SERIOUS INCIDENT

Aircraft Type and Registration:	Airbus A319-111, G-EZBI
No & Type of Engines:	2 CFM 56-5B5/P turbofan engines
Year of Manufacture:	2007 (Serial no: 3003)
Date & Time (UTC):	29 August 2019 at 0900 hrs
Location:	Nice Côte d'Azur Airport, France
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 157
Injuries:	Crew - None Passengers - None
Nature of Damage:	None reported
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	62 years
Commander's Flying Experience:	19,991 hours (of which 7,235 were on type) Last 90 days - 137 hours Last 28 days - 58 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During their initial pre-flight preparation, the flight crew chose to calculate takeoff performance based on the most limiting intersection available, Bravo 3, on Runway 04R at Nice Côte d'Azur Airport. The aircraft departed from intersection Alpha 3 where the runway length available was 316 m greater than from Bravo 3. At lift-off the commander noted that the departure end of the runway was closer than he would have expected but did not perceive any other performance issues. Subsequent analysis of recorded flight data and the flight crew's takeoff calculations indicated that both pilots had inadvertently used performance figures for a departure from intersection Quebec 3. With both pilots making the same mis-selection, the takeoff performance cross-check was invalidated and the error went undetected. The available runway length from Quebec 3 was 701 m greater than from Bravo 3.

The flight crew considered that the software user-interface and data presentation was a factor in the intersection selection error being made and subsequently missed. The investigation found that the operator was planning an update to the performance software that would place greater emphasis on a graphical rather than textual representation of runway characteristics.

The aircraft manufacturer was in the process of releasing an enhanced automatic takeoff surveillance system for the A320 family of aircraft. The enhanced system could act as an additional safety barrier for incidents of this nature.

History of the flight

During their pre-flight preparation, the flight crew chose to calculate takeoff performance for Bravo 3 (B3), the most-limiting viable runway intersection on Runway 04R (RW04R) at Nice Côte d'Azur Airport (NCE) (Figure 1). The subsequent cross-check of their independent performance calculations revealed a 1 kt discrepancy between takeoff speeds. The pilots considered the discrepancy to be acceptable and used the most conservative figures for departure.

As they approached the runway, the flight crew were offered a departure from intersection Alpha 3 (A3). Believing that they had the more-limiting B3 performance figures entered into the flight management computer, the flight crew accepted this clearance. On reaching V_1, the aircraft commander considered that the runway remaining was less than he would have expected, but not alarmingly so. The departure used a standard reduced thrust takeoff and, although it was available, the commander '*did not feel TOGA*[1] *was required*' in that situation.

A takeoff performance calculation error was detected after flight by the operator's flight data monitoring (FDM) programme. Cross-checking FDM information with electronic flight bag (EFB) calculations indicated that both pilots had inadvertently selected the Quebec 3 (Q3) intersection, rather than B3, in their performance software. The mis-selection was not detected during an initial data validation '*departure distance check*' and cross-checking EFB calculation outputs did not trap the error.

