Safety first
The Airbus Safety magazine

Prevention of Unstable Approaches

Unstable approach has been a problem since the very beginning of commercial aviation. Even so, it is still one of the most common contributing factors to many of the incidents and accidents that occur on landing today.

Regardless of the changes or cycles our industry faces, this article is a timeless reminder for the importance of efficient preparation for approach including anticipation of late changes, and the need for cooperation between flight crews and air traffic controllers. The article also provides tips to detect a potential unstable approach in advance so that it can be corrected long before the stabilization height. Respecting stabilized approach criteria is also highlighted as well as being go-around minded in the case of late destabilization.

This article is also available on safetyfirst.airbus.com and on the Safety first app for iOS and Android devices.

MANAGING CHANGES IN AVIATION

New challenges

A global pandemic, such as COVID-19, has several ramifications for the aviation industry. This includes the challenge for pilots to maintain recency in the face of an unprecedented drop in air traffic. Ongoing concerns about the effects of the pandemic can also be distracting for flight crews. It is an important reminder for crews to remain focused on their tasks throughout the flight. Especially during very dynamic and variable phases such as arrival, approach, and landing.

Modified ATC guidance

In a congested airspace, ATC sequences the large number of aircraft arriving at their destination airport by providing speed and trajectory guidance. However, ATC may not transmit this guidance when the traffic is low. Flight crews should therefore avoid the trap of expecting ATC to provide this guidance in usually congested airspaces, and always be aware of the need to monitor and control their energy.

Shortened approach trajectories

When an airspace is less congested in situations like the COVID-19 pandemic, ATC can clear flight crews on more direct routings. The flight crew must then quickly adapt their strategy to efficiently manage the aircraft energy due to the shortened approach trajectories.

In all cases, the flight crew must take advantage of the various tools and techniques available to efficiently manage and monitor their energy.

PREPARATION FOR A STABILIZED APPROACH

Energy Management

Good aircraft energy management from the top of descent is a prerequisite for a stabilized approach. Aircraft energy management is a combination of tools, anticipation, and a flexible flight crew action plan.

Use of the Flight Management System

The use of the FMS during descent, approach, and landing provides efficient assistance to the flight crew to manage the energy of the aircraft and reach the final approach at the correct speed. The "*Procedures - Normal Procedures - Standard Operating Procedures - Descent*" from the FCTM provides details on how the FMS computes the descent profile and how the use of the managed guidance modes enables the aircraft to stay near this ideal profile during descent. This is also described in the "Control your speed during descent, approach and landing" Safety first article published in July 2017.

Anticipation of late changes

In areas that use specifically constructed arrivals and approaches that enable sequencing of high volumes of traffic in congested environments, the anticipation of a late "direct to" request from ATC, if traffic is low, can help to reduce the crew workload and stress. The flight crew should review the planned approach trajectory and be prepared for the "worst case" scenario of a "direct to" that would significantly reduce the track miles to the runway.

Discussing the approach strategy during the Approach Briefing

During the approach briefing, management of late changes due to ATC requests should be anticipated and discussed, ensuring the strategy and task sharing are clearly defined. This should be part of the flight crew's Threat and Error Management (TEM) considerations.

Cooperation between flight crews and air traffic controllers

Cooperation between flight crews and ATC is essential to prevent situations that may lead to an unstable approach. The Air Traffic Controller should inform the flight crew if a shorter route is expected as soon as possible . This would enable the flight crew to anticipate and adapt their strategy accordingly and avoid high workload in the last phases of the approach.

Flight crews should alert ATC when they are unable to comply with any request and should ask for additional track miles to manage the aircraft's energy if necessary.

Selecting the appropriate approach speed technique

The **decelerated approach** is the standard technique for approach using xLS (ILS, MLS, GLS or FLS) or FINAL APP guidance.

