Isle of Man
CIVIL AVIATION ADMINISTRATION

Safety Insight

Safe Final Approach Considerations for ATC

Issue No: 01/21

Photo courtesy SKYbrary

Annually, approximately 30% of commercial transport aviation accidents are runway excursions. A significant amount of these excursions are the result of poorly executed final approaches.

The responsibility for the achievement and execution of a safe final approach lies with the flight crew, but controllers and assistants can play a key part in exacerbating or mitigating the situation.

- Controllers can contribute to an unstabilised approach through their vertical lateral and speed control instructions.
- Controllers and assistants can provide a defence against an unsafe approach by recognising when aircraft are significantly displaced from the expected lateral and vertical approach path and taking appropriate steps.

Stabilised Approach — ATCO Guidance

Credit: Skybrary

What is a Stabilised Approach?

EASA defines a 'stabilised approach' as an approach that is flown in a controlled and appropriate manner in terms of configuration, energy and control of the flight path from a pre-determined point or altitude/height down to a point 50 ft above the threshold or the point where the flare manoeuvre is initiated if higher. For Commercial Air Transport, EASA requires the predetermined path requirements for conducting an stabilised approach to be established by the operator and published in their Operations Manual Part B

Commonly applied criteria are for flights to be stabilised by 1000 feet above aerodrome elevation in IMC and 500 feet in VMC.

The exact criteria are detailed but includes being on the correct flight path and target speed, correctly configured, with briefings and checklists completed.

Stabilised Approach — ATCO Guidance (continued)

Do you help pilots to make their flight predictable?

1. Delayed descent instructions or significant shortcuts may result in pilots requesting additional distance or contribute to high energy unstabilised approaches. Read more...
2. Flight crew typically conduct the approach briefing before reaching top of descent. Changing runway, especially when reducing the distance to fly, induces significant crew workload. Read more...
3. Non-precision approach implies higher crew workload and less possibility for deceleration during the final approach compared with an ILS approach. Controllers should aim to position the aircraft on final at a greater distance from touchdown. Read more...
4. Flight crew uncertainty about distance to touchdown affects the optimal profile management and can result in aircraft being high and fast on final approach. Read more...

Stabilised Approach — ATCO Guidance (continued)

Do your clearances and procedures allow aircraft to be stabilised by the heights at which typical operator stabilisation gates are set?

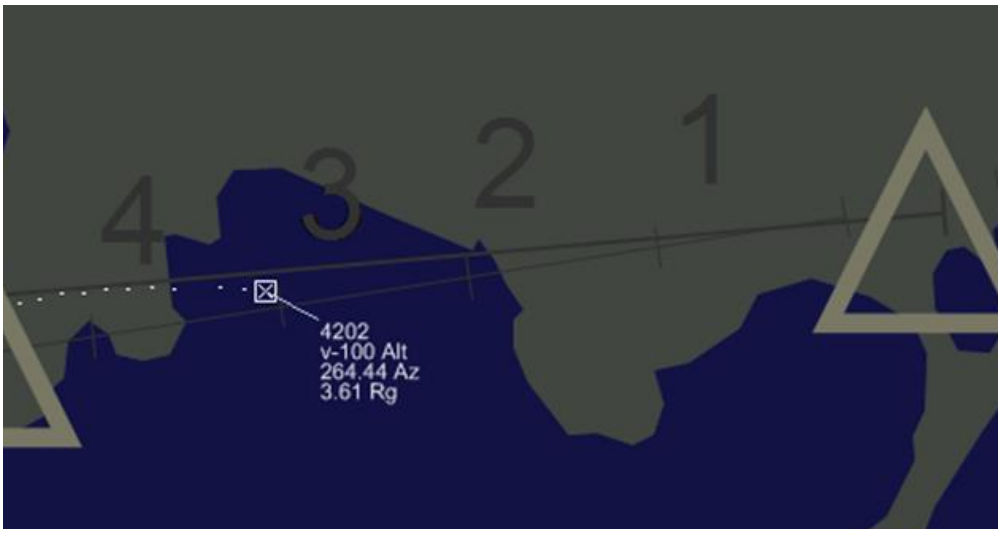
5. Modern jet aircraft need longer distance to descend and decelerate than propeller-driven aircraft. Read more...
6. Instructing an aircraft to reduce speed during the upper parts of the descent will usually cause it to drift above its descent profile. Read more...
7. 160 knots is the maximum acceptable speed to 4 nm from touchdown in order for most aircraft types to get the approach stabilised at the speed which will typically be needed when 1000 feet above the runway. Read more...
8. Be aware of forecast winds both aloft and at the surface to minimise exposure to an excessive tail wind component on approach and minimise any tailwind component for landing. Read more...
9. Optimal vectoring will typically result in an aircraft being fully established on final approach not later than 6 NM (and 2000ft) from touchdown. Read more...
10. Vector so that the glide slope is intercepted when an aircraft is in level flight. Read more...

