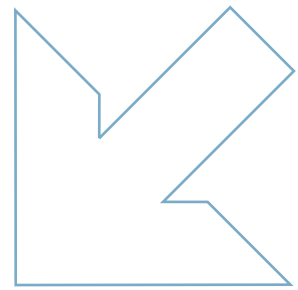




A320/ Runway overrun



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Flight Safety Director

1 | Introduction

Runway excursions, together with Controlled Flight Into Terrain (CFIT), are one of the main categories of incidents and accidents. In the last two years, ten runway excursions were reported to Airbus. This article will describe one of these occurrences, where the aircraft was damaged beyond economical repair.

The root causes of this event are common to many other runway excursions, and it is therefore worthwhile to share the lessons learned from this accident and to repeat the following key safety messages:

- Fly stabilized approaches
- Be go-around minded

2 | Description of the event

An A320 performed a visual approach to a runway 12. The aircraft landed at 6h23' local time and overran the end of the 1966 meter long runway at a speed of approximately 85kt.

It stopped approximately 200 meters beyond the runway limit and the 156 occupants were able to evacuate the plane safely. There was no post impact fire, but the aircraft suffered a hull loss.

The following sequence of events has been retrieved from the DFDR and CVR. Data from the latter is incomplete as the Captain's voice was not audible.

Flight conditions at 4 700ft :

The aircraft was performing a visual approach. Gross weight was 64t (Max landing weight is 64.5t) Configuration clean (Slat 0° / Flaps 0°) with landing gears up and locked.

Autopilot 1 was engaged in DES (longitudinal mode) and NAV (lateral mode). Both Flight Directors (FD) were engaged. ATHR was engaged in thrust mode. Captain was the Pilot Flying (PF).

Selected altitude on FCU was 3 000ft.
Aircraft heading was 155°.

Wind speed was 23kt, and wind direction 300°. This resulted in a 20kt tailwind and a 13kt right crosswind.

Speed target was managed by the FMGC and was equal to 285kt.
CAS was 306kt
Vapp = 138kt

Approach

Approaching 3 000ft, The crew contacted ATC :

- F/O : "... approaching 10 DME 3 000"
- ATC : Roger and wind is calm.
Report finals runway 12".
- F/O : "Check finals runway 12 ...".

As the aircraft approached 3 000ft, the A/P vertical mode changed to Altitude Acquire (ALT*) then to Altitude Hold (ALT). The ATHR changed to speed mode.

The A/P vertical mode was then changed to Flight Path Angle (FPA), with a selected -3° FPA target. The aircraft descended accordingly.

The selected FPA was then changed to 0° and the aircraft leveled off at 2 800ft RA. The crew selected configuration 1¹ and, 3 seconds later, landing gears down.

The crew armed the ground spoilers, and the selected FPA was successively changed to -3.6° , then to -5.5° and -7° after having selected configuration 2² at about 2 600ft RA (CAS was 198kt ; VFE = 200kt).

The F/O announced "Still high" and immediately after "Too close".

At 2 300ft RA, the Captain disconnected the A/P and disengaged both FD. ATC announced "Wind is calm³, cleared to land runway 12".

At 1 600ft RA, configuration 3⁴ was selected (CAS was 186kt; VFE = 185kt).

At about 1 150ft RA, during the LH turn to intercept the runway centerline, configuration FULL⁵ was selected (CAS was 170kt; VFE = 177kt) and within about one second, speedbrake lever was pushed aft to command extension. To do that, the crew disarmed the ground spoilers.

The F/O announced "High speed he" and immediately after "Let's circle again it's too high" followed by "High".

¹ Configuration 1: Slats 18° / Flaps 0°

² Configuration 2: Slats 22° / Flaps 15°

³ The wind information was not reliable because the wind indication system had been out of order for several months. A NOTAM had been issued, but the crew was not aware.



Slats and flaps surfaces reached the position FULL about 3s after the crew selected this configuration. Speedbrakes started to retract (speedbrakes are inhibited in configuration FULL on A320).

A Single Chime (SC) sounded, which corresponds to the "SPD BRK DISAGREE" caution, triggered because of the difference between the actual position of the speedbrakes (retracted) versus the commanded position (extended).

The speedbrake lever remained in the extended position until the end of recorded data. The ground spoilers were not rearmed.

The Captain then pushed the stick and increased the rate of descent up to 1 900ft/min.

At 600ft RA the EGPWS alarm "Sink Rate" triggered and sounded twice.

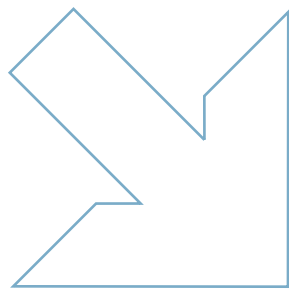
The Captain decreased the nose-down pitch from -6.5° to -2.5° . The aircraft rate of descent decreased.