However, Airbus recommends that the flight crews use an **early stabilized approach** technique when:

- a selected guidance is used (TRK/FPA or LOC/FPA)
- the final approach path is at a high glide path angle
- the intermediate approach segment is at a lower altitude than usual, and as a result, the Final Descent Point (FDP) is at a shorter distance from the runway

The flight crew should enter Vapp as a speed constraint at the FDP, enabling the FMS to calculate the adjusted vertical descent profile (not applicable to A220 aircraft).

The "Control your speed during descent, approach and landing" Safety first article, published in July 2017, illustrates the two approach speed techniques.

EARLY DETECTION OF AN UNSTABLE APPROACH

In many cases, a potential unstable approach can be detected long before the stabilization height. The flight crew should take advantage of the tools and techniques available for early detection of an unstable approach. This will enable them to take the time to recover the situation using trajectory modification in cooperation with ATC. This will avoid the need for last-minute corrections by the flight crew or a discontinued approach.

Situational awareness

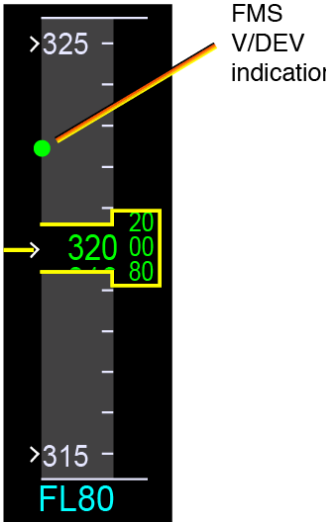
Use of the FMS V/DEV indication during descent

The use of the FMS V/DEV indication available on the FMS PROG page (A320/A330/A340), PERF DES page (A380/A350), or FMS DES page (A220) and its indication on the PFD altitude scale **(fig.1)** and VSD (A220) provides the flight crew with an indication of the aircraft position compared with the FMS descent profile.

This indication is also useful when radar vectored and flying near the FMS route.

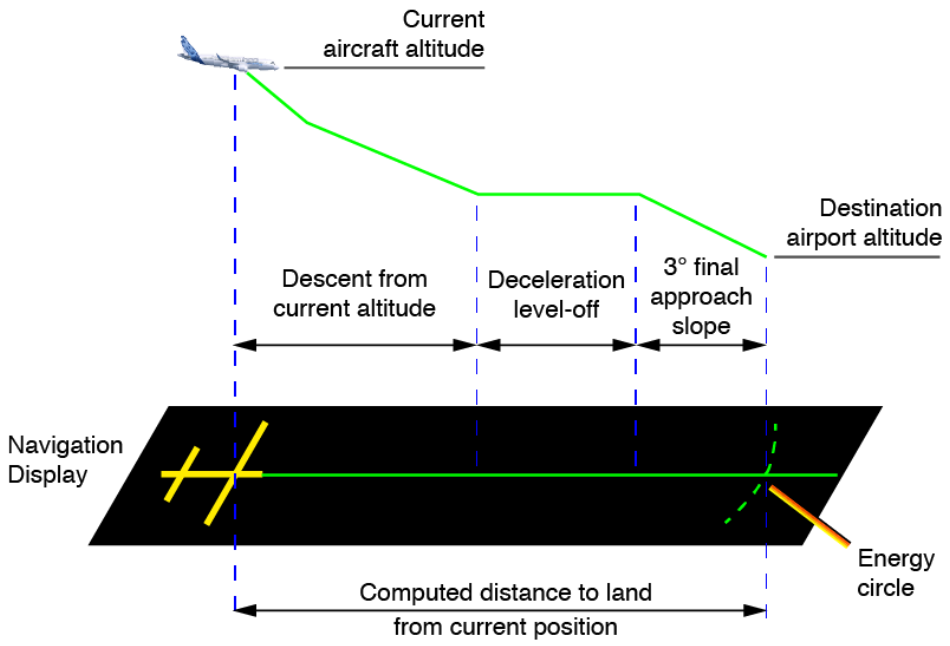
Sequencing of the FMS Flight Plan

The flight crew needs to sequence the FMS flight plan if it is not done automatically when in selected lateral modes during radar vectors. It enables the FMS to compute an updated descent and approach trajectory and therefore to still provide a useful reference to the crew. In addition, it allows the flight crew to switch back to managed guidance mode when cleared from ATC constraints. More information on the Flight Plan sequencing is available in "*Procedures - Normal Procedures - Standard Operating Procedures - Approach - Configuration Management - Initial approach"* in the FCTM.



