SERIOUS INCIDENT

Aircraft Type and Registration:	Airbus A320-216, EC-KLT	
No & Type of Engines:	2 CFM56-5B6 turbofan engines	
Year of Manufacture:	2007 (Serial no: 3376)	
Date & Time (UTC):	26 August 2019 at 1205 hrs	
Location:	On approach to Birmingham Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 6	Passengers - 189
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	40 years	
Commander's Flying Experience:	9,700 hours (of which 8,080 were on type) Last 90 days - 150 hours Last 28 days - 61 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft made two approaches above the correct descent profile, on each occasion leading to a missed approach. On the second missed approach the aircraft initially continued descending and was not configured appropriately, reaching an angle of attack at which the ALPHA FLOOR[1] energy protection mode activated to increase engine thrust. The aircraft made a subsequent approach, landing without further incident.

During a subsequent event, involving the same operator and aircraft type (but different flight crew), the aircraft remained above the correct approach descent profile initially but descended below it later in the approach and performed a missed approach. The pilots in this case managed the vertical profile manually using a flight control mode with which they were not familiar.

In both cases the pilots appeared not to have understood when to commence the final descent to follow the vertical profile of the approach. The operator's safety department has recommended improvements in approach training and strategies to assist situational awareness. The operator and air traffic services provider are working to gain a better understanding of each other's approach requirements.

Footnote

[1] A system designed to protect the aircraft from stalling by applying TOGA thrust.

History of the flight

After an uneventful flight from Barcelona, the aircraft positioned for an RNAV[2] approach to Runway 33 at Birmingham Airport. Both pilots were experienced on the aircraft and the co-pilot was acting as the handling pilot. The weather at the time was good with light winds reported and no cloud below 5,000 ft agl.

The aircraft was at 4,000 ft approximately 11 nm south of the airport when ATC cleared it to descend to 2,000 ft and carry out the RNAV approach (Figure 1). The pilots read back the clearance correctly but, thirty seconds later, the aircraft had not changed altitude and they contacted ATC to request descent. ATC again cleared the aircraft to descend to 2,000 ft and to carry out the approach. The aircraft was 10.5 nm from the runway when it started descending. At 9.4 nm it was at 3,800 ft, 1,000 ft above the correct profile.

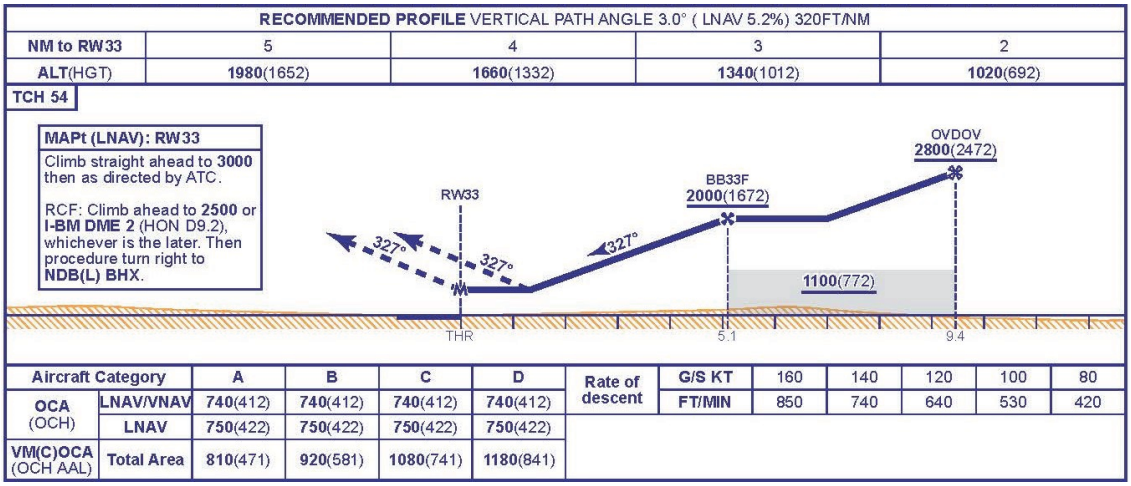

Figure 1

Vertical profile of RNAV approach to Runway 33 at Birmingham Airport
(Extract from UK Aeronautical Information Publication)

When the aircraft was 3 nm from the runway, ATC cleared it to land, at which point the aircraft was at 2,000 ft, 660 ft above the correct profile. The pilots continued the approach, but at about 0.3 nm from the threshold and at 470 ft, they announced they were going around. ATC cleared the aircraft to climb to 4,000 ft and gave radar vectors for a further approach.