At 500ft RA CAS was approximately 170kt (Vapp+ 32), and the rate of descent was about 1 800ft/min.

F/O said "Our speed is too high. We can make another circuit. How about that".

The Captain continued the approach.





Landing

At 200ft RA the wind characteristics were: 11kt tailwind and 6kt crosswind from the left.

At 170ft RA, Autobrake MED was selected.

At about 150ft RA, the EGPWS alarm “Sink Rate” triggered and sounded twice.

The Captain pulled the stick and adjusted the pitch from -2.5° nose down to $+1^{\circ}$ nose up (reached at about 50ft). The aircraft rate of descent decreased.

At approximately 50ft RA, both thrust levers were retarded to idle. CAS was 159kt (Vapp + 21).

The aircraft flew over the runway 12 threshold, at a height of 35ft.

F/O called out “Speed”.

The aircraft floated above the runway during 9s and both main landing gears touched down at about 740m beyond the runway 12 threshold (1 226m of runway left), CAS was 150kt (Vapp+12). The aircraft bounced and touched down again at 1 070m beyond the runway threshold (896m of runway left). CAS was 146kt (Vapp+8), ground speed was 158kt.

Both brake pedals were fully pressed and the aircraft longitudinal deceleration reached 0.3g.

The thrust levers remained at idle and no reverser thrust was selected.

Note: Pressing the brake pedals normally deactivates the Autobrake. Here, the Autobrake did not activate since the ground spoilers did not deploy as they had been disarmed upon speedbrake selection. Ground spoilers, even disarmed, extend at touchdown at reverser thrust selection. However, as mentioned above, in this event reverser thrust was not selected.

⁴ Configuration 3 : Slats 22° / Flaps 20°

⁵ Configuration FULL: Slats 27° / Flaps 35°

⁶ Spoilers 2 to 4 act as speed brakes

Both brake pedals were kept pressed while Autobrake mode selection was changed to MAX.

This had no effect because the Autobrake was not activated.

The Captain then pulled full back stick and the thrust levers were set to TOGA for about 2s (while the aircraft was 316 meters from the runway end) and back to idle.

CAS was approximately 113kt.

The brake pedals were slightly released, and then were fully pressed again⁷.

The aircraft left the runway at a ground speed of approximately 85kt, crossed a field, descended a steep gradient and came to a stop in some trees.

3 | Key Points

- The aircraft was performing a visual approach to the 1 966m long runway 12, with A/P1 and both FD engaged.
- A/P was disconnected at 2 300ft RA.
- At about 1 200ft RA, during left final turn, configuration FULL was selected and immediately after, speed brake lever was pushed aft. This disarmed the ground spoilers.
- At 500ft RA, CAS was approximately 170kt (Vapp+32) and the rate of descent was about 1 800ft/min.
- The approach was never stabilized.
- The aircraft first touched down at 740m from the runway threshold (1 226m left), CAS was 150kt (Vapp+12).
- The second touch down occurred at about 1 070m from the runway threshold (896m left), CAS was 146kt (Vapp+8).
- Both thrust levers remained at idle. No thrust reverser was selected.
- The crew performed manual braking, deceleration rate reached 0.3g.
- The aircraft left the runway at about 85kt.

Note : With ground spoilers deployed at touch down without reversers, the aircraft would have stopped at about 350m before the runway end (400m if reversers had been selected).

⁷ Since CAPT and F/O brake pedals are mechanically linked, the DFDR does not allow to determine who actually pressed on the pedals.

4 | Lessons learned

4.1 Stabilized approach

The approach was never stabilized.

An unstabilized approach may result from an inappropriate evaluation of the situation and inadequate time management to plan, prepare and execute the approach.

This adequate preparation should be done through briefings, which are safety nets to ensure:

- Shared evaluation of the situation and setting of common objectives.
- A clear definition of the tasks and task sharing to be performed.
- A mutually agreed action plan, which includes preparing a go-around strategy if, for unexpected reasons, the approach has to be aborted.

During the approach, the crew should then monitor flight parameters and external conditions carefully in order to detect deviations from the planned approach, as even small deviations may lead to reduced safety margins.

FCOM 3.03.20 p.1, Visual Approach, indicates: *“Perform the approach on a nominal 3-degree glideslope using visual references. Approach to be stabilized by 500 feet AGL on the correct approach path, in the landing configuration, at VAPP.”*

4.2 Be go-around minded

The Flight Crew Training Manual 02.070 Approach Briefing reads as follows :

“The crew must be ready mentally for go-around at any stage of the approach. Should a failure occur above 1 000 ft RA, all ECAM actions (and DH amendment if required) should be completed before reaching 1 000 ft RA, otherwise a go-around should be initiated. This ensures proper task sharing for the remainder of the approach. Any alert generated below 1 000 ft should lead to a go-around.”