(fig.1) Example of a V/DEV indication on the PFD altitude scale of an A320

Use of the energy circle (A320/A330/A340/A350/A380)



(fig.2) Computation principle of the energy circle

The ND will display the energy circle when the aircraft is in HDG or TRK lateral guidance modes and within 180 NM of its destination. It provides a visual cue of the minimum required distance to land, i.e. the distance required to descend in a straight line from the current aircraft position at its current speed down to the altitude of the destination airport at approach speed. The descent profile used to compute the distance takes into account speed limits, the wind, a deceleration level-off segment and a 3° final approach segment **(fig.2)**. If the airport is inside the energy circle, the flight crew should take action to adjust the situation using speed or rate of descent adjustments or speedbrakes as necessary or by requesting additional track miles from ATC.

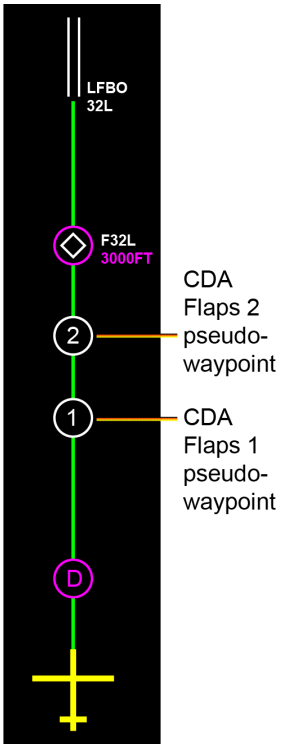
The flight crew needs to keep in mind the computation logics of the energy circle to better take advantage of the indications displayed on the ND.

Use of the bearing/distance field in the PROG page

The flight crew should consider inserting the landing threshold in the BRG/DIST field of the FMS PROG page. This will provide the direct distance to the landing threshold, and therefore, a very conservative estimation of the shortest possible distance to land. To do a quick mental estimation of the vertical position vs. distance, the flight crew can use the formula DELTA FL = DIST (nm) * 3 DEG.

Continuous Descent Approach (CDA) function (A320/A330/A350)

The CDA function is standard on all A350 aircraft and is an option on A320 and A330 aircraft equipped with Release 2 FMS standard. The CDA function computes a continuous descent profile that ensures the aircraft is configured for landing and is at VAPP, at 1 000 ft AAL. The CDA function displays pseudo waypoints on the ND **(fig.3)** indicating to the flight crew the latest position to extend the slats and flaps in order to follow the vertical profile of the approach.



(fig.3) CDA pseudo waypoints on the Navigation Display

Cross-crew Communication

Efficient crew communication is essential during the entire flight, especially during the whole dynamic approach phase that can include several changes in speed and aircraft configuration in addition to the navigation and the guidance toward the final segment. Flight crewmembers should express any concern they may have about a parameter they are not comfortable with, even before reaching the stabilization height. Such an exchange can bring the attention of the other flight crewmember to a parameter that may not have been noticed. This communication between the crewmembers will also prepare them for a potential discontinued approach or go-around and will prevent a rushed go-around maneuver at the last minute.

BE PREPARED TO INTERRUPT THE APPROACH AT ANY TIME

The flight crew should be prepared to discontinue the approach or go-around at any time, if it is not possible to reach or maintain a stabilized flight path.

