Australian Government

Australian Transport Safety Bureau

Airspeed management event involving a Fokker F28-0100, VH-UQN

Rockhampton Airport, Queensland, on 10 November 2019

ATSB Transport Safety Report

Aviation Occurrence Investigation (Defined)

AO-2019-063

Final – 7 June 2022

Cover photo: **Alliance Airlines**

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

Publishing information

Published by: Australian Transport Safety Bureau
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Addendum

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Safety summary

What happened

On 10 November 2019, a Fokker F28 Mk0100 (F100) aircraft, registered VH-UQN, was on final approach at night to runway 33 at Rockhampton Airport, Queensland. The aircraft was slightly high on the approach profile when smoke haze from nearby bushfires reduced the visibility on approach, obscuring the vertical approach lighting.

At about 400 ft above ground level, the aircraft encountered moderate turbulence affecting the aircraft's approach profile. At about 300 ft, the airspeed reduced below the minimum approach speed and the pilot flying encountered increased resistance in the thrust levers while trying to recover airspeed. After a short period, the pilot forced the thrust levers to the desired setting. The aircraft's engines responded, airspeed increased accordingly, and the aircraft landed safely.

What the ATSB found

The ATSB found that, when on final approach, the flight crew encountered reduced visibility and moderate turbulence from a bushfire, which added uncertainty and the late identification of a high approach profile. While attempting to regain the correct profile, the airspeed reduced below the minimum allowable speed, activating the automatic flight envelope protection or alpha mode before the aircraft started to accelerate. The flight crew were unaware of the alpha mode activation.

The operator's initial type qualification training for the F100 aircraft and cyclic training did not adequately prepare the operator's pilots to identify and respond to alpha mode activations during critical phases of flight. The ATSB further identified that the aircraft's rate of descent exceeded the operator's stabilised approach criteria for a short period during the approach; however, it was also identified that there was no permissible exceedance criteria in the stabilised approach criteria for transient exceedances.

There was an 8-day delay in reporting the incident to the ATSB. It was identified that the operator's recently-installed internal safety reporting system provided warnings that adequately reflected the urgency of reporting, but contained a visual display peculiarity that subtlety concealed reportable matters, resulting in the report being unprocessed for 6 days.

The ATSB also identified that the acting safety systems manager was unable to effectively conduct the role due to limited experience in the role, increased workload, and remote working conditions during this time. This, along with other key changes, limited the operator's capacity to provide effective safety assurance.

What has been done as a result

The operator issued an operations notice to pilots, which included guidance on the dangers of low thrust and low airspeed situations during performance decreasing conditions. The notice also provided greater guidance about the activation of alpha mode within its fleet. The operator updated its cyclic simulator training to include alpha mode activation scenarios and developed alternative procedures for pilots when encountering alpha mode activations.

Further, the operator proactively implemented an update to its safety reporting system that highlighted reportable matters by removing lesser priority indicators. It further introduced a statistical reporting tool to monitor the above system enhancement to ensure ATSB reporting obligations were measured and appropriately reported. In addition, it finalised the internal safety manual and standard operating procedures, developed a position handover checklist, and reviewed its company policy manual to detail the formal delegation of duties relating to key safety post holder positions.

Safety message

Flight crew awareness of automatic flight protections and their subsequent effect is paramount to the safe operation of passenger transport flights. Effective initial and cyclic training, and assessments in these systems, is important to ensure that pilots respond appropriately to these situations during critical phases of flight.

Operators are reminded that effective change management is an essential part of any safety management system. Changes to key safety management systems, key post holder positions, and the procedures and processes that support systems and personnel, need to be carefully managed in order to operate a robust and effective safety management system.

Contents

The occurrence

On 10 November 2019, a Fokker F28 Mk0100 (F100) aircraft, registered VH-UQN, was being operated by Alliance Airlines on a regular public transport flight from Brisbane to Rockhampton, Queensland. The flight crew had conducted a Brisbane to Rockhampton return flight earlier in the day, which was uneventful, and the weather was favourable with light winds. Bushfires had started to the north-east of Rockhampton Airport; however, the smoke associated with the fires did not have any effect on the earlier flight.

The aircraft had departed Brisbane for the third sector of the day at about 1857 Eastern Standard Time[1] and was scheduled to arrive at Rockhampton at 2000. The first officer (FO) was designated as the pilot flying and the captain was the pilot monitoring.[2] There were no weather concerns apart from smoke haze, which had worsened across south-east Queensland.

The flight crew reported that the flight was uneventful while en route to Rockhampton. Prior to descent, they conducted a standard briefing, which included the speeds required for the approach and the threat of reduced visibility due to smoke. Nearing Rockhampton, they were directed by air traffic control to conduct a standard instrument arrival procedure[3] from the south-east onto runway 33[4] at Rockhampton Airport (Figure 1).

Figure 1: Approach track to Rockhampton Airport

Source: Google Earth, annotated by the ATSB

[1] Eastern Standard Time (EST): Coordinated Universal Time (UTC) +10 hours.
[2] Pilot flying (PF) and pilot monitoring (PM): 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. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.
[3] Standard instrument arrival route: a published standard route for arriving at the destination aerodrome.
[4] Runway number: the number represents the magnetic heading of the runway.

Once established on final approach for runway 33, the FO recalled disconnecting the autopilot at about 700 ft. At about 560 ft above ground level, the meteorological minima[5] of the instrument approach, the flight crew recalled that the aircraft was maintaining the correct approach profile and speed, and noted that an additional spot fire could be seen about 1 km to the north-west of the airport. As they continued, smoke was observed to drift across the approach path due to a north-westerly wind change. Descending below 560 ft, the weather conditions and visibility began to deteriorate.

The flight crew reported that the slant visibility[6] to the runway began to reduce, and smoke discoloured the precision approach path indicator (PAPI)[7] lights from their usual red/white appearance, to an orange colour. The FO indicated that they were unable to discern any vertical guidance from the PAPI. At about 400 ft, the aircraft was also affected by light to moderate convective turbulence from the nearby bushfire.

As the PAPI discolouration cleared, the FO recalled seeing one red light on the PAPI, indicating that the aircraft was slightly high on its approach path. In response, the FO reduced the aircraft's pitch attitude and reduced the thrust by overriding the autothrottle system. The aircraft then encountered a downdraft, which further increased the rate of descent and decreased airspeed.

At about 300 ft, the captain observed the airspeed trending towards the minimum allowable airspeed (V_{MA}). The FO recalled attempting to increase thrust to recover the reducing airspeed, at which time they encountered stiff thrust lever resistance. The FO reported that, about 2 seconds after encountering the thrust lever resistance, the captain called 'speed'.[8] The FO responded by informing the captain that the thrust levers were 'stuck'. Shortly after, the captain called 'speed' a second time. The captain recalled considering taking over and conducting a go-around, however, noticed that the aircraft airspeed was below V_{MA}. Due to the aircraft position, the unknown reason for the blocked thrust levers and reduced stall margin, the captain did not command a go-around.

Due to the resistance to the advancement of the thrust levers, it took a few more seconds before the FO was able to forcibly move the thrust levers forward to the desired setting. The FO recalled that airspeed increased, the thrust lever resistance reduced, and a normal landing was safely carried out at about 1958.

The flight crew discussed the incident after engine shutdown. As part of their troubleshooting of the incident, they did not believe that an alpha mode activation[9] had occurred due to the activation prior to V_{MA} -5 kt. They could not recall any other indication on the flight deck that alerted them to the possible activation of alpha mode during the approach.

The captain grounded the aircraft and contacted maintenance watch to organise engineering assistance from Brisbane. An engineer arrived the next morning and examined the aircraft systems, however, could not identify any technical fault with the aircraft. As a precaution, the engineer disabled the aircraft's autothrottle system in accordance with approved maintenance procedures. The aircraft was released to service and operated back to Brisbane for further testing.

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5 Meteorological minima: the minimum values of meteorological elements as determined by the Civil Aviation Safety Authority in respect of specified types of flight operation.

