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Flying a Go-Around Managing Energy

Introduction

Airbus recently performed some research on the quality of go-around execution. This involved examining nearly 500,000 approaches flown by many airlines from around the world.

The results highlighted that in some cases crews are choosing not to apply the Airbus Standard Operating Procedure (SOP) for the go-around phase.

Particularly when a go-around was performed above 1,200 ft, the flight crew often decided to adapt the engines thrust selection instead of setting TOGA thrust. Feedback from operators also indicates a similar tendency. As a result, Airbus received several reports of unexpected aircraft trajectories and energy management techniques during the go-around procedure.

Therefore, it was decided to address these issues by:

- Better defining an optional thrust levers management technique during the a go-around, as per Airbus SOP.
- Developing a “Discontinued Approach” technique that would allow crews to effectively “abort” the approach without selecting TOGA detent.

The Flight Crew Training Manual (FCTM) and the Flight Crew Operating Manual (FCOM) were updated accordingly end 2013 (updates respectively in March and May 2014 for the A300/A310 and A380).

Feedback from Operators

Between 2010 and 2012, Airbus performed a survey on go-arounds that required a close examination of the approach phase of nearly 500,000 flights. The confidential survey gathered data from 12 airlines from all areas around the world. Amongst many facts that were established was the general go-around rate which was one go-around in 340 approaches for the A320 family fleet and one go-around in 240 approaches for the A330/A340 fleet.

The main outcome of this survey was that, above 1,200 ft AAL, over half of the go-arounds were performed without selecting the thrust levers to the TOGA detent (fig1).

Perhaps the most obvious result of this research was that with go-arounds at heights above 1,200 ft the adherence to the Airbus standard go-around procedure was only about 50%.

The reason is that crews are reluctant to use TOGA power, even briefly, if they only have a short climb to their FCU Altitude.

In addition to the figure above, several other discreet areas of go-around management were analysed. These included configuration management, speed control,

pitch control and the use of automation versus manual flight.

To initiate a go-around, Airbus has always recommended the application of the standard go-around procedure with the selection of TOGA detent. With an aircraft that is flown according to the SOP there is no particular difficulty with such a procedure. But if the pitch target is not achieved and a go-around with maximum thrust is applied to a light weight aircraft, this may give rise to an excess energy situation. So the questions being asked were: is there a solution to limit the excess aircraft energy, and is there an alternative to the standard go-around procedure for these "high altitude" go-arounds?

Recommendations on the Go-Around Procedure

To initiate a go-around, flight crews set the thrust levers to the TOGA detent. The engine thrust then increases to the maximum available thrust. Setting the thrust levers to the TOGA detent is important because the lever movement to TOGA engages the correct FMA modes and then, the FMS sequences the Missed Approach guidance that is pre-coded in the FMS Navigation Database.

When the flight crew performs a go-around SOP, they set the thrust levers to the TOGA detent.

This triggers the:

- **Disarming or disengagement of approach modes in the flight guidance**
- **Engagement of the go-around mode in the flight guidance (SRS – GA TRK)**
- **Engagement of the go-around phase in the FMS.**

However, in some cases, maximum thrust is often not required to perform a safe go-around and at some airfields the Missed Approach Altitude is quite low.

The SOP already mentioned that after having set the thrust levers to TOGA detent, if TOGA thrust was not required, the flight crew might retard the thrust levers as required. However, there was no additional recommendation for the flight crew on which position the thrust levers had to be set.

Airbus now specifies in the procedure:

If TOGA thrust is not required, the flight crew should set the thrust levers to the CL detent, after having selected them to TOGA position just at the go-around initiation point.

This action aims at limiting the aircraft energy during the go-around phase.

Discontinued Approach Technique

Some operators have developed their own customized go-around procedures. These procedures have resulted in unexpected aircraft trajectory and energy situations. Therefore, Airbus developed a technique, based on the knowledge of all associated aircraft systems, to achieve the objective of performing a go-around without applying TOGA thrust. The technique, called "Discontinued Approach", enables the flight crew to abort an approach without setting the thrust levers to the TOGA detent.

The main actions that flight crew have to perform are:

- De-selection of the approach mode
- Management of aircraft trajectory
- Selection of a new destination in the FMS, if required.