Discontinued approach versus go-around

If the flight crew needs to interrupt the approach at or above the FCU altitude, then the “Discontinued approach” procedure should be considered. If the flight crew interrupts the approach below the FCU altitude, then the go-around procedure should be applied. For more information, refer to the “Flying a Go-around, Managing Energy “ Safety first article published in January 2014.

Soft go-around

To limit the aircraft acceleration during go-around, especially when the aircraft is light, the soft go-around can be used on aircraft equipped with the soft go-around function. Refer to the “Introduction to the Soft Go-around Function” Safety first article published in January 2017 for more information.

THE STABILIZATION GATE

Rigorous respect of a stabilization gate provides a good basis for the accomplishment of a subsequent safe landing: a stabilized aircraft at the stabilization height enables the pilot flying to be prepared for a safe and efficient landing flare.

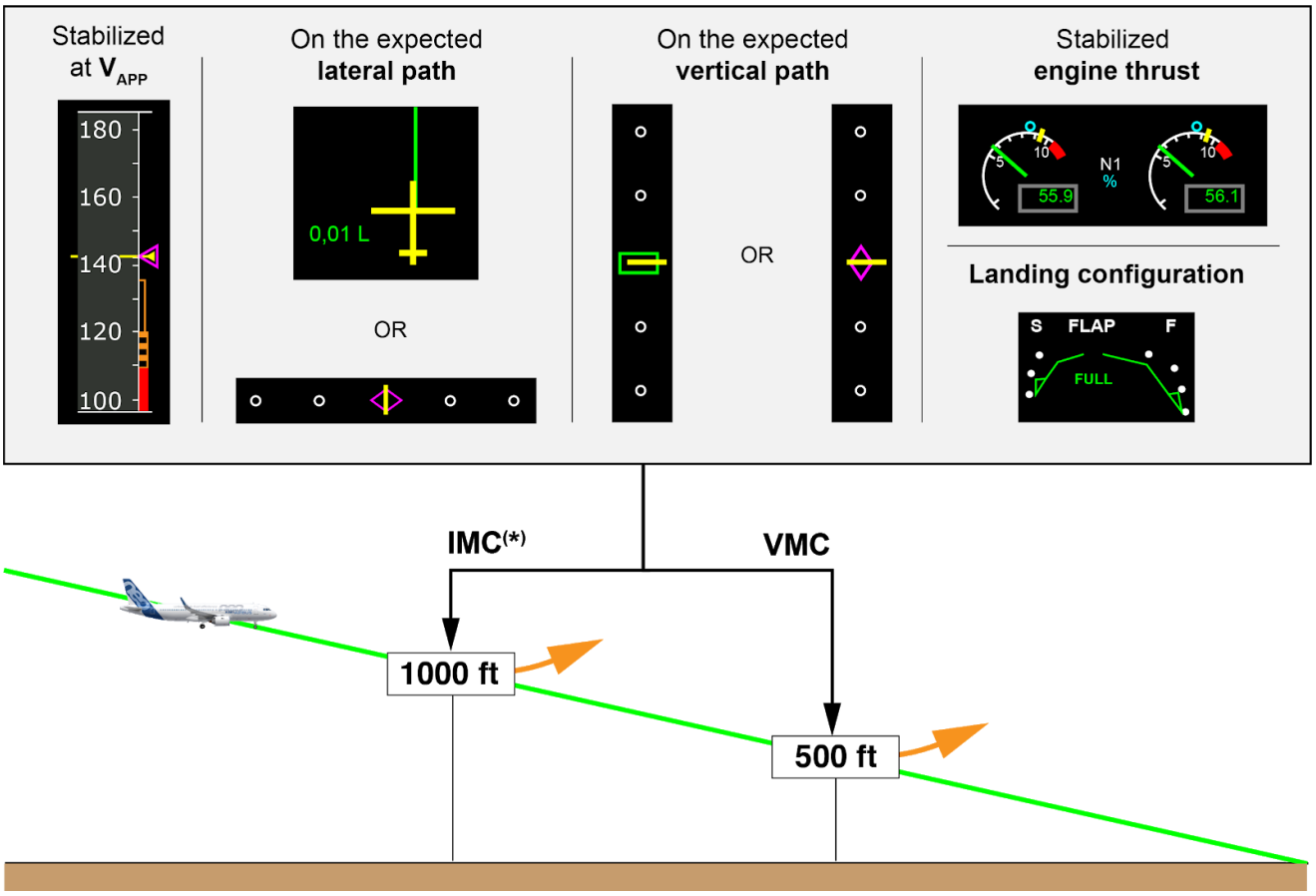
Operators should define and provide their flight crew with a clear definition of their stabilization criteria and stabilization height based on the FCOM guidance, their local regulations and experience.