Shortly after the aircraft began climbing, the commander took over as handling pilot and informed ATC that the crew had experienced a navigation problem on their initial approach, requesting a localiser/DME approach[3] for the second approach. ATC accepted the request and provided radar vectors to position the aircraft to commence the approach. When the aircraft was on base leg, ATC cleared it to descend to 2,000 ft, but the crew mistakenly read back the clearance to descend only to 3,000 ft. This mistake was missed by ATC and was not corrected.

Footnote

[2] An approach providing both lateral and vertical guidance based on a global navigation satellite system.
[3] In which lateral but not vertical guidance is provided by ground-based radio aids.

The aircraft descended to 3,000 ft whilst positioning to establish on the localiser, during which it was given further clearance to descend with the approach. When the aircraft began its final descent from 3,000 ft it was about 7 nm from the runway and crossed the final descent point, 5.1 nm from the runway and 200 ft above the correct profile altitude.

Initially the crew continued the approach, but then informed ATC they were too high and requested a left turn. In response, ATC instructed the crew to turn left onto a heading of 240° and to climb to 4,000 ft. The crew commenced the turn 2.5 nm from the runway, descending through 1,900 ft. At the same time, they selected a climb to 4,000 ft using the OPEN CLIMB mode[4], leaving the landing gear down and full flaps set. They did not select the TOGA thrust mode appropriate for a standard go-around manoeuvre. This caused the aircraft to pitch up to about 10° nose-up.

The aircraft began to decelerate, and the crew changed to the VERTICAL SPEED mode, reducing pitch to about 1° nose-up. However, the aircraft entered the ALPHA FLOOR protection mode, automatically setting TOGA thrust and causing the speed to increase. The commander then set the thrust levers to prevent the aircraft exceeding the full flap limiting speed. With pitch reducing, the aircraft continued to descend and ATC again instructed the crew to climb. The crew selected a climb of about 900 ft/min still using the VERTICAL SPEED mode and the aircraft, having descended to 1,300 ft (about 940 ft agl), then started to climb.

The aircraft climbed to 4,000 ft and ATC gave further vectors for another localiser/DME approach. The aircraft then landed without incident.

Further occurrence

On 20 December 2019 there was a further occurrence involving the same operator and aircraft type, but with a different crew, during a localiser/DME approach to the same runway. The cloud base at the time was reported to be broken at 1,300 ft AGL and scattered at 900 ft agl.

ATC records reveal that on this occasion the pilots had been cleared to descend to the platform altitude of 2,000ft and, when established on the localiser, to descend further with the approach. The pilots subsequently explained that they had been unsure of the correct decent point when ATC had cleared them for the approach, but from a higher altitude than the platform altitude for the approach depicted on their chart. They had then attempted to calculate what they believed to be the correct descent point, in the process losing situational awareness and descending too late. This resulted in the aircraft remaining above the correct approach profile and going around.

ATC provided vectors for an RNAV approach to Runway 33 and then asked the pilots to confirm whether they wanted to perform an RNAV approach or a localiser approach. The pilots reported that this made them believe they should have been making an RNAV

Footnote

[4] In which the aircraft climbs at an indicated airspeed selected by the pilots, with up to CLIMB power set.

approach which confused them. They however asked for, and were given, a further localiser/DME approach.

During this second approach the aircraft was again high and the pilots attempted to regain the correct approach path, but at 6.5 nm from the runway, the aircraft had descended 700 ft below the correct approach profile to 1,300 ft. The aircraft then climbed 500 ft before descending again and was 360 ft above the correct approach profile at 3 nm but continued the approach and landed.

Operator's stable approach criteria

The operator's standard operating procedures required crews to go around if, on passing a nominal gate at 3 nm or 1,000 ft above the touchdown zone elevation, the aircraft was not stable on the approach. The definition of 'stable' was:

- aircraft in the final configuration,
- checklist completed,
- on the glide slope and localiser,
- speed V_{APP} +25 kt to -5 kt, and
- no excess deviations.

The operator commented that it considered it acceptable for pilots to delay the commencement of the go-around manoeuvre slightly in order to not become rushed, but only when it was considered safe to do so.

