Runway Excursions at Take-off

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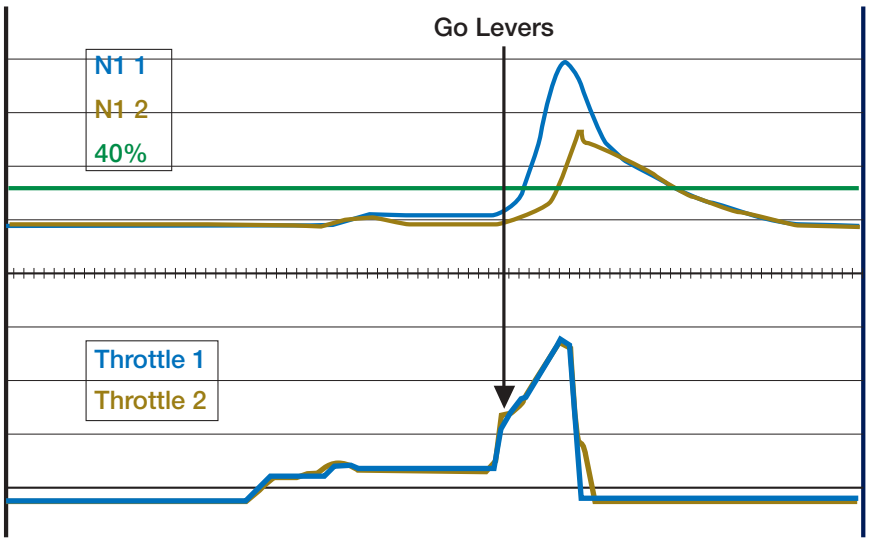
Director of Flight Safety

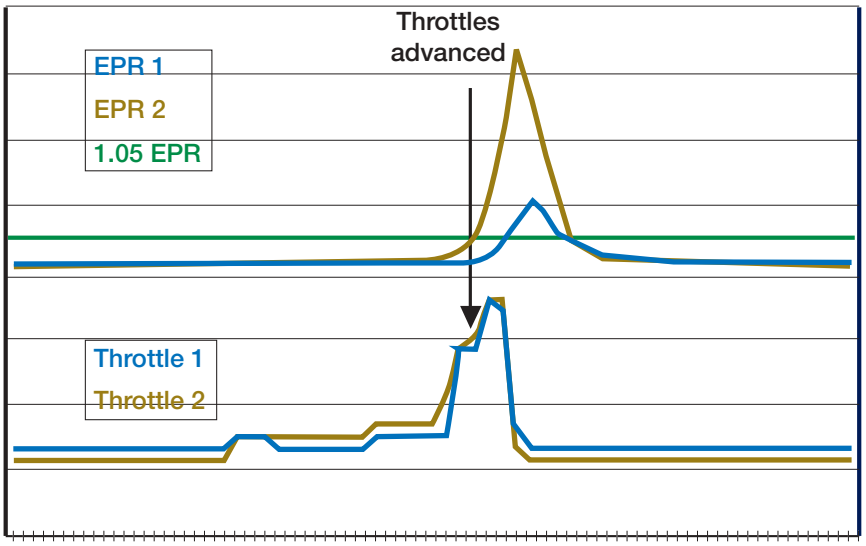
There have been two events involving an A310 and an A320 that resulted in the aircraft exiting the runway during the take-off run. The circumstances that caused these events are very similar:

During the alignment on the runway centreline before take off, one throttle was advanced slightly above the other. This led to a situation where one engine was at idle and the other was slightly above idle. Then, the go-levers were triggered (A310) or the thrust levers were advanced (A320) without prior N1 stabilization. The engine that was above idle accelerated faster than the other, leading to an asymmetrical thrust increase. In both cases, the take off was rejected but the aircraft left the side of the runway at low speed. Here are presented the curves retrieved from the DFDR:

A310



A320



Engine acceleration depends on acceleration schedule (FF vs N2) and throttle movement. There are two types of acceleration:

- Slow throttle movement "behind" the engine acceleration schedule: Thrust is function of the throttle position.
- Fast/normal throttle movement "ahead of" the engine acceleration schedule: Thrust is function of the max acceleration schedule capability

The time to accelerate the engine up to the takeoff power depends on the initial power level: acceleration from min ground idle is slow, while acceleration from intermediate thrust is fast.

At low power setting, engines may have different acceleration profiles while the same acceleration profile for both engines is available from a certain amount of thrust.

As a summary, asymmetrical power increase can occur if the go-levers are triggered (A310) or the thrust levers are advanced (A320) without N1 stabilization while:

- One engine is at idle and the other is slightly above idle
- One engine is slower to accelerate than the other.

FCOM recommendations:

A310:

- Slightly advance throttles and monitor spool-up until both engine are above idle (approx 40% N1) or
- Slightly advance throttles and monitor spool-up until both engine are aligned and stabilized between 1.05 and 1.10 EPR with no more than 0.002 EPR difference between both engines.

A320:

- If the crosswind is at or below 20 knots and there is no tailwind: PF progressively adjust engine thrust in two steps:
- from idle to about 50 % N1 (1.05 EPR).
- from both engines at similar N1 to takeoff thrust.
- In case of tailwind or if crosswind is greater than 20 knots: PF sets 50 % N1 (1.05 EPR) on both engines then rapidly increases thrust to about 70 % N1 (1.15 EPR) then progressively to reach takeoff thrust at 40 knots ground speed

Prevention strategies:

Communication to airlines: Airbus presented these events during the last Safety Committee of IATA and during the last Flight Operation conference and wrote this article in Safety First.

Regular communication to pilots: It is important to emphasize the understanding of engine response at takeoff thrust setting, particularly the requirement of setting a similar N1 (or EPR) on both engines, prior to setting the takeoff thrust during type rating and recurrent training. Airbus encourages airlines to share these lessons-learned through Airline's bulletin to all pilots.

Operational documentation improvements: Airbus will enhance the wording of the FCOM and add a note in the wide body FCOM and single aisle and long range FCTM to emphasize the fact that if this procedure is not properly applied, it may lead to asymmetrical thrust increase and, consequently, to severe directional control problem.

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