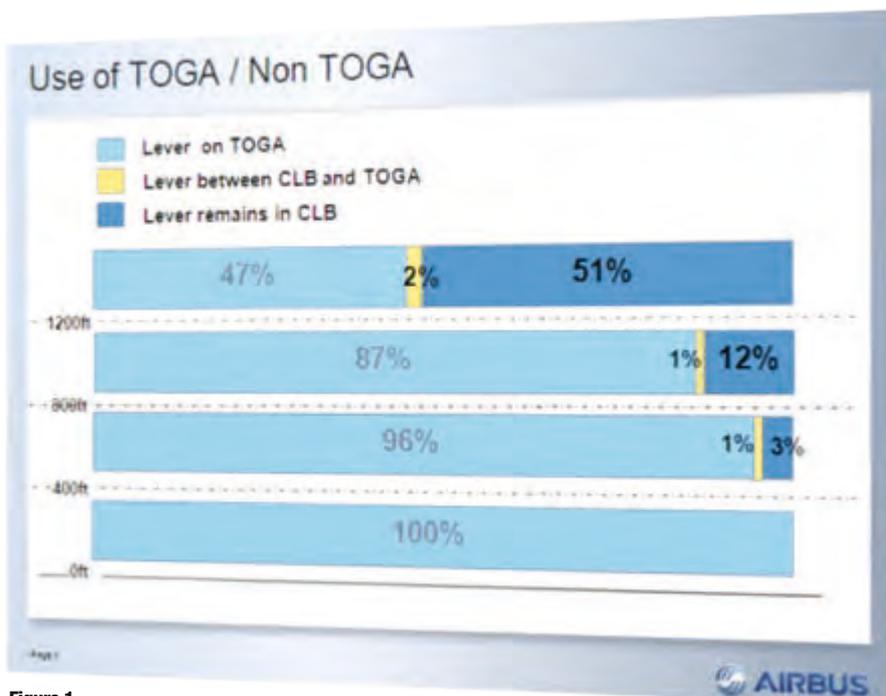


Figure 1
Airbus survey on the use of TOGA during go-around

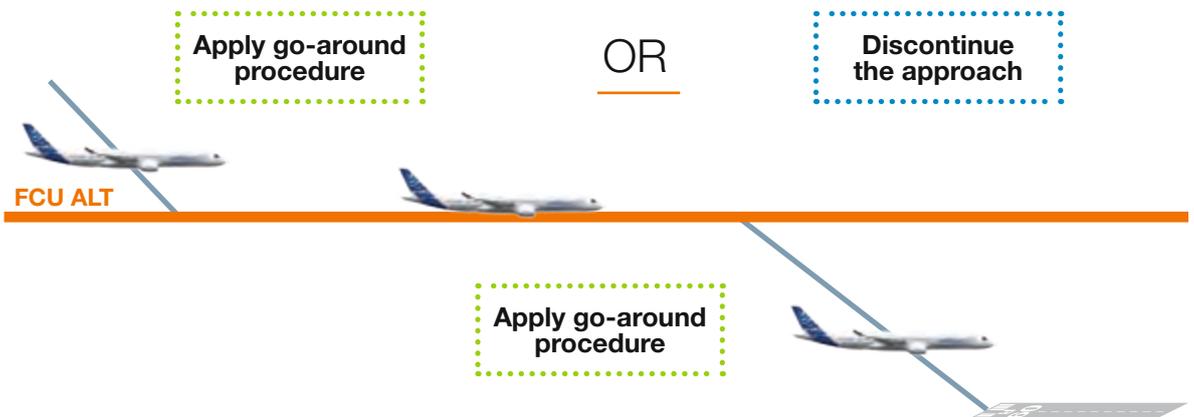


Figure 2
Depending on the altitude selected on the FCU, the flight crew may discontinue the approach.

The FCU altitude during a descent and approach is normally reduced in steps, with ATC clearance, until the initial approach altitude (typically 3,000 ft) is reached. At glide slope capture (G/S) or final approach commencement (FINAL APP) the FCU altitude is set to the missed approach altitude.

The flight crew uses this selected FCU altitude for the decision-making:

- At or above the FCU selected altitude: use either the go-around SOP for the Discontinued Approach Technique (fig.2)
- When below the FCU selected altitude: use the go-around SOP.

If the flight crew wants to apply the discontinued approach technique, they must go through the **five** following steps:

- 1) Call **“CANCEL APPROACH”**
- 2) Leave the thrust levers in the CL detent
- 3) De-selects APPR mode(s)

To de-select the approach modes, the flight crew can use the applicable pushbutton: APPR or LOC (if a LOC only approach is being executed). In the case of an ILS approach, for example, both these actions disarm or disengage the LOC and G/S approach modes on the FMA. This action ensures that possible spurious LOC and/or G/S capture (fig.3) are avoided.

- 4) Manage the aircraft trajectory in vertical and lateral axis.