Operator's investigation

The operator conducted its own investigation into both incidents and found:

Fatigue

The fatigue level of each pilot involved in both events was assessed by means of a Samn-Perelli score. This uses a seven-point scale to define the level of pilot alertness. A score of 1 indicates the lowest level of fatigue and 7 the highest. The operator determined that the score for each of the four pilots varied between 2.22 and 2.43, with a score of 2 being defined as *'very lively, responsive, but not at peak'* and 3 as *'Okay, somewhat fresh'*.

Crew experience

The operator determined that the crews in both occurrences were appropriately experienced.

Event on 26 August 2019

The operator's investigation found that the crew had struggled to reduce the speed of the aircraft in the distance available once they commenced the final stages of the approach, but that, with correct energy management, there had been sufficient distance available to manage the speed whilst descending with the approach profile.

The investigation also highlighted a difference between the descent profile for the RNAV approach published in the UK AIP[5] and that published by the operator's chart provider[6]. Whilst the former had a platform altitude for the approach of 2,000 ft with final descent starting at 5.1 nm from the threshold, the operator's approach charts showed a continuous descent starting from 2,800 ft at 7.6 nm (Figure 2). This led to confusion by the pilots when initially they were cleared to 2,000 ft on the first approach, causing them to delay their descent and to ask ATC again for the descent instructions. This had served to compound the issue of the late configuration of the aircraft for the approach whilst trying to slow down, resulting in the aircraft not establishing on the correct approach profile and leading to the missed approach.

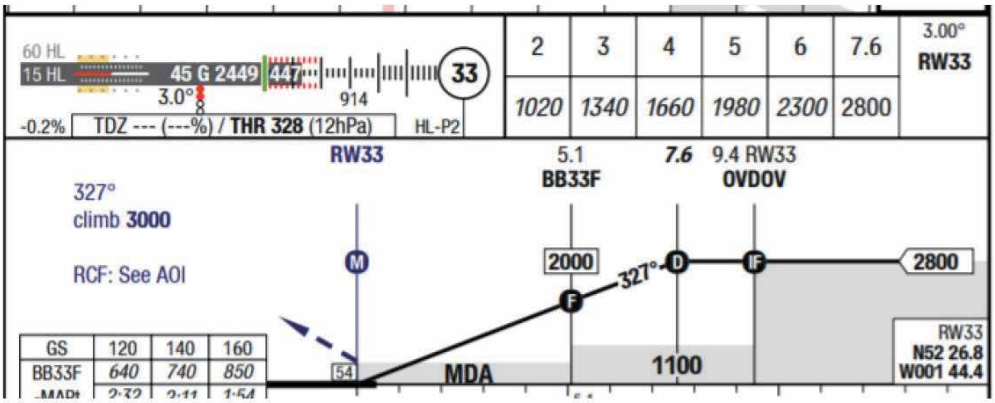

Figure 2

Extract from operator's chart for RNAV approach to Runway 33 at Birmingham

On the subsequent approach the crew were once again unsure about where to start the descent from 3,000 ft, having been cleared to do so. The aircraft remained above the correct approach profile and the pilots discontinued the approach again. On this occasion the commander was concerned that going around a second time would alarm the passengers, and he requested a turn instead. The operator's report did not determine what the commander intended to do next.

Regarding the event on 20 December 2019

The operator's investigation again found that whilst the aircraft in this case had initially been slightly high, there was sufficient distance remaining during the approach to successfully manage the descent profile, although the pilots involved still believed this was inadequate. However, the pilots did not establish the aircraft on a stable approach and commenced a missed approach 1 nm from the threshold.

During the second approach the aircraft again started slightly high. The pilots attempted to re-establish the aircraft on the correct profile from above by selecting a descent of 2,900 ft/min in the VERTICAL SPEED mode. This was maintained until 6.2 nm from the

Footnote

[5] Aeronautical Information Publication.
[6] There is no regulatory requirement for the two to be the same.

threshold, at which point the crew switched to the TRK-FPA (track-flight path angle) mode[7]. The operator found that flight crews were not accustomed to descending using this mode, which had contributed to the crew's continued lack of situational awareness and their descent below the correct approach path. The pilots did not notice this immediately but, when they did, started a climb before once again descending, remaining above the correct profile but landing nonetheless.

The operator commented that the normal procedure for establishing the aircraft on the correct descent path when too high relied on the presence of vertical guidance such as a glideslope. In this case, where there was no glideslope, this would have hampered the successful implementation of the procedure.

The pilots reported that being asked several times by ATC if they wished to conduct an RNAV approach instead, undermined their confidence in continuing with the localiser/DME approach.