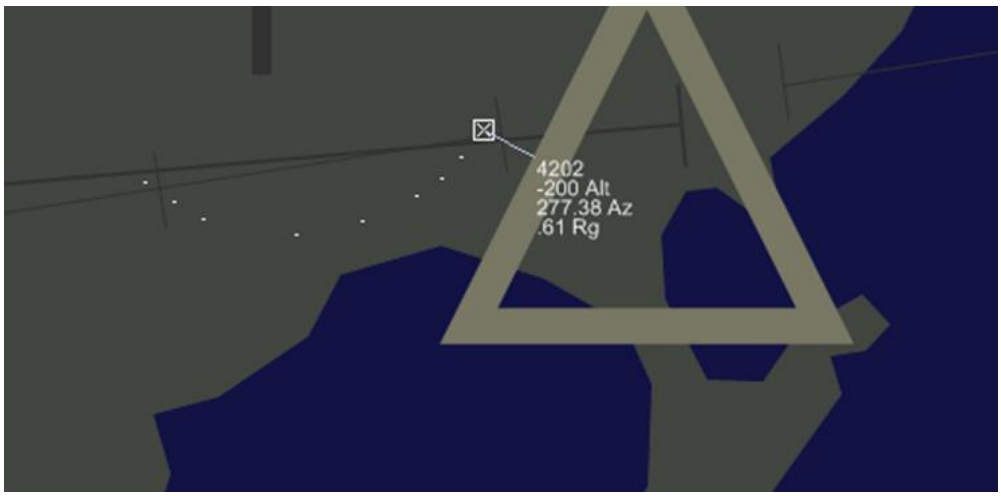
Isle of Man Case Study

On 8 June 2016 between 0920 and 0940 UTC, a PA32 on a flight from Humberside Airport to Isle of Man Airport undertook ILS approaches to RW08 at Isle of Man Airport in IMC conditions.

On the first two approaches, the pilot repeatedly failed to establish on the localiser and on both occasions was instructed by the Approach Controller to break off and be repositioned. On the third approach the pilot reported 'localiser established' and was transferred to Aerodrome Control but subsequently at 6 miles from touchdown initiated a descent well below the glidepath and then flew a very erratic lateral path.

Screen shots of the radar replay are shown below — the Aerodrome QNH was 1025 hPa and the altitudes depicted on the aircraft data label are based on 1013.2 hPa, so read approximately 300 feet lower than the actual altitude.





Isle of Man Case Study (continued)

The pilot reported 'abandoning' the approach and diverted back to the UK.

CCTV screen capture with the PA32 aircraft highlighted by arrow and square in top right corner tracking northeast:

The IOMA ATC controllers concerned correctly submitted Mandatory Occurrence Reports which led to an IOM CAA investigation. The IOM CAA provided the outcomes of its investigation to the pilot's licencing authority (UK CAA) which enabled appropriate action to be taken by them.

Whilst ATC positioning was not a contributory factor, the pilot was not warned of the aircraft's divergences from the approach path nor were any go-around instructions issued by either the Approach Radar or Aerodrome Controllers. See CAP493 Section 2, Chapter 1 - 19.5:

> 'A landing aircraft, which is considered by a controller to be dangerously positioned on final approach, shall be instructed to carry out a missed approach. An aircraft can be considered as dangerously positioned when it is poorly placed either laterally or vertically for the landing runway.'