In addition, the Visual Approach SOP contained in FCOM 3.03.20 indicates :

“Have the aircraft stabilized by 500 feet AGL, on the correct approach path at VAPP (or ground speed mini) with the appropriate thrust applied. If not stabilized, a go-around should be considered.”

A go-around should be considered as well when confusion exists about :

- The use of automation
- The aircraft's response

4.3 Ground spoilers, thrust reversers and auto brake

The ground spoilers were disarmed when the crew selected the speed brakes.

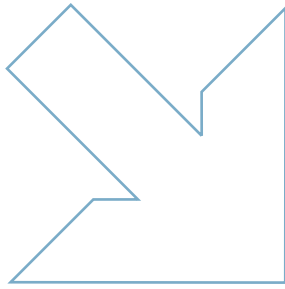
At touch down, the PF did not select the reversers and the PNF did not check the ground spoilers extension nor the reversers deployment.

Airbus recommends adherence to the SOP in FCOM 3.03.22. p5/6. The touchdown procedures have been revised in June 2008 (REV 42) to include, among other modifications, notes reminding crews that:

- If ground spoilers are not armed, ground spoilers extend at reverser thrust selection on both engines.
- Autobrake is inhibited if the ground spoilers do not extend.

The revised touchdown procedures are shown hereafter:





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		SEQ 001	REV 42

● **At touchdown :**

– **REV MAX**

- Select MAX REV immediately after the main landing gear touches down. If the airport regulations restrict the use of thrust reversers, select and maintain the thrust levers in reverse idle position until taxi speed is reached. A slight pitch up that can be easily controlled by the pilot, may occur when the thrust reversers are deployed before the nose landing gear touches down. Lower the nosewheel without undue delay.
- The PNF continues to monitor the attitude.
- In the case of an engine failure, the use of the remaining thrust reverser is recommended.
- Braking may begin before the nosewheel has touched down, if required for performance reasons. However, when comfort is the priority, the flight crew should delay braking until the nosewheel has touched down. During rollout, the flight crew should avoid sidestick inputs (either lateral or longitudinal). If directional control problems are encountered, the flight crew should reduce thrust to reverse idle until directional control is satisfactory.
- After reverse thrust is selected, the flight crew must perform a full stop landing.

R – **GROUND SPOILERS CHECK/ANNOUNCE**

- R Check that the ECAM WHEEL page displays the ground spoilers extended after
- R touchdown.
- R · If no ground spoilers are extended :
- R – Verify and confirm that both thrust levers are set to IDLE or REV detent
- R – Set both thrust reverser levers to REV MAX, and fully press the brake pedals.

R *Note : If ground spoilers are not armed, ground spoilers extend at reverser thrust*

R *selection.*

R – **REVERSERS CHECK/ANNOUNCE**

- R Check that the ECAM E/WD page displays that the reverse deployment is as
- R expected (REV green).

– **DIRECTIONAL CONTROL ENSURE**

- Use rudder pedals for directional control.
- Do not use the nosewheel steering control handle before reaching taxi speed.

– **BRAKES AS RQRD**

- Monitor the autobrake, if it is on. When required, brake with the pedals.
- Although the green hydraulic system supplies the braking system, if pedals are pressed rapidly, a brake pressure indication appears briefly on the BRAKE PRESS indicator.

R *Note : If no ground spoilers are extended, the autobrake is not activated.*

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- R **– DECELERATION** **CHECK/ANNOUNCE**
- R The deceleration is felt by the flight crew, and confirmed by the speed trend on the
- R PFD.
- R The deceleration may also be confirmed by the DECEL light (if autobrake is on).

5 | Conclusion |

This event illustrates the need to prepare each approach and to perform an adequate briefing, which will help the crews in:

- The execution of a stabilized approach
- The recognition of the need to carry out a timely go-around
- The performance of a safe go-around

Runway excursions remains a major category of incidents and accidents.

Avoiding them requires following two golden rules :

- Fly stabilized approaches
- Be go-around minded

This message is essential as insufficient preparation of the approach and/or minor deviations in the flight path may result in major safety consequences.

Airbus also recommends giving consideration to the Flight Operation Briefing Notes (FOB)N “Flying Stabilized Approach”, FOB “Descent and Approach Profile Management” and FOB “Aircraft Energy Management during Approach”.

The Flight Operation Briefing Notes are available on the Airbus website at the following address and can be downloaded at:

http://www.airbus.com/en/corporate/ethics/safety_lib/



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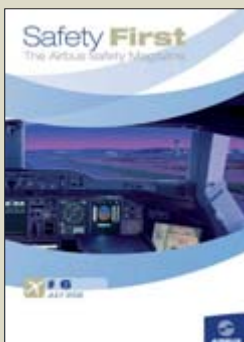
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