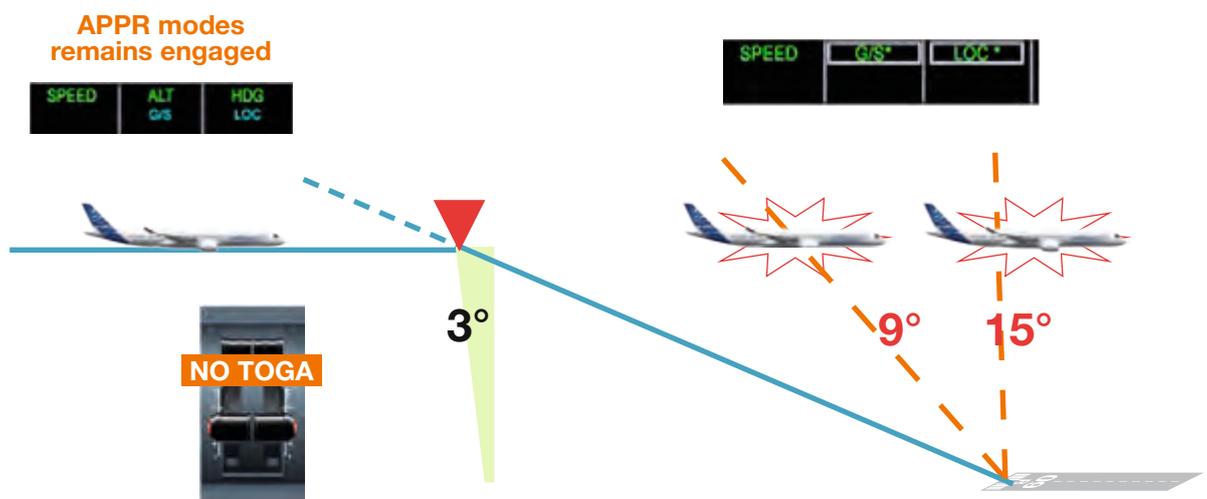
- Depending on the ATC orders, select a

heading (HDG), or re-engage NAV if the intention is to fly the missed approach in the FMS Flight Plan (F-PLN).

- Select the appropriate vertical mode to descend or to level-off according to the altitude assigned by the ATC.
- Select a new speed according to the situation.

- 5) Enter a new DEST in the FMS, if required (fig. 4)

If the flight crew intends to fly the missed approach and overflies the last waypoint of the approach, the FMS considers that the “destination” in the F-PLN has been achieved. The flight crew will have to enter a new destination, which could be the same airport or a diversion airport.



If a flight crew aborts an approach during an ILS approach without setting the thrust levers to the TOGA detent, the Auto Flight System remains in approach mode with LOC and G/S modes engaged. If the aircraft enters the capture zone of ILS (G/S beam), the aircraft may follow the trajectory of the ILS.

Figure 3
Spurious LOC and/or G/S capture

The “false” ILS trajectory could be based on the secondary beam of the ILS at 9 or 15 degrees. As a result, the aircraft can perform a very abrupt trajectory change to follow the secondary G/S beam.

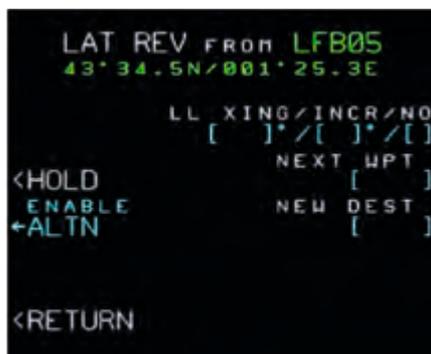


Figure 4
The missed approach remains available when discontinuing the approach. However, the FMS may have "lost" the destination

Conclusion

A thorough go-around survey and in-service feedback highlighted that flight crews were applying customized procedures to interrupt the approach, instead of applying the Airbus go-around SOP procedure. This occasionally led to some poorly flown go-arounds with unexpected trajectories and some mis-configuration issues.

It was therefore decided, in order to avoid excess aircraft energy during the go-around, to:

- **Refine the go-around SOP** with a recommendation, if TOGA thrust is not required, to set the thrust levers to CL detent just after the TOGA detent selection.
- **Develop a new optional technique to discontinue the approach when at or above the FCU altitude**, without setting the thrust levers to TOGA.

This technique consists in the five following steps:

- 1) Call "CANCEL APPROACH"
- 2) Leave the thrust levers in the CL detent
- 3) De-selects APPR mode(s)
- 4) Manage the aircraft trajectory in vertical and lateral axis
- 5) Enter a new DEST in the FMS, if required.

It is important to remember that the standard go-around procedure remains the only procedure within the SOPs that addresses all the go-around requirements in term of performance. Therefore, if there is any doubt about the performance criteria (obstacles, climb gradients etc) during the intended go-around, the standard go-around procedure must be applied.

This article highlights the two recommendations that were introduced in the FCOM PRO-NOR-SOP "Approach General" and in the FCTM Normal Operations NO-180 "Approach" at the end of 2013 (updates respectively in March and May 2014 for the A300/A310 and A380).

Two 'Safety first' articles have in the past been devoted to the go-around procedure:

- The first, "Go-around Handling" issue 10, August 2010, highlighted that on Airbus Fly By Wire aircraft the go-around flight guidance modes of the Auto Flight System are triggered by setting the thrust levers to TOGA.
- The second, "The go-around Procedure" issue 12, July 2011, insisted on the need to fly and maintain the proper pitch and on the necessity to retard the thrust levers from TOGA to CL detent without delay in the event of an early capture of altitude.

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