6 Slant visibility: The visibility from air to ground as seen by aircraft while approaching the airfield. It may be more or less than the horizontal visibility as observed from the ground.

7 Precision Approach Path Indicator (PAPI): a ground based system that uses a system of coloured lights, used by pilots to identify the correct glide path to the runway when conducting a visual approach.

8 Speed: a standard company call between flight crew to build situational awareness to the aircraft speed during landing.

9 Alpha mode activation: automatic high angle of attack flight envelope protection, designed to avert low speed loss of control.

Context

Personnel information

Flight crew experience and qualifications

The captain held an Air Transport Pilot (Aeroplane) Licence and was appropriately qualified to conduct the flight. The captain also had an engineering background and had previously worked domestically for a number of airlines, before joining the operator in 2016. The captain had about 5,270 hours total time, with about 1,726 hours on the aircraft type, and was familiar with Rockhampton Airport, having operated there routinely for a number of years.

The first officer (FO) also held an Air Transport Pilot (Aeroplane) Licence, was appropriately qualified, and had extensive airline and charter experience both domestically and internationally. Having returned from expatriate international airline operations as a captain on Boeing 767, 757 and 777 aircraft, the FO worked for the operator for about 18 months prior to the incident, and had accumulated about 20,709 hours total time, with about 890 hours on type.

Training

General information

Civil aviation safety regulations require pilots to undergo regular assessment of skills and knowledge in particular operational areas to ensure competency. Proficiency checks assist in combatting the normal degradation of critical skills over time and serve as an important opportunity for operators to standardise and educate flight crew about recent operational changes, safety information, organisational guidelines and provide education on specific subjects. Most passenger transport operators satisfy this requirement by flight crew participation in an approved training and checking system called flight crew cyclic training. This training occurs numerous times a year and at set intervals.

All of the operator's flight crew were required to complete initial type qualification training on the F100 before progressing to cyclic training and proficiency program assessments.

Alpha mode protections were covered in the operator's initial type qualification training by all flight crew. However, at the time of the incident, ongoing cyclic training did not include alpha mode protection proficiency training or assessment. Both flight crew reported that the initial training received covered only the alpha mode activation and thrust increase, and did not identify other aspects such as the sensation of blocked thrust levers.

The operator stated that, at the time of the occurrence, the training provided in the initial type rating was that recommended by the aircraft manufacturer. The type certificate holder advised that there was no obligation for them to create a flight crew training syllabus with associated training schedules for initial type training, nor for recurrent proficiency training. For that reason, such a flight crew training syllabus had not been issued. The type certificate holder further advised that, at the request of the operator after the occurrence, they had provided a recommended procedure for the demonstration of alpha mode for training purposes, although this was not specifically intended for critical phases of flight.

Captain

The captain completed initial type training on 5 May 2017 with the required element of alpha mode protection completed at that time. The captain's last cyclic training assessment was conducted on 9 August 2019 and indicated a satisfactory-above satisfactory skill level, and good technical knowledge and skills. A further line check conducted on 3 September 2019 also supported the cyclic training results.

The captain recalled that there had been no further training in alpha mode, and expressed concern that there was no standard call or crew resource management process in place for flight crew to communicate the activation and resolution of an alpha mode activation.

First officer

The FO conducted initial type training on the F100 and was assessed as competent on 28 June 2018. Part of this training required satisfactory assessment of the element relating to alpha mode protection. The FO reported that the initial simulation demonstration in respect to alpha mode was conducted at about 5,000 ft, which was considerably different to experiencing it on approach to land at night in turbulence.

Cyclic training was undertaken on 12 May 2019, with results of this assessment indicating an above satisfactory skill level with very good technical knowledge and skill. A line check conducted on 30 July 2019 further supported the results of the cyclic training.

Recent history

Both flight crew were based in Brisbane and the operator reported that their individual rosters provided them with sufficient sleep opportunity in the nights prior to the incident. They both reported having a normal amount of sleep leading up to the incident. The FO reported being on 4 days of leave before working the day prior, and both flight crew reported being fully alert on the flight. The captain also reported not noticing any impact on the FO's alertness during the flight.

Aircraft information

General

The Fokker F28 Mk0100 (F100) is a low-wing, twin-engine, medium-size, short-range, jet aircraft used by several regional carriers in Australia. It is powered by 2 Rolls-Royce RB.183 TAY medium by-pass, rear mounted turbofans. As of 28 June 2021, 24 F100 aircraft were in service with the operator.

Post-incident engineering testing

During initial troubleshooting at Rockhampton, the engineer concluded that the report of blocked thrust levers occurred when the autothrottle system (ATS) was engaged and that no fault codes or system reliability issues were identified.

After an uneventful return flight to Brisbane, further testing on the aircraft systems was conducted. This testing revealed no evidence of any malfunction within the alpha mode system, and further review of recorded flight data by the manufacturer revealed that the alpha mode functioned correctly. In addition, testing of the dynamic rods, which can introduce a stuck thrust lever sensation, was carried out as a part of the system troubleshooting and a resistance anomaly was identified through fault codes that displayed on the automatic flight control and augmentation system (AFCAS) maintenance panel. The engineer replaced the flight augmentation computer as a precaution and, after multiple system checks, returned the aircraft to service. Further testing of the dynamic rods by the operator identified a technical anomaly, however, this was not considered a factor in the incident.

Automatic flight control and augmentation system

System overview

The aircraft was fitted with an AFCAS that received information from the flight management system, and other flight and navigation data systems. It monitors the aircraft configuration, engines and other aircraft systems. The AFCAS integrates this data and displays the information to the pilots on the aircraft state and reference airspeeds, and provides guidance on aircraft flight profile and navigation. The AFCAS also provides a number of aircraft flight envelope protection features, which includes minimum speed protection.

Minimum speed protection

The minimum speed protection system was based on an automatically calculated minimal allowable airspeed (V_{MA}). The V_{MA} is calculated by the AFCAS and is dependent on the aircraft weight, flap settings, flight phase and altitude information. In flight, V_{MA} is displayed as the top of the amber strip located on the primary flight display speed scale (Figure 2). Minimum speed protection consists of 3 sub-system elements; the most relevant to this incident being the V_{MA} protection and alpha modes.

Figure 2: Minimum allowable airspeed on the primary flight display

Source: Operator, annotated by the ATSB

V_{MA} protection

The AFCAS does not accept speed selections below V_{MA}, and aircraft speed deceleration to less than V_{MA} is prevented by the AFCAS using either elevator or thrust control. The aircraft manufacturer identified limitations in this protection, stating that:

> *V_{MA} protection may be not adequate in conditions of strong turbulence or during fast decelerations.*

For those identified conditions, alpha mode then provides low speed protection.

Vertical speed indicator

Vertical speed is displayed on the right side of the primary flight display and is indicated in a positive and negative scale by an electronic needle indication with an abbreviated number display (Figure 2) in hundreds of feet per minute. The scale deflection does not have identified values, rather, it relies on flight crew knowledge to interpret the smaller dot above and below the level indicator as 500 ft/min marks, and larger scale marked in 1,000 ft increments. The abbreviated number display adjusts in increments of 100 ft/min, but only identifies the rate of decent in hundredths of the displayed rate. For example, 700 ft/min is identified as 7 on the abbreviated display.

Alpha mode

Alpha mode was designed to protect the aircraft from an aerodynamic stall[10] by automatically applying a controlled escalation of engine thrust to increase aircraft airspeed to V_{MA}, or the selected airspeed set by the flight crew, whichever is higher. This potentially prevents the aircraft from entering a low speed, high angle of attack[11] state, where it would be vulnerable to loss of control.

The F100 *Aircraft Operations Manual*, section 1.18.4, stated that one of the system behaviours on activation of alpha mode was a thrust limit change to take-off/go-around (TOGA) thrust.