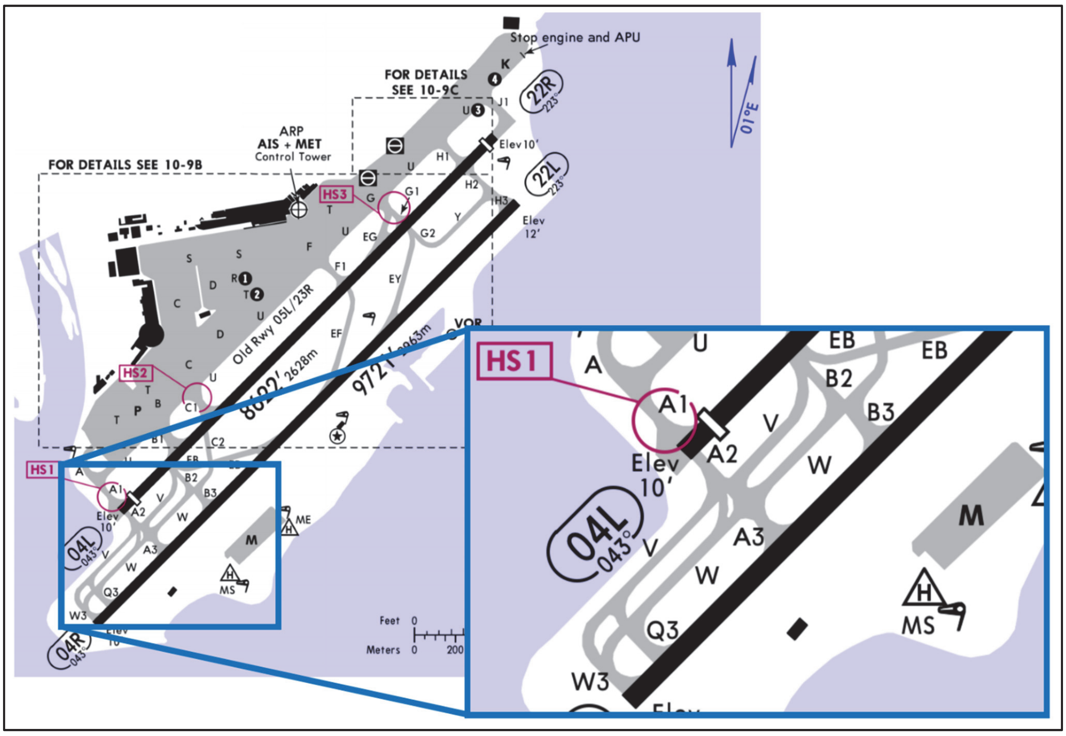

Figure 1

Overview of NCE with zoomed view of RW04R departure intersections

Footnote

[1] Take Off Go Around (TOGA) is the maximum available thrust setting on the Airbus A320 family of aircraft.

Aircraft performance

Revising takeoff calculations after engine start typically requires aircraft data entry modifications and possible changes to aircraft configuration during the taxi phase. This is an additional opportunity for error at a critical stage of flight. In order to avoid late changes, it is common practice for pilots to calculate takeoff performance for the most-limiting likely departure runway intersection. If they subsequently depart from an intersection with more runway distance available, they often do not recalculate takeoff parameters.

The operator's standard operating procedures (SOP) require that aircraft takeoff performance is calculated on company-issued EFBs. Calculations are conducted independently by each pilot and then validated by cross-checking outputs. One element of this process is to cross-check that the runway length displayed on the EFB matches the takeoff run available (TORA) listed on the '*Aerodrome Ground Chart or any applicable NOTAM*'. This process is designed to trap individual errors based on the presumption that both pilots are unlikely to make the same mistakes at the same time.

A comparison of the TORA from Q3, A3 and B3 is shown at Table 1.

Intersection	TORA (m)	TORA vs Q3 (m)
Q3	2,858	n/a
A3	2,473	-385
B3	2,157	-701

Table 1

TORA comparison between runway intersections Q3, A3 and B3

An indicative calculation conducted by the AAIB revealed that outputs from takeoff calculations based on B3 and Q3 differed significantly. For a departure from B3 rather than Q3, takeoff speeds were ≥13 kt slower, the thrust reduction (flex) temperature was 8° lower and a different flap setting was required (Figure 2). From A3 the speeds were 8 kt slower than from Q3, the flex temperature was 61° and Flap 2 was the optimum setting. Meaningful comparisons of takeoff run required could not be drawn because all three calculations used different settings to achieve balanced-field performance.[2]

Footnote

[2] In simple terms, a balanced field takeoff is one where the accelerate-stop distance required is equal to the takeoff distance required. This is achieved by optimising the aircraft configuration and takeoff thrust setting for the takeoff distance available (TODA).