Studies of go-around handling

The BEA[8] *'Study on Aeroplane State Awareness during Go-Around'* concludes that time pressure and high workload are features of events in which crew awareness of the aircraft state during a go-around is degraded. Startle, preoccupation with other tasks and difficulties in managing the automatic systems are often involved.

Airbus Flight Operations Briefing Note *'Decent Management – Being Prepared for Go-Around'* notes that failure to recognize the need for and to execute a go-around when appropriate is a major cause of approach-and-landing accidents, and that it is necessary to be *'go-around minded'* and prepared to do so correctly. It also offers recommendations for training and operational procedures to promote safer outcomes.

Analysis

It was possible to complete the approaches successfully at the point the aircraft were originally cleared to do so. In the August incident, the aircraft's speed was not managed early in the initial approach and the crew were not certain of the correct descent point, leading to an increasingly difficult situation for them to manage. In the December incident, not maintaining the correct profile early in the initial approach again led to difficulties maintaining the correct flight path.

The approaches were continued whilst not meeting the stable approach criteria, and go-arounds were carried out late in the approach, both of which reduced safety margins as highlighted in previous safety studies.

Having gone around, the subsequent approaches should also have been safely achievable. In the August incident the commander chose to change the type of approach, which placed additional pressure on the pilots in setting up the aircraft and re-briefing. Positioning the

[7] This mode allows the crew to select a flight path angle (eg 3°, rather than by rate of descent (eg 700 ft/min).

[8] Bureau d'Enquêtes et d'Analyses – the French aviation safety investigation authority.

aircraft further from the airport before commencing the subsequent approach would have allowed the crew more time to prepare.

The commander in this case stated that he did not wish to alarm the passengers by conducting a further go-around but did not explain his plan thereafter. The aircraft was in VMC and, if his intention was to reposition visually for another approach, this might explain why the aircraft was not reconfigured for a go-around (nor TOGA selected) when ATC instructed the aircraft to climb. The result was both a further descent and increase in angle of attack which triggering of the aircraft's ALPHA FLOOR protection system. Even when the climb was initiated, the crew continued without changing the aircraft's configuration, indicating the startle and high workload likely to arise from this unintended situation.

The pilots of the aircraft involved in the December occurrence chose to conduct a localiser/DME approach on both occasions. The aircraft did not maintain the correct profile on either approach. When ATC vectored the aircraft for an RNAV approach this caused the pilots to doubt that they were conducting the correct type of approach.

The December incident involved a high rate of descent being selected to regain the appropriate approach path. The operator's own investigation suggested the crew may have overlooked the fact that there was no glideslope for the aircraft to capture, resulting in it continuing its descent below the correct approach profile. Unlike the first incident, this occurred whilst the aircraft was in IMC, which removed any visual cues for the crew and resulted in a significant departure below the correct profile, taking the aircraft below the minimum safety altitude for that part of the approach.

The challenge faced by both crews in managing their descent has been the subject of discussions between the operator and air traffic service provider. ATC commented that had the incorrect readback of the cleared altitude been perceived and corrected, this might have prompted the crew on that occasion to continue their descent.

Different chart providers have different ways of depicting approach profiles. However, the AIP remains the source document and ATC will naturally rely on this, rather than individual operator's charts, when managing air traffic. Where differences exist, it is desirable for operators and ATC to ensure their effect is understood.

Conclusion

The aircraft did not maintain the correct vertical profile because the pilots were not sure when to commence the final descent. The depiction of the descent profile on charts provided by the operator may have contributed to this uncertainty.

In the first event it is likely that the increased workload of an unplanned missed approach contributed to the pilots not configuring the aircraft correctly for the go-around, resulting in the aircraft entering the ALPHA FLOOR protection mode. In the second event, having also commenced the final descent late, the pilots did not maintain the correct profile thereafter because the type of approach required them to manage the vertical flight path manually, and they were not familiar with the flight mode they were using.

Safety actions

As part of the resolution of the issues raised in these two incidents, the operator's safety department has recommended:

- the inclusion of high energy approaches and go-arounds in future company simulator training;
- a review of approach intercept procedures to ensure they make adequate provision for approaches without a glideslope;
- the introduction of procedures to assist pilots in estimating distance to run during an approach; and
- procedures to deal more effectively with a loss of situational awareness.

The operator and air traffic services provider are working to gain a better understanding of each other's approach requirements.

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