B738, Vicinity Bristol UK

Credit: Skybrary

On 1 June 2019, a Boeing 737-800 on a flight from Verona to Bristol was instructed by the TWR controller to discontinue its day VMC non precision approach because it was considered to be dangerously low on final approach. The TWR controller had been alerted to the aircraft's altitude by the Assistant

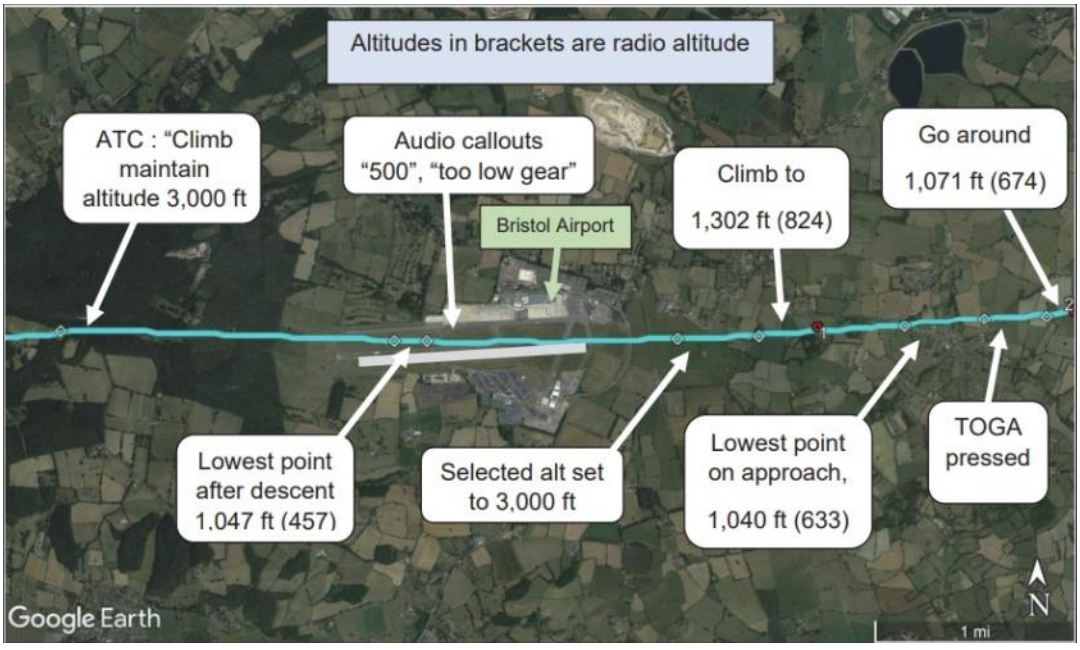
On contacting Bristol APP the radar controller advised the flight crew that they had 33 nm to go and could expect to be cleared for a RNAV(GNSS) approach to runway 27. Ten seconds later, with the flight at FL 100, a reduction to 23 track miles was offered and following crew acceptance, radar vectors towards final approach were provided. Once descent from FL100 commenced, the crew set the Bristol QNH of 1019, deployed the speed brakes and increased the 'Selected Airspeed' to 300 knots, despite the fact that the maximum permitted airspeed below this altitude is 250 KIAS. An idle thrust descent at up to 3000 fpm followed as the controller routed the aircraft direct to waypoint 'ELROV', the procedure IF on the extended runway centreline at 9.8 nm from the runway threshold. LNAV mode was successfully engaged and, with the airspeed in excess of 300 KCAS, descent continued towards the beginning of the initial approach which began 4 nm before ELROV and which was marked on the approach chart as maximum 210 KIAS. This speed was nevertheless exceeded by around 70 knots.

As ELROV was approached, the crew made three attempts to engage the autopilot in VNAV mode, the first with the airspeed still at 265 KCAS despite continued idle thrust, but were unable to achieve this because of the excessive speed and therefore continued final approach with 'LVL CHG' mode selected and the MDA set as the selected altitude. Soon after the flight passed ELROV, the APP controller, with the recorded airspeed still 241 KCAS with 8nm to go, asked the crew to 'start reducing speed please, 190 knots or less'. He then transferred the flight to TWR, advising them 'that the aircraft was fast'. The TWR controller noted this but since there was no traffic ahead he had 'considered that it was safe to allow the flight to continue'.

B738, Vicinity Bristol UK (continued)

Still at idle thrust and at an excessive airspeed, this descent was established at approximately 250 ft below the procedure vertical profile. As the MDA was approached, the 'ALT AQ' mode activated causing the rate of descent to decrease but it still remained significantly below profile and also still below the applicable Minimum Obstacle Clearance Altitude.