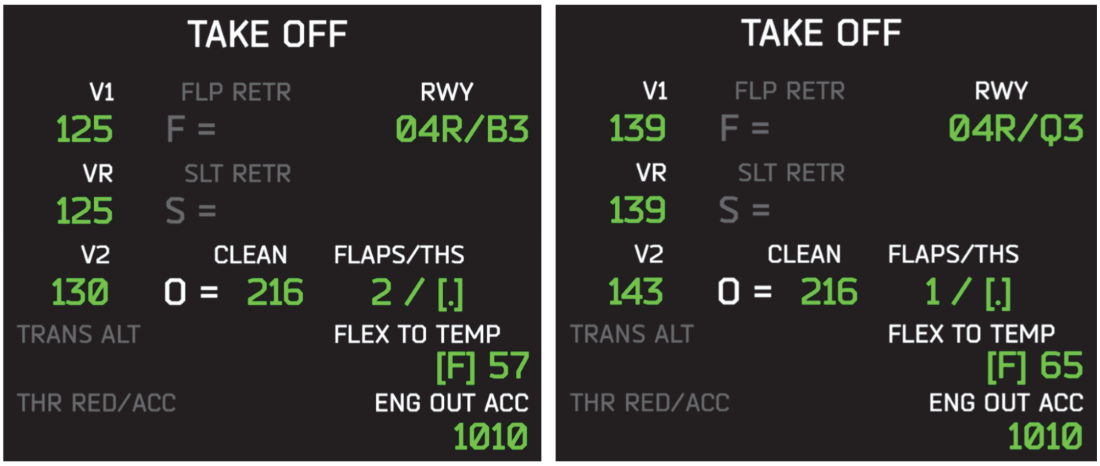

Figure 2

Indicative performance comparison for
NCE RW04R intersection B3 (left) and Q3 (right)

Personnel

The aircraft commander recalled carrying out a '*departure point distance confirmation*' during the pre-flight preparation. He made the following observation after the incident: "…although I believe we were thorough and conscientious, the error failed to be trapped". As a result of this incident, he has reinforced his departure threat and error management briefing to include a review of possible departure intersections and their associated takeoff performance implications. He has also added a dedicated TODA cross-check between EFB and airfield charts to his pre-takeoff PEDS[3] review.

Other information

The flight crew considered that the performance calculation software's user-interface was a factor in the intersection selection error being made and missed. It was the aircraft commander's view that "EFB Toughbook data entry is clumsy and often requires re-entering especially runway details and, at NCE, B3 and Q3 appear next to each other and are easy to mis-select". The investigation found that the operator was in the process of introducing an EFB performance software update that placed greater emphasis on a graphical, rather than text-based, representation of runway dimensions and associated intersections. The accuracy of outputs from the revised system would still be subject to the normal limitations of human performance associated with data entry tasks.

The aircraft manufacturer was in the process of making its '*second step of the Takeoff Surveillance (TOS2) functions,* [first] *introduced on A350 aircraft in 2018*,'[4] available on the A320 and A330 families of aircraft. TOS2 is an automated function which includes checks

Footnote

[3] A final review of calculated takeoff performance (P), emergency turn procedure (E), expected departure routing (D) and initial stop-climb altitude (S).

[4] Safety First, The Airbus Safety Magazine: Takeoff Surveillance & Monitoring Functions, October 2019. Available at: https://safetyfirst.airbus.com/takeoff-surveillance-and-monitoring-functions [accessed 18 December 2019].

to confirm that the aircraft is on the intended runway and that the takeoff performance data entered by the flight crew is '*compatible with the runway distance available*.' The ability to retrofit TOS2 on an individual A320-family aircraft is dependent on that aircraft's '*exact system configuration.*' The incident aircraft was not TOS2-capable.

Analysis

Comparison of indicative takeoff performance parameters for B3 and Q3 departures indicated that the only credible explanation for the