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[10] Aerodynamic stall: occurs when airflow separates from the wing's upper surface and becomes turbulent. A stall occurs at high angles of attack, typically 16° to 18°, and results in reduced lift.

[11] The angle of the wing relative to the direction of the airflow.

Indication is provided to flight crew on the flight deck through the primary flight display (Figure 2), the thrust limit change displays the climb (CLB) indication in the top left of the flight display from a green CLB to a white CLB.

Alpha mode activation will occur for a number of flight conditions, including, but not limited to, if the aircraft's airspeed drops 5 kt below 1.3 times the stall speed in a given configuration. However, alpha mode activation could occur at higher speeds if the aircraft is subject to an increasing load factor,[12] fast decelerations at low thrust settings, or in conditions that may exacerbate these factors, such as atmospheric turbulence. For the incident flight, the aircraft type certificate holder indicated the V_{MA} varied between 131–132 kt.

The ATS increases thrust by a deliberately controlled increase (forward movement) in the throttle lever position. The amount of thrust required is dependent on the aircraft's airspeed increasing to V_{MA} or the selected airspeed, whichever is higher, and could increase thrust up to the TOGA setting. The increased thrust will increase airspeed, potentially preventing the aircraft from slowing to the point of stall. The ATS controls the increased thrust to the engines through the dynamic rods.

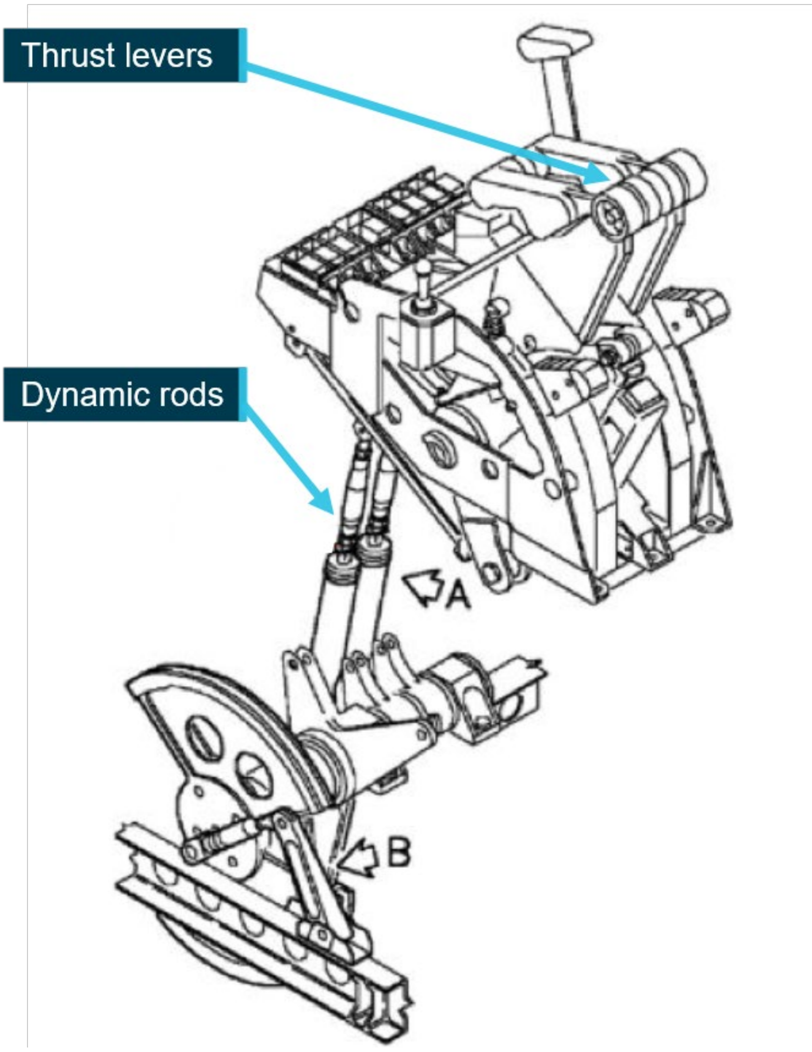
Dynamic rods

The F100 is fitted with mechanical/electrical connecting rods joining the thrust levers and the thrust control cable system, known as dynamic rods (Figure 3). The dynamic rods are fitted with switches, which activate allowing normal pilot input on the thrust levers to override the ATS by opening the autothrottle engage clutches. When alpha mode is active, these switches are deactivated and the thrust levers may appear rigid, requiring significant effort to move them.

The system is designed to prevent flight crew from reducing thrust further during a low-speed event, thereby potentially providing protection against a low-speed loss of control. However, the increased thrust lever force required also affects the normal operation of the thrust lever to increase thrust.

[12] Vertical acceleration in g.

Figure 3: Dynamic rods schematic



Source: Operator, annotated by the ATSB

The dynamic rod behaviour under alpha mode was specific to the operator's F100 fleet. The Fokker F28 Mk070 (F70) series, also operated by the operator, was also fitted with alpha mode but did not have the dynamic rod feature. A modification was available to remove the dynamic rod behaviour in the F100; however, this had not been incorporated into any of the operator's F100 fleet at the time of the incident. The operator reported that it had considered incorporating the modification across the Fokker fleet, but this was not achievable due to part availability and cost.

Thrust lever resistance

At the time of the incident, The F100 *Aircraft Operations Manual* provided a caution regarding the thrust level resistance experienced when the aircraft was in alpha mode as:

> CAUTION:
>
> The force override switches are de-activated during alpha mode operation and if, at this moment, the pilot attempts to manually advance the thrust levers to speed up engine response, he experiences heavy override forces which may give the impression that the thrust levers are blocked. Although not recommended, ATS can be overridden by holding the ATS disconnect buttons [on the thrust levers] depressed and advancing the thrust levers until the speed is above V_{MA} and the alpha mode is deactivated.

If significant force is applied to the thrust levers while alpha mode is active, the pilot could advance the thrust levers by overpowering independent slip clutches within the system. However, this does not deactivate alpha mode, but does manually increase the thrust. When the aircraft regains airspeed to V_{MA} or the selected speed set by the flight crew, alpha mode will deactivate. This restores the dynamic rod switches to normal functionality, and the increased thrust lever force will no longer be experienced by the pilot.

Approach stability

The stabilised approach concept is identified by the International Civil Aviation Organization as a set of criteria to maintain a stable approach speed, descent rate, vertical flight path, and configuration to the landing touchdown point to reduce the occurrence of controlled flight into terrain. The operator's stabilised approach criteria, detailed in the *Operations Policy and Procedures Manual – Standard operating procedures*, stated:

> All flights must be stabilized by 1,000 feet above airport elevation in instrument meteorological conditions (IMC) and 500 feet above airport elevation in visual meteorological conditions (VMC).
>
> The approach is stabilized when all of the following criteria are met.
>
> - the aircraft is on the correct flight path;
> - only small changes in heading/pitch are required to maintain correct flight path;
> - the aircraft speed is not more than V_{REF} + 20 knots indicated airspeed and not less than $V_{REF;}$
> - the aircraft is in the landing configuration;
> - sink rate is no greater than 1,000 feet per minute; if an approach requires a sink rate of greater than 1,000 feet per minute, a special briefing should be conducted;
> - power setting is appropriate for the aircraft configuration and is not below the minimum power for approach as defined by the aircraft operating manual;
> - all briefings and checklist have been conducted;
> - specific types of approaches are stabilized if they also fulfill the following
> - instrument landing system (ILS) approaches must be flown within one dot of the glideslope and localizer
> - a Category II or Category III (ILS) approach must be flown within the expanded localizer band
> - unique approach procedures or abnormal conditions requiring a deviation from the above elements of a stabilized approach require a special briefing.
>
> An approach that becomes unstabilzed below 1,000 feet above airport elevation in IMC or below 500 feet above airport elevation in VMC requires an immediate go-round.

The ATSB reviewed the manuals of a number of Australian domestic and international carriers, and identified that it was common for these operators to provide exceedance limitations in their procedures to allow flight crew discretion to momentarily exceed a part of the stabilised approach criteria during an attempt to correct the transient exceedance.

