This procedure is therefore vulnerable unless underpinned by consistently effective auto-flight system management and attention to the descent profile.

An alternative approach used by some operators that provides an additional defence against infringement of any segment minimum safe altitudes is to reselect the FCU altitude selector to the next minimum altitude as descent progresses and waypoints are sequenced. Although this approach provides an additional defence against infringement, it potentially has an adverse effect on crew workload and broader situation awareness, particularly where waypoints are closely spaced. Reselection of the FCU altitude selector as each segment minimum safe altitude is cleared requires more regular crew interaction and manipulation of the auto-flight system, particularly if the auto-flight system captures intervening altitude minima during descent.

One A320 operator requires their flight crews to reselect the FCU altitude selector to the next segment minimum safe altitude when in open descent mode, but allows the VIP altitude to be selected provided managed descent is the active descent mode. Such an approach emphasises the importance of ensuring an appropriate combination of descent mode management and FCU altitude selection procedures.

Summary

This occurrence resulted from a combination of continued use of open descent mode, without any specific procedural prompt to draw the attention of the crew to an unchanged mode, combined with the operator's procedures that allowed the crew to set the FCU altitude selector to the VIP altitude irrespective of the intervening segment minimum safe altitudes. When the captain selected approach mode, the FMA changes were announced correctly, but the crew were not procedurally required to specifically reconsider the suitability of the existing active descent mode. With the altitude selector set to the VIP altitude, existing procedures were then ineffective in alerting the crew to the descent below the segment minimum safe altitudes.

Although incidents of this nature are not common, the risk of descent through segment minimum safe altitudes resulting from the combined effect of an unintended selected descent mode and the operator's FCU altitude selection procedures is always present. Formally-required checks do not cater for all situations and may not always be complied with for various reasons. However, a formal requirement for the flight crew to announce and confirm the active descent mode at an appropriate point during the descent would provide more assurance that the type of error that occurred on this occasion would not occur again. One such point in the approach would be when the flight crew select an altitude lower than the next segment minimum safe altitude, such as in this case where the crew selected the VIP altitude when cleared for the approach.

Findings

From the evidence available, the following findings are made with respect to the descent below two segment minimum safe altitudes involving an Airbus A320, registered VH-VQA, during the approach into Queenstown on 16 July 2012. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Safety issues, or system problems, are highlighted in bold to emphasise their importance. A safety issue is an event or condition that increases safety risk and (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 operating environment at a specific point in time.

Contributing factors

- Contrary to their intent, and consistent with the limitations of prospective memory, the flight crew did not switch from open descent mode to managed descent mode when the approach mode and the Vertical Intercept Point altitude were selected.
- The crew did not detect that descent continued in the unintended open descent mode beyond the point at which the captain intended to switch to managed descent mode and did not maintain awareness of the aircraft's descent profile in relation to the instrument approach procedure's segment minimum safe altitudes.
- The crew did not strictly adhere to the operator's sterile flight deck procedures.
- **The operator's procedures did not require the flight crew to specifically check the active auto-flight mode during descent, and allowed the crew to select the Vertical Intercept Point altitude when cleared for the approach by air traffic control. This combination of procedures provided limited protection against descent through an instrument approach procedure's segment minimum safe altitudes. [Safety issue]**

Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and 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 directly involved parties were provided with 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.

Descent mode management and Flight Control Unit altitude selection

Number:	AO-2012-103-SI-01
Issue owner:	Jetstar Airways
Operation type:	Aviation: Air Transport
Who it affects:	All operators of highly-automated aircraft

Safety issue description:

The operator's procedures did not require the flight crew to specifically check the active auto-flight mode during descent, and allowed the crew to select the Vertical Intercept Point altitude when cleared for the approach by air traffic control. This combination of procedures provided limited protection against descent through an instrument approach procedure's segment minimum safe altitudes.

Proactive safety action taken by: Jetstar Airways

Action number: AO-2012-103-NSA-32

On 22 January 2014, Jetstar stated that the application of the Airbus Golden Rules was embedded in its operation and was regularly emphasised throughout pilot training sequences and should be applied during all operations. It also advised that, in January 2013, the discussion of Operational Golden Rules in its Flight Crew Training Manual was significantly expanded (consistent with changes to the Airbus manual). This additional text included the following:

> **Understand the FMA at all times.**
>
> The flight crew must confirm the operational effect of all actions on the FCU, or on the MCDU, via a crosscheck of the corresponding annunciation or data on the PFD and on the ND.
>
> At all times, the flight crew should be aware of the following:
>
> • Guidance modes (armed or engaged)
>
> • Guidance targets
>
> • Aircraft response in terms of attitude, speed, and trajectory
>
> • Transition or reversion modes.
>
> Therefore, to ensure correct situational awareness, at all times, the flight crew must:
>
> • Monitor the FMA
>
> • Announce the FMA
>
> • Confirm the FMA

• Understand the FMA.