Operators should encourage their flight crews to strictly respect the stabilization gate and to perform a go-around if they cannot achieve the criteria or if they do not feel comfortable with the stabilization of their aircraft. A non-punitive policy regarding go-arounds combined with adequate go-around training using various

scenarios will increase flight crew confidence in their handling of the maneuver and will improve their go-around decision making.

Stabilization criteria from the FCOM **(fig.4)** illustrated below provides guidance to help Operators define their own stabilization policy. If one of the conditions is not satisfied, the flight crew should initiate a go-around, unless they estimate that only small corrections are required to recover stabilized approach conditions.

(fig.4) FCOM stabilization criteria for an A320 aircraft



(*) In IMC, a later speed and thrust stabilization can be acceptable provided that:

- It is allowed by Operator policies and regulations
- The aircraft is decelerating toward the target approach speed
- The flight crew stabilizes speed and thrust as soon as possible and no later than 500 ft AAL.
- The flight crew does not detect any excessive flight parameter deviation.

LATE AIRCRAFT DESTABILIZATION

Being stabilized at a gate is not sufficient to ensure a safe and efficient landing. The flight crew must keep the flight parameters stable and within the limits until the landing.

However, some external conditions such as wind gradients may lead to late destabilization.

Close monitoring of the flight parameters

The nearer the aircraft gets to the ground, the greater the importance of efficient monitoring of the flight parameters is.

The PM must make a callout if any flight parameter deviates above the defined thresholds. The PF must then either correct the deviating parameter, if possible, or initiate a go-around if the correction cannot be made in a timely manner.

Refer to the FCOM "*Procedures - Normal Procedures - Standard callouts - Flight parameters*" for information about the callouts to be used during approach and the thresholds for flight parameters deviations.

The "A focus on the Landing Flare" Safety first article, published in September 2020, provides an example of a late destabilization in final approach and the associated recommendations for go-around near the ground.

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Every pilot is already aware of the potential safety consequences of an unstable approach condition. Knowing that an unstable approach is still a contributing factor to many accidents or incidents during approach and landing, it is why repeating and sharing the lessons learned can ensure the flight crew is well prepared to ensure a safe landing.

Flight crews should anticipate scenarios that can happen during descent and approach during their approach briefing, such as late changes requested by ATC. The aircraft's energy can then be efficiently managed by using the available tools and techniques provided in Airbus documentation. This will also enable the flight crew to identify any possibility of an unstable approach as soon as possible, allowing for early intervention to either recover the situation or to interrupt the approach. Anticipating late change in the action plan for the approach and landing phases is part of the Threat and Error Management (TEM) considerations.

Cooperation with ATC is essential to ensure that the flight crew are informed of any expected shortened trajectory in advance, so they can adapt their strategy accordingly. Flight crews should alert ATC when they are not able to comply with a request, and if necessary, ask for additional track miles to manage the aircraft's energy.

Operators should promote strict adherence to stabilization criteria with flight crews and to consider the stabilization height as a hard decision gate that should not be passed if any of the stabilization criteria is not met. A non-punitive policy regarding go-around should apply together with appropriate training for go-around in various situations. This will increase the confidence and competencies of the flight crews to discontinue the approach or perform a safe go-around at the appropriate time in the case -or with the risk- of an unstable approach.

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