When discussing the concepts and terms associated with a stabilised approach, the International Civil Aviation Organization (International Civil Aviation Organization, 2015) noted that 'normal bracketing corrections' or momentary exceedances from pre-determined stabilised approach criteria was acceptable in some circumstances. For example:

> Upon establishing visual contact with the runway environment, the pilot should be able to continue to a safe landing using normal bracketing corrections, or, if unable, should perform a missed approach.

These corrections relate to bank angle, rate of descent, and power management. Considering the operating limitations stated in the aircraft's approved flight manual, the recommended ranges of acceptable momentary exceedances to stabilised approach criteria were:

- course guidance variation depending on the approach type
- maximum bank angle of 30º if specified in the approved operating manual used by the pilot
- ± 300 ft/min deviation in rate of descent

- permissible power range if specified in the approved operating manual
- momentary overshoots made necessary by atmospheric conditions.

At the time of the incident, the operator did not have a policy regarding momentary exceedances.

Recorded information

General information

VH-UQN was fitted with a flight data recorder (FDR) and cockpit voice recorder (CVR). Upon returning to Brisbane, the operator downloaded, and analysed the FDR data using flight data analysis program software. The ATSB reviewed this data, along with FDR analysis conducted by the aircraft type certificate holder, and this is summarised below.

Due to the extended period from the incident and it being reported to the ATSB, the CVR record of the flight had been overwritten. As such, the investigation was not able to verify the timeline of flight crew communications, which may have provided additional information.

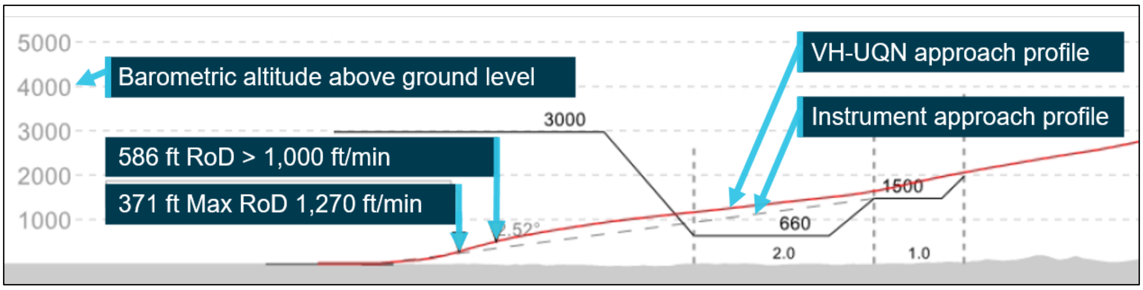
Flight path and thrust data

- At about 800 ft on descent on final approach, an airspeed of 137 kt was selected by the flight crew. The landing gear had been extended and the flaps were in the landing configuration. Flight data indicated the aircraft was stable at that time with a rate of descent (RoD) of about 750 ft/min, a pitch attitude of 1° nose down, and thrust lever angle (TLA) of 37°.
- At about 630 ft, the autopilot was disconnected.
- At about 550 ft, the aircraft was pitched to about 3° nose down and the RoD increased to about 1,100 ft/min, with a TLA of 33° and an airspeed of 138 kt.
- At about 490 ft, the aircraft was pitched to about 2° nose down with a RoD of about 1,200 ft/min. The thrust levers indicated 'OVERRIDE' on the FDR data, as the auto throttle servo motors were not engaged, meaning the AFCAS could not reposition the thrust levers. However, the position of the thrust levers was still changing with a TLA of 29°. The airspeed had increased to 139 kt.
- At about 450 ft, the thrust levers were reduced to 21° TLA and the aircraft was pitched to about 3° nose down.
- Between about 400 ft and 300 ft, the TLA was further reduced to 17° and the pitch attitude maintained at 3° nose down as the RoD increased to a maximum of 1,270 ft/min.
- At about 250 ft, the airspeed fell below $V_{MA.}$
- At 203 ft, the airspeed had reached its lowest recorded reading of 127 kt, about 27 kt above the stall speed. The FDR data indicated TOGA limit activation, triggering the minimum speed protection of alpha mode and the ATS increased the thrust over a period of about 7 seconds to recover airspeed.
- The aircraft speed accelerated above V_{MA}, about 3 seconds after alpha mode activation at about 165 ft. The aircraft made a normal landing.

Approach stability

The operator's flight data analysis software triggered 2 high RoD events during the approach at 586 ft and the second at 371 ft (Figure 4).

Figure 4: Flight path trajectory for VH-UQN at Rockhampton



Source: ADI occurrence flight summary, annotated by the ATSB

Data for the initial stages of the approach indicated that the aircraft was relatively stable until about 600 ft, when the aircraft's rate of decent began to increase past 1,000 ft/min. At about 370 ft, a maximum descent rate of 1,270 ft/min was recorded as the airspeed reduced to 135 kt. This added instability to the approach, however, the descent rate was not sustained above 1,200 ft/min for greater than 6 seconds. The flight crew did not consider the momentary increases in RoD as leading to an unstable approach requiring a go-around.

Speed reduction below V_{MA}

The FDR data indicated that, at 0957:55, the aircraft's airspeed reduced below the V_{MA} of 132 kt and continued to reduce to the lowest recorded speed of 127 kt about 3 seconds later, about 5 kt below V_{MA}. The activation of alpha mode increased thrust, and airspeed increased above V_{MA} about 3 seconds later.

The F100 *Aircraft Operations Manual*, section 1.18.04 (Version 11, Issue 3 Page 2) detailed a caution relating to the activation of alpha mode with low thrust settings:

> CAUTION:
>
> When ATS engages as a result of alpha mode activation with the engines spooled down or in case of a high deceleration rate, the speed may fall well below VMA before the aircraft starts to accelerate.

Meteorological information

Forecast conditions

Prior to departure, the flight crew reviewed the operator's pre-flight briefing documents and accessed the weather forecasts from the national aeronautical information processing system[13] on an iPad. The Bureau of Meteorology graphical area forecast for Rockhampton indicated reduced visibility down to 4,000 m in isolated smoke with moderate turbulence below 10,000 ft in thermals. Low-level, the grid-point wind and temperature forecast indicated a wind strength of about 15 kt from the south-south-east, changing to a north-westerly at about 10 kt. The forecast en route conditions were consistent with the flight crew's recollections on the day.

Actual weather conditions

Prior to landing at Rockhampton, the flight crew obtained the local weather from the automatic terminal information service,[14] which indicated visibility of 5,000 m in smoke. The flight crew further stated that 3,600 m was the minimum visibility required for landing. They reported that the flight conditions on previous sectors that day had been affected by reduced visibility from smoke haze over most of south-east Queensland.

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[13] National aeronautical information processing system: a web browser interface that provides amongst other things, access to national aeronautical weather forecasts via the internet through the Airservices Australia website.

[14] Automatic terminal information service (ATIS): a continuous VHF radio broadcast of local aerodrome weather observations, including wind direction and speed, and runway in-use.

The flight crew reported no significant turbulence at higher altitudes. However, on final approach, they reported that the turbulence increased as the aircraft descended, and continued until after the approach minima where moderate turbulence was experienced. The captain described moderate turbulence as being 'physically moved around in your seat' with fluctuating airspeed and vertical speed indications on the aircraft instrumentation.

Bushfires and visibility

Heightened bushfire activity had been present for a number of weeks across south-east Queensland. Some effects such as reduced visibility from smoke, remained an ongoing challenge for aircraft operators during that time.

The flight crew reported sighting a number of bushfires in the vicinity of the airport. One was located about 1 km to the north-west of the airport, with further larger fires to the south-west as they approached Rockhampton. As the flight crew made their final approach to land, the north-westerly wind strengthened with an associated wind change, and localised smoke began drifting across the runway.