At this point, the TWR controller was involved with an aircraft push back problem on the apron but the Assistant present had become concerned by what they considered was the unusually low altitude of the 737 and drew the controller's attention to it. The controller stated that on looking, he had considered that the aircraft was 'dangerously positioned' as defined in the MATS Part 1 and had 'instinctively instructed the crew to go-around' - the aircraft was at 2nm from touchdown. This instruction was acknowledged and a go around commenced with the First Officer flying manually by reference to the flight director and take off/go-around thrust selected . However, because the MDA rather than the go-around stop altitude was still the selected altitude, the flight director command had changed from a climb to a level off on reaching MDA. As it did so, the auto-throttle mode changed from 'go-around' to one which maintains the current airspeed and this led to engine thrust reducing below 20°. Further difficulties were encountered by the flight crew resulting in the aircraft descending and reaching a minimum of 457 feet agl.



B738, Vicinity Bristol UK (continued)

When the aircraft climb ceased and became a descent overhead the airport, the TWR Assistant had again drawn the TWR controller's attention to the aircraft and on seeing where the aircraft was this led him to transmit 'All Stations Bristol Standby'. Eighteen seconds later, as the aircraft continued to climb, he instructed the flight to climb to and maintain 3000 feet QNH 1018. Once the flight reached and levelled off as instructed, it was transferred to APP radar and vectored to the south of the airport and onto another RNAV (GNSS) approach which was completed to a landing without further event.

The Conclusion of the Investigation was formally documented as follows:

> 'Flying a shortened routing led to a rushed and unstable approach which did not follow the correct vertical flight path. This was observed by ATC who instructed the aircraft to go around. The crew found themselves performing a go-around unexpectedly but did not know why they had been required to do so. The go-around was conducted with a mis-set altitude on the Mode Control Panel, and neither crew member noticed for a significant period that the aircraft was descending during the manoeuvre.'
>
> 'Crews should always be ready to perform a go-around because there can be many reasons why they might have to, either internal or external to the aircraft, such as on instruction from ATC.'

Take Away Points for ATC

- If you see an aircraft (either visually or using surveillance) under your control that you consider to be:
  - unusually displaced from the lateral or vertical path — warn the pilot;
  - dangerously positioned (poorly placed either laterally or vertically for the landing runway) — instruct the pilot to "go-around". "***BIGJET 347, go around I say again go around, acknowledge***" (CAP413, 4.65).
- Approach Controllers: when you have transferred aircraft on final approach to Aerodrome Control — alert Aerodrome Control if you consider that the aircraft's lateral or vertical path is dangerously positioned.
- Aerodrome Controllers: subject to appropriate prioritisation, monitor the vertical and lateral positioning of aircraft on final approach — visually or using surveillance tools.
- Assistants: if you see something that doesn't seem quite right — alert the controller. The assistant at Bristol did exactly the right thing.

Stabilised Approach Awareness Toolkit for ATC

The following links consolidate the SKYbrary toolkit for ATCOs:

- Contribution of Unstabilised Approaches to Aircraft Accidents and Incidents
- Flight Crew Workload in Preparation for the Execution of an Approach
- Unstabilised Approach: Inappropriate ATC Speed Instructions
- Unstabilised Approach: Delayed Descent Instructions
- Unstabilised Approach: Lack of or Wrong Information About Distance to Touchdown
- Unstabilised Approach: Landing Distance and Final Speed Calculations
- Unstabilised Approach: Vectoring into Short Final Distances
- Unstabilised Approach: Vectoring Resulting in Intercepting the Glidepath from Above

Relevant CAP493 (MATS Part 1) Content

"A landing aircraft, which is considered by a controller to be dangerously positioned on final approach, shall be instructed to carry out a missed approach. An aircraft can be considered as dangerously positioned when it is poorly placed either laterally or vertically for the landing run-way." (Section 2, Chapter 1 - 19.5)

"A controller may suspect that an aircraft is in an emergency situation or has suffered unlawful interference when: (4) the erratic behaviour of an aircraft or position symbol is observed;" (Section 5, Chapter 1 - paragraph 3.1)

"Surveillance systems may also be used to provide the following, whether or not the aircraft has been identified: (1) Information on the position of aircraft likely to constitute a hazard;" (Section 1, Chapter 6, paragraph 1A.3)

"Nothing in this manual prevents controllers from using their own discretion and initiative in response to unusual circumstances, which may not be covered by the procedures herein." (Section 1, Chapter 1, paragraph 1.2)

Also see:

- Section 1, Chapter 13 - 2 (Speed Control—Arrivals and Descending Aircraft)
- Section 3, Chapter 2 - 9 (Vectoring to Final Approach)
- Appendix F - Speed Control Guidance