Jetstar also advised that, on 15 November 2012, a specific warning was included on its Queenstown approach chart to state that:

> In normal circumstances, managed descent mode is required beyond the IAF.

Jetstar also stated:

> With respect to this particular incident it is apparent that the crew did not apply the Airbus Golden Rules nor did they follow the recommendation documented in our Route Manual Supplement Queenstown section as per below:
>
> "Approach charts specify minimum segment altitudes prior to the VIP. Managed descent mode provides protection against infringing these minimum altitudes. If selected vertical modes are used, pilots must exercise caution in complying with these altitudes. It is strongly recommended that pilots use managed descent mode in preference to selected vertical modes, especially when re-intercepting the vertical path from above prior to the VIP."
>
> With the above in mind, Jetstar believes that there is no specific requirement to check the active mode during descent. The pilots should have been fully aware of what vertical mode the aircraft was in without verbalising it. Jetstar also assert that had the above recommendation been followed, the crew would not have been in a selected descent mode during descent.

ATSB comment in response:

The ATSB notes that Jetstar has provided additional guidance material regarding auto-flight mode awareness in its flight crew guidance material. It also notes that specifically mandating the requirement for crews to select the managed descent mode prior to the initial approach fix on the Queenstown approach charts will potentially reduce the likelihood that crews will not be in that mode by that point, although it is noted that the flight crew of the occurrence flight on 16 July 2012 were actually intending to change to managed descent mode prior to this point.

The ATSB acknowledges the difficulty of further minimising the likelihood of these rare types of monitoring errors, and that there are effective risk controls in place to prevent such monitoring errors from resulting in a more serious occurrence.

Current status of the safety issue:

Issue status: Partially addressed

Justification: The ATSB is satisfied that the safety action will reduce the risk of the safety issue to some extent.

Additional safety action by Jetstar Airways

In response to this occurrence and in the context of the results from its line audits, Jetstar advised that it reviewed its sterile flight deck policy as part of a broader review of operational distractions. As a result of that review, the period during descent where the sterile procedures apply will be condensed 'to support a greater level of discipline'.

General details

Occurrence details

Date and time:	16 July 2012 – 0830 NZST	
Occurrence category:	Incident	
Primary occurrence type:	Flight below minimum altitude	
Type of operation:	Air Transport High Capacity	
Location:	Near Queenstown, New Zealand	
	Longitude: S 44º 49.07'	Latitude: E 168º 58.78'

Aircraft details

Manufacturer and model:	Airbus	
Registration:	VH-VQA	
Operator:	Jetstar Airways	
Serial number:	3783	
Type of operation:	Air Transport High Capacity	
Injuries:	Crew – Nil	Passengers – Nil
Damage:	None	

Sources and submissions

Sources of information

The sources of information during the investigation included:

- Jetstar Airways
- the Transport Accident Investigation Commission, New Zealand (TAIC)
- Airways Corporation of New Zealand Ltd
- French Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA)
- Airbus
- Jeppesen.

References

Björklund, CM Alfredson, J & Dekker, SWA 2006, 'Mode monitoring and call-outs: An eye-tracking study of two-crew automated flight deck operations', *The International Journal of Aviation Psychology*, vol. 16, pp. 257-269.

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

Dismukes, RK & Burman, B 2010, *Checklists and monitoring in the cockpit: Why crucial defences sometimes fail*, National Aeronautics and Space Administration Technical Memorandum NASA/TM-2010-216396.

Federal Aviation Administration Human Factors Team 1996, *The interfaces between flightcrews and modern flight deck systems*, Federal Aviation Administration, Washington DC.

Goteman, O & Dekker, S 2006, Flight crew callouts and aircraft automation modes: An observational study of task shedding, *International Journal of Applied Aviation Studies*, vol. 6, pp. 235-248.

Performance-based operations Aviation Rulemaking Committee/Commercial Aviation Safety Team Flight Deck Automation Working Group 2013, *Operational use of flight path management systems*. Available from www.faa.gov.

Sarter, NB Mumaw, RJ & Wickens, CD 2007, 'Pilots' monitoring strategies and performance on automated flight decks: An empirical study combining behavioural and eye-tracking data', *Human Factors*, vol. 49, pp. 347–357.

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 Jetstar, the flight crew, TAIC, BEA, Airbus and the Civil Aviation Safety Authority. Submissions were received from Jetstar, the flight crew, TAIC and Airbus. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

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.

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Investigation

ATSB Transport Safety Report
Aviation Occurrence Investigation

Descent below segment minimum safe altitudes involving Airbus A320-232 VH-VQA near Queenstown, New Zealand, 16 July 2012

AO-2012-103
Final – 13 March 2014