The flight crew recalled that, as the aircraft descended through about 1,400 ft, the effects of increasing wind were felt, and approaching about 560 ft, slant visibility began to deteriorate with smoke discolouring the precision approach path indicator (PAPI). The flight crew stated that they received reduced vertical visual cues on approach to the runway, however, the runway lights remained visible throughout the entire approach.

Convective turbulence

Convective turbulence can be described as rising warm or hot air creating unstable atmospheric conditions. It can be created by the normal heating of air over the earth's surface or by the hot air from a bushfire or combustion process. Heated air is less dense than the cooler air around it and rises. Cooler air will rush in underneath to fill this void also producing wind changes and air turbulence. These updrafts of hot air and downdrafts of cooler air can produce gusty fluctuations in vertical and horizontal air masses, causing in-flight turbulence.

Airport information

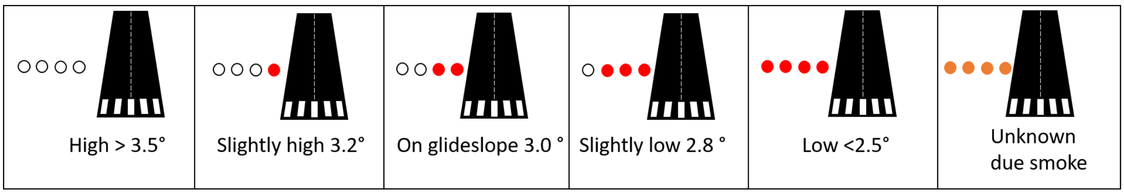
Precision approach path indicators

Rockhampton Airport was equipped with precision approach path indicators (PAPI), which are an array of lights located beside the runway providing visual reference and vertical guidance to pilots up to 20 NM (37 km) from the runway at night, right down to landing (Figure 5).

The PAPI lights are normally located abeam the 1,500 ft runway markers and are characterised by 4 high intensity light beams with coloured filters. Dependent on the aircraft's vertical profile, the pilot would see either red or white lights. A normal 3° approach path would be identified by equal numbers of red and white lights. If the aircraft was below the glideslope, there would be more red lights than white, and above glideslope, more white lights than red would be displayed.

The PAPI light display is susceptible to the line-of-sight limitations of distance and visibility. The presence of smoke is likely to discolour the light array and make distinguishing colour from red to white difficult (Aeronautical Research Labratories, 1981).

Figure 5: PAPI light indications



Source: ATSB

Safety management systems

High and low-capacity regular public transport operator certificate holders in Australia are required to manage the safety of their operations on a day-to-day basis. Part of this responsibility falls within a safety management system (SMS), which requires a systemic approach to setting policy and safety objectives, to manage safety risk, provide safety assurance, and to communicate safety outcomes within the organisation.

Safety assurance is one key component of an SMS and relies upon the systematic monitoring and measurement of the operator's safety performance and evaluating safety management processes and practices. Safety assurance provides demonstrable safety outcomes from the SMS and enables benchmarking to provide verifiable organisational performance to an acceptable level of safety.

Organisations experience change due to a number of factors such as business improvements that may result in changes to internal systems and processes or procedures. As stated by the International Civil Aviation Organization (2018), these changes may:

> …affect the effectiveness of existing safety risk controls. In addition, new hazards and related safety risks may be inadvertently introduced into an operation when change occurs. Hazards should be identified and related safety risks assessed and controlled as defined in the organization's existing hazard identification or SRM [safety risk management] procedures.

Organisational information

Safety occurrence reporting

Reporting process

The operator's safety department was responsible for the reporting of regulatory and safety related information to government departments such as the Civil Aviation Safety Authority (CASA) and ATSB. In the instance of an ATSB immediately or routine reportable matter,[15] defined under the *Transport Safety Investigation Act 2003* and Regulations (2003), a responsible person who had knowledge of the reportable matter was to provide a written report to the ATSB within 72 hours from the time of the occurrence.

Incident and accident reports were submitted electronically through the operator's reporting system and reviewed by the safety department. Occurrence data collected under the reporting system was used to identify developing trends and to provide safety management oversight of the airline's operations. The reports were then distributed to subject matter experts in different departments for feedback and validation. Once validated, the safety department consolidated the departmental responses and then provided an organisational response to CASA and the ATSB.

This incident was reported through the safety reporting system by the captain 2 days after, on 12 November 2019. However, the report was overlooked within the reporting system until 16 November 2019. The ATSB received the report from the operator on 19 November 2019, 9 days after the incident.

Changes to the safety occurrence reporting system

A new safety reporting system was implemented in June 2019, as the operator transitioned safety management system software providers to a new supplier. The web-based system was designed to provide safety management support for airlines and other aviation organisations. The SSM described the new system as a:

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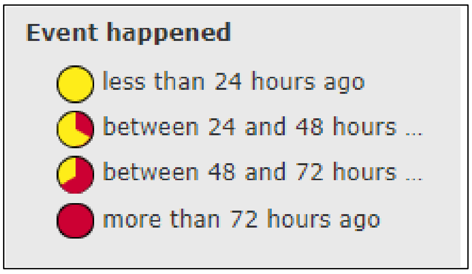
[15] An immediately reportable matter is a transport safety matter that has had a fatal or serious outcome and must be reported to the ATSB by telephone as soon as is reasonably practicable. A routine reportable matter is a transport safety matter that has not had a serious outcome and does not require an immediate report, but transport safety was affected or could have been affected.

> …fairly intuitive and accountable system where nothing could be purposely hidden or changed within the system unless the change was recorded and justified.

One unique element of the system was the electronic tracking of occurrences and reports as they were reported online through the safety systems portal. Once logged, each occurrence had a unique identifier and started a virtual 72-hour countdown timer (Figure 7) to track the assessment, validation, and reporting of each occurrence. Primarily, this was to ensure safety assurance action within the prescribed period of an ATSB reportable matter.

The timer initially appeared yellow and then progressively changed to red indicating the time remaining for the submission of the written report to the ATSB. Once completely red, the report was overdue to the ATSB. The countdown timer offered a dashboard review screen where multiple occurrences could be reviewed in a date-based order.

Figure 6: Safety management reporting system 72-hour countdown timer



Source: Operator

When a report had been submitted to the ATSB, the timer was removed. However, for reports that did not require notification to the ATSB, the timer remained and appeared red until it had been validated. The operator indicated that these reports could potentially take several days to validate. As such, multiple reports with red timers would be visible on the dashboard. However, if a report was submitted late, as was the case for this incident, the report would appear in the list below other reports that had already been processed. With this setup, there was no obvious indication that a late report had not been submitted and was outstanding for ATSB reporting.

Another key element of the introduction of the web-based safety reporting system was that this enabled safety reporting from employees using mobile platforms such as crew iPads, thus enhancing the timeliness and ease of reporting.

Changes in internal processes

The SSM identified that any change to a key system introduces risk. The introduction of the new reporting system required significant redevelopment of organisational process, manuals and supporting guidance documents. Some of these changes were yet to be fully implemented into the internal safety systems standard operating procedures at the time of the incident. One such procedure was related to the operator’s process for providing further information to external requests received from the ATSB and CASA.

Part of the introduction also included educating staff on the new system and required changes to work practices. This included dissemination of information, the briefing of operational departments, and staff education on changes to internal manuals and documented processes. During this time, the SSM and the ASSM had been employed for a period of less than 6 months and were responsible for the implementation of much of this work to support the new safety reporting system changes.

Key safety post holder positions

Safety systems manager

The safety systems manager (SSM) began working with the operator in July 2019 and was responsible for the day-to-day management of the SMS as well as the safety reporting system. They were also responsible for the implementation and integration of the new safety reporting system, and the procedures and supporting guidance documentation. At the time of the incident, the SSM was on leave for 3 weeks and was not contactable. The SSM role was passed on to the acting SSM (ASSM).

Acting safety systems manager

The ASSM started with the operator in June 2019, in the substantiative position of safety and quality manager. This position entailed responsibility for dangerous goods, work health and safety, environment, and emergency response. The ASSM was also identified by CASA as an alternate postholder for the SSM position and provided support to the SSM position when required.

The ASSM stated that there was an expectation that extra duties would be accommodated by staff, in addition to their existing duties. Therefore, during the period as ASSM, they were still required to conduct their normal role in addition to the tasks of the SSM. The ASSM reported that part of their substantive role required travel to remote mine sites to conduct audits. They advised that they had travelled from Brisbane to Adelaide for the week of the handover from the SSM and then travelled to a north-western Australian mine site for 4 days, which had intermittent internet access and mobile phone coverage.

Handover of safety systems manager role

On 1 November 2019, the SSM sent an email to internal staff, notifying them that the ASSM would be acting in the position until 21 November 2019. CASA was also advised by the SSM of the same absence.

The SSM recalled that there was no formal handover or training undertaken for the acting role, and that a brief discussion was held relating to the internal operating procedure of checking the safety reporting system every 12 hours. The ASSM also recalled not receiving a formal handover, however, recalled receiving an email with a number of tasks to complete shortly before departing for the 4-day audit.

The SSM was unaware that the ASSM was planning to be away travelling during the time required to fulfill the role of ASSM. The SSM also remarked that, while not against company policy, this situation was most likely not optimal as the ASSM role required access to a computer, and a reliable internet and phone connection to work effectively while remotely based.

Changes in key positions

Prior to the incident, the SSM had been in the role for about 5 months before going on leave and passing the role to the ASSM. The ASSM had been in their substantive role for about 6 months before acting in the role of SSM as an alternate post holder. This was the first time the ASSM had conducted this role.

The overall quality manager was reported to have been in the position for a couple of years and the general manager was reported to have been in that position for about 20 months.

Organisational and role assimilation

Successful integration of a new staff member into an organisation is referred to as organisational assimilation and it consists of a number of factors including learning how to interact with new co-workers, understanding organisational norms, adjustment of the employee's expectations around involvement in the organisation and adaption to the new role (Myer & Oetzel, 2003). New employees may adapt their expectations of the new role based on their previous experiences.

Both organisational and role assimilation is dependent on the individual's previous experiences and how different they find the new role and the organisation. Generally, the longer the employee has been with the organisation, then the greater the time the employee has to adjust their expectations of the role, to conform to the requirements of the organisation.

Likewise, the time taken by an employee to assimilate into a new role and organisation, while substantial, cannot be quantified. This remains subject to the individual's ability to make sense of the new role and organisation (Weick, 1995) and relies on their will and ability to adapt in order to attain the required competency.

Related occurrences

Perceived thrust levers being stuck during alpha mode

In 2009, another Australian operator of Fokker 100 aircraft had an event during the base leg of an approach. The crew reported that when they attempted to increase thrust they found that the thrust levers appeared to be blocked. After about 5 seconds, they were able to push the thrust levers forward, using a much greater force than normal to overcome the autothrottle system, by which time the airspeed had decreased to V_{MA}. Subsequent investigation by the operator identified no technical problems with the aircraft.

As a result of the event, that operator developed educational material to support cyclic training, specifically covering alpha mode indications and thrust lever blockage.

In 2014, the same operator had a different operational occurrence in which the crew correctly recognised an alpha mode activation. Further information was then also provided to the operator's crew on specific combinations of automation modes likely to result in the activation of the alpha mode function.

The other Australian operator subsequently advised the ATSB that this information about alpha mode activation was incorporated into its initial Fokker 100 pilot type rating ground school training material as well as its recurrent ground and simulator training.

ATSB investigation (AO-2013-103)

On 25 June 2013, the flight crew of an Airbus A320-232 aircraft were conducting an instrument landing system approach with autoland training at Sydney Airport, New South Wales. During the approach, the training captain (pilot flying) disconnected the autothrust system by retarding the thrust levers to the IDLE STOP, and asked the FO to assess the effect on the proposed approach. After briefly referring to the Quick Reference Handbook, the flight crew extended the landing gear and wing flap, and finalised the pre-landing checklist. The flight crew then became involved in a discussion about the requirements in the handbook for the proposed approach.

With engine thrust at idle and the aircraft in a high drag configuration, the airspeed quickly reduced to below the minimum approach speed. The captain was in the process of applying thrust when the aircraft's alpha-floor protection system activated. TOGA thrust was automatically commanded by this system and the flight crew conducted a missed approach.

The ATSB found that, during an autoland training exercise with the autothrust disengaged, both pilots were distracted by their consideration of a training scenario. As a result, they did not identify the airspeed reducing below the target approach speed in sufficient time to prevent activation of the aircraft's alpha-floor protection system.

ATSB investigation (AO-2013-159)

On 7 September 2013, an Airbus A320 aircraft, was on descent into Auckland, New Zealand via a required navigation performance approach to runway 23 Left. During the later stages of their descent, the flight crew managed the aircraft speed to meet an air traffic control request and according to applicable company speed restrictions.

The auto-flight system sequenced to final approach mode passing about 4,200 ft, but exited final approach mode when the flight crew subsequently levelled the aircraft approaching 3,000 ft. The flight crew levelled the aircraft to reduce speed to comply with a company speed restriction of 210 kt maximum below 3,000 ft. Having slowed sufficiently, subsequent manipulation of the auto-flight system resulted in the inadvertent engagement of open climb mode, which resulted in an increase in engine thrust and aircraft acceleration.

Attempting to avoid exceeding the limiting speed applicable to the existing aircraft configuration, the captain retarded the thrust levers to the idle stop, inadvertently disconnecting the auto-thrust system. The flight crew resumed the approach, unaware that the auto-thrust system was disconnected, and therefore no longer controlling aircraft speed. As the aircraft continued to decelerate, soon after the final stage of flap was selected for landing, the flight management guidance system generated a low energy warning. As the flight crew was responding to the low-energy warning, alpha-floor auto-thrust mode engaged. The flight crew accelerated the aircraft to approach speed using manual thrust control, and was able to continue the approach for an uneventful landing.

The operator made findings with respect to flight crew communication, aircraft energy state monitoring, wider automation management and mode awareness issues, and the procedures governing the reinstatement of aircraft control following intervention by the pilot not flying. The operator also found that there may be some commonly held misunderstandings with respect to some aspects of the instrument approach procedures.

Safety analysis

Introduction

While on final approach to runway 33 at Rockhampton Airport, the aircraft became slightly high on approach. Attempted corrections by the first officer (FO) to regain the approach path resulted in the aircraft entering a low speed/low thrust configuration, which activated the alpha mode protection. In response, the flight crew attempted to increase thrust, but the thrust levers appeared to be 'blocked'. The FO forcibly moved the thrust levers and the aircraft was subsequently landed safely.

A post-flight engineering assessment found no evidence to indicate a technical problem, or failure of any of the mechanical components in the system, which may have led to the blocked thrust levers or inadvertent activation of alpha mode.

This analysis will consider the circumstances that preceded the incident, including weather, visibility, flight crew training, and stability of the approach. Changes to key safety management reporting systems and safety personnel, as well as post-incident circumstances such as organisational delays and the management of safety reporting, will also be discussed.

High approach profile

On the day of the incident, the southern Queensland aviation network was affected by widespread reductions in visibility due to bushfire generated smoke haze. Additionally, the Rockhampton area was impacted by moderate, low-level, convective turbulence from localised bushfires.

During descent at night into the strengthening north-westerly wind, the aircraft was buffeted by rising hot air and encountered smoke from the bushfires close to Rockhampton Airport. Convective turbulence from rising and sinking air affected the aircraft's vertical speed on the approach. Reduced visibility was encountered on final approach as smoke discoloured the runway lighting and precision approach path indicators (PAPI), rendering the vertical approach guidance lights temporarily unusable.

During the late stages of the approach, the flight crew reported that, at about 400 ft, the smoke discolouration of the PAPI lights reduced and they identified that they were slightly high on the approach profile. The aircraft's airspeed and vertical approach profile was affected by convective turbulence from a local bushfire, impacting the flight crew's ability to maintain the approach path.

The FO reduced the thrust setting and lowered the nose of the aircraft to correct for being slightly high on the approach path. This, coupled with convective turbulence, very likely resulted in an increased rate of descent and subsequent airspeed reduction towards the minimum approach speed (V_{MA}).

High descent rate

Flight crew reaction to changing in-flight performance, requires them to identify a parameter change is occurring, decide to apply correction, apply the correction technique, monitor the correction for change against the parameter, identify that the desired parameter has been regained, reduce corrective input, and monitor for change.

The aircraft's flight data noted 2 high rate of descent events when below 600 ft on approach, with a maximum rate of about 1,200 ft/min for a short period of time. This exceeded the operator's stable approach criteria, which required a rate of less than 1,000 ft/min. The identification of the high descent rate may not have been as immediate as the data suggested, as the flight crew were in the higher workload phase of landing in challenging conditions. Granularity of the vertical speed indicator increments, abbreviated vertical speed readout and display layout most likely affected the flight crew's ability to readily identify the increased rate of descent above 1,000 ft/min. This required greater attentional resources to identify, correct and monitor the rate than the flight crew had available with the late PAPI identification (as the smoke cleared) of the slightly high approach profile while entering convective turbulence.

Low airspeed management

While on final approach, the FO overrode the autothrottle system, manually reduced the thrust setting and lowered the nose of the aircraft to correct for being slightly high on the approach path. This, combined with the convective turbulence from the bushfire, resulted in a fluctuating rate of descent, peaking at about 1,200 ft/min for about 6 seconds. The recorded flight data showed that the airspeed decreased below the minimum approach speed (V_{MA}). As a result of the low speed, low thrust condition, alpha mode activated at 203 ft.

Consequently, after the captain's second 'speed' call, the FO had to forcibly move the thrust levers forward to counteract the thrust lever resistance, as a result of alpha mode activation. The alpha mode activation combined with flight crew's actions resulted in the aircraft responding to the increased thrust.

The airspeed increased above the V_{MA} about 3 seconds after alpha mode activated. Alpha mode then disengaged, allowing free movement of the thrust levers, which may explain why the FO described experiencing a reduction in thrust lever resistance. While the airspeed reduced to 5 kt below V_{MA} for 1 second, the airspeed remained above the stall speed by about 27 kt before recovering, and a normal landing made.

Mode confusion

During the approach to land, both pilots identified the deceasing airspeed and attempted to rectify this. However, neither recognised that alpha mode had activated. The FO had identified that the thrust levers appeared blocked, but could not identify why this occurred. Consequently, they continued to force the thrust levers forward, without knowing that the alpha mode system was actively increasing thrust to recover airspeed. The flight crew continued the approach, and considered that the conduct of a go-around may place the aircraft in a nose high, slow speed condition without the sufficient thrust, thereby increasing the risk of loss of control.

After an uneventful landing, the flight crew discounted the possibility of an alpha mode activation as they recalled that the airspeed had not reduced below the minimum approach speed. Mode awareness is a type of situational awareness based on the pilot's understanding of aircraft configuration and flight control system modes. Being aware of the active mode(s) and understanding the corresponding actions and responses is necessary for proper use of the autoflight system. Ineffective auto-flight system mode awareness has been identified as a contributing factor in many occurrences since the introduction of complex auto-flight systems (United States Federal Aviation Administration, 1996).

Flight crew training on alpha mode

As per the operator's standard practice, the flight crew had been checked as competent on their understanding of alpha mode during their initial aircraft type training. However, the simulator demonstration was conducted at altitude and did not include elements of competency relating to alpha mode activation in different flight configurations and states, or at critical times such as final approach. Further, the training did not include the higher force caused by the dynamic rod lockout, which was only applicable to the operator's F100 fleet. The operator's flight crew may operate both variants at different times.

In addition to the initial training, flight crews were not routinely assessed on alpha mode during cyclic training. Recurrent or cyclic training was a mechanism for developing and assessing flight crew performance across a range of necessary competencies. This ensured that each crew member was adequately trained and proficient for the aircraft type and their position held. As highlighted by the Civil Aviation Safety Authority, recurrent or cyclic training assists with the prevention of the degradation of critical skills over time.

In this case, it had been more than 1–2 years since the flight crew had completed their initial type training for the F100, noting that this did not capture all aspects regarding alpha mode. As such, the flight crew were not aware that alpha mode activation could occur above the minimum approach speed in different aircraft states or that thrust lever resistance would be experienced when in this mode. Therefore, the initial type qualification training on the F100 did not adequately prepare pilots to recognise and recover from an alpha mode activation during a critical phase of flight, such as during approach to land. Also, there was no further cyclic training in relation to alpha mode activation and procedures to support flight crew decision making when such an activation occurred.

Stabilised approach criteria

The operator's criteria for stabilised approach was reviewed and found to be consistent with the International Civil Aviation Organization (ICAO) recognised standard operating procedures. The operator provided this information to flight crew by publication in the *Operations Policy and Procedures Manual – Standard operating procedures*.

The review of other operators' manuals found that their procedures allowed for momentary exceedances of the stabilised approach criteria. This allowed flight crew to continue an approach with some flexibility to external environmental influences. The operator's published stabilised approach criteria did not reflect this flexibility, and the operator's internal investigation did not consider the approach to be unstable and no further mention of the stabilised approach criteria was identified.

New safety reporting system

The operator's newly introduced safety reporting system displayed submitted reports on a dashboard in date and time order, and assigned a visual coloured 72-hour countdown timer to aid in tracking. This visual tool was displayed against all submitted reports, not just those required to be notified to the ATSB. However, due to the design of the system, ATSB notifiable reports that were submitted late would not only have appeared further down the list, but appeared overdue. Similarly, other occurrences that did not require reporting to the ATSB, however required validation by the relevant department responsible managers, would have also appeared overdue.

As previously mentioned, safety reporting systems are an essential tool within a safety management system for gathering valuable safety information. This information could be used for identifying occurrences that required further investigation, for discovering lessons learnt, and for providing a useful source of information for hazard identification. However, this was reliant on a system design that was effective.

In this case, when the captain's safety report was submitted about 2 days after the incident, it was not likely displayed on the initial dashboard screen due to the date order and it would have been listed below already overdue reports. This meant that it would not have been clearly visible to the safety department staff. This system characteristic was not identified prior to this incident, which made identification and subsequent report tracking more difficult for the safety department. In turn, this did not allow for the effective prioritisation of submitted safety reports.

Organisational change

There had been a significant turnover of staff within the operator's safety department prior to the incident, with a number of key staff having only been in their respective positions for less than 6 months. This coincided with the introduction of the new safety reporting system. This reduced short-term organisational memory relating to the introduction of the new system, and came at an important stage of system implementation, with the redevelopment of new supporting processes under the operator's standard operating procedures. This required increased education to the operator's staff on the use of the new system, by the safety systems department. This likely affected the safety systems manager (SSM) and the acting SSM (ASSM), with increased tasks and workload during a period of organisational and role assimilation within the operator.

The ASSM was approved as the alternate postholder position for the SSM. However, having not previously acted in the role, and with a limited handover, it was unlikely that the ASSM was able to adequately fulfill the requirements of this role in addition to their ordinary workload and remote duties.

Implementation of supporting processes into the operator's standard operating procedures for the new safety reporting system relied on the SSM to review and make changes to the existing organisational process. However, all procedures had not yet been finalised, in particular, that relating to further requests for information for immediately and routine reportable matters to the ATSB. Therefore, there was little guidance available to the ASSM regarding ATSB reporting.

Safety assurance is a key component of a safety management system. Of particular importance are changes to internal systems and processes or procedures. As previously highlighted by the International Civil Aviation Organization, such changes could inadvertently introduce new hazards and associated risks to an operation. The system change, coupled with new employees in the safety department, and the redevelopment of internal processes, did not identify the visual display deficiencies and possible unintended outcomes of the new safety reporting system. This increased the safety department's workload and introduced an increased risk of some reports not being appropriately classified, reported, or acted upon in a timely manner.

Findings

ATSB investigation report findings focus on safety factors (that is, occurrences and conditions that increase risk). Safety factors include ‘contributing factors’ and ‘other factors that increased risk’ (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition ‘other findings’ may be included to provide important information about topics other than safety factors.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is 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 operating environment at a specific point in time.

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

From the evidence available, the following findings are made with respect to the operational event involving a Fokker F28-Mk0100, VH-UQN, at Rockhampton, Queensland, on 10 November 2019. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing factors

- On final approach to land at Rockhampton Airport, reduced visibility and turbulence from a bushfire added uncertainty and late identification of a high approach profile.
- On final approach, the flight crew experienced a low airspeed management event.
- **The operator’s training for the Fokker F28-Mk0100 did not prepare pilots for alpha mode activation during critical phases of flight.** (Safety issue)
- The flight crew were unaware the alpha mode had activated, resulting in mode confusion prior to and after they advanced the thrust levers on final approach.

Other factors that increased risk

- On short final, the aircraft's rate of descent increased beyond the operator's stable approach criteria. The crew did not consider that the approach was unstable and continued the approach due to perceived blocked thrust levers, and possible adverse consequences of conducting a go-around.
- **Changes in the operator's key safety post holder positions, safety reporting systems and internal processes reduced effective safety assurance.** (Safety issue)
- **The operator’s safety management reporting system did not enable the effective prioritisation of submitted safety reports.** (Safety issue)

Other key findings

- Although the operator provided guidance to flight crews about the stable approach criteria, it did not specifically permit transient exceedances of the set criteria.
- Associated with a number of reasons, there was a significant delay in the occurrence (which was a routinely reportable matter) being reported to the ATSB.

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the aviation industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

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.

The initial public version of these safety issues and actions are provided separately on the ATSB website, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website as further information about safety action comes to hand.

Safety management reporting system

Safety issue description

The operator's safety management reporting system did not enable the effective prioritisation of submitted safety reports.

Issue number:	AO-2019-063-SI-01
Issue owner:	Alliance Airlines Pty Limited
Transport function:	Aviation: Air transport
Current issue status:	Closed – Adequately addressed
Issue status justification:	The ATSB is satisfied that the amendments to the new safety reporting system will increase the likelihood that immediately and routine reportable matters will be notified to the ATSB within the required timeframe.

Proactive safety action taken by Alliance Airlines Pty Limited

Action number:	AO-2019-063-PSA-01
Action organisation:	Alliance Airlines Pty Limited
Action status:	Closed

The operator advised that it implemented an update to the new safety reporting system to allow for the ATSB indication dial to be cleared independently of the departmental validation of the report. The system now clearly highlights reports that have been submitted late with the ATSB indication dial showing in isolation.

The operator further added that, in addition to this change, the software provider has been requested to include a statistical tool that monitors the time from initial receipt of the report to the time the report is processed for ATSB reporting. This will allow for future monitoring of the updated system to ensure on-going compliance to *Transport Safety Investigation Act 2003*.

ATSB comment

The operator has addressed the key concern of this safety issue, in particular the clear identification of unreported occurrences within the operator's safety reporting system. The system modification adequately addresses a significant display issue in identifying outstanding reportable matters. This has increased visibility of the SMS system in processing late and outstanding reports in the system to safety systems staff and allows the operator to run statistical reports to monitor ongoing reporting compliance.

Flight crew training

Safety issue description

The operator's training for the Fokker F28-Mk0100 did not prepare pilots for alpha mode activation during critical phases of flight.

Issue number:	AO-2019-063-SI-02
Issue owner:	Alliance Airlines Pty Limited
Transport function:	Aviation: Air transport
Current issue status:	Closed – Adequately addressed
Issue status justification:	The ATSB notes that Alliance Airlines has taken safety action to reduce the risk of this safety issue.

Proactive safety action taken by Alliance Airlines Pty Limited

Action number:	AO-2019-063-PSA-02
Action organisation:	Alliance Airlines Pty Limited
Action status:	Closed

On 15 October 2020, the operator introduced new type qualification and cyclic training that encompassed alpha mode procedures through operations notice ON 201213. Initial training of alpha floor requirements was articulated further and alpha mode was introduced into cyclic training to ensure flight crew operating the F100 and F70 were checked as proficient twice a year.

Organisational change

Safety issue description

Changes in the operator's key safety post holder positions, safety reporting systems and internal processes reduced effective safety assurance.

Issue number:	AO-2019-063-SI-03
Issue owner:	Alliance Airlines Pty Limited
Transport function:	Aviation: Air transport
Current issue status:	Closed – Adequately addressed
Issue status justification:	The ATSB notes that Alliance Airlines has taken action to standardise internal process and strengthened safety assurance.

Proactive safety action taken by Alliance Airlines Pty Limited

Action number:	AO-2019-063-PSA-03
Action organisation:	Alliance Airlines Pty Limited
Action status:	Closed

The operator finalised its review of the internal safety manual and standard operating procedures, developed a position handover checklist, and reviewed its company policy manual to detail the formal delegation of duties relating to key safety post holder positions.

Safety action not associated with an identified safety issue

Additional safety action Alliance Airlines

The operator advised that an update to its stabilisation policy and associated criteria was being conducted and this will also introduce guidance on transient exceedances of the criteria.

General details

Occurrence details

Date and time:	10 November 2019 – 1958 EST	
Occurrence class:	Incident	
Occurrence categories:	Other powerplant/propulsion, turbulence/windshear/microburst	
Location:	2 km south-east of Rockhampton Airport, Queensland	
	Latitude: 23º 23.85' S	Longitude: 150º 28.9' E

Aircraft details

Manufacturer and model:	Fokker Aircraft B.V. F28Mk0100	
Registration:	VH-UQN	
Operator:	Alliance Airlines PTY Limited	
Serial number:	11361	
Type of operation:	Air transport - high capacity	
Departure:	Brisbane Airport, Queensland	
Destination:	Rockhampton Airport, Queensland	
Persons on board:	Crew – 4	Passengers – 97
Injuries:	Crew – Nil	Passengers – Nil
Aircraft damage:	Nil	

Glossary

AFCAS	Automatic flight control and augmentation system
ASSM	Acting safety systems manager
ATIS	Automatic terminal information system
ATS	Autothrottle system
CASA	Civil Aviation Safety Authority
EST	Eastern Standard Time
FAA	United States Federal Aviation Administration
FDR	Flight data recorder
FO	First officer
ICAO	International Civil Aviation Organization
IMC	Instrument meteorological condition
PF	Pilot flying
PM	Pilot monitoring
PAPI	Precision approach path indicator
NAIPS	National aeronautical information processing system
RNP	Required navigation performance
RoD	Rate of descent
SOP	Standard operating procedure
SSM	Safety systems manager
TLA	Thrust lever angle
TOGA	Take-off/go-around
UTC	Coordinated universal time
VMC	Visual meteorological condition
V_{MA}	Minimum allowable airspeed

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the flight crew
- Alliance Airlines PTY Limited
- Virgin Australia Regional Airlines
- the aircraft type certificate holder
- the recorded flight data
- Civil Aviation Safety Authority
- Bureau of Meteorology
- Airservices Australia.

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Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section 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 following directly involved parties:

- Alliance Airlines PTY Ltd
- the flight crew
- the acting safety systems manager

- the safety systems manager
- Fokker Services and Dutch Safety Board
- the Civil Aviation Safety Authority
- the Bureau of Meteorology.

Submissions were received from Alliance Airlines PTY Ltd, the captain, the safety systems manager and Fokker Services. The submissions were reviewed and, where considered appropriate, the text of the final report was be amended accordingly.

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- 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, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, international agreements.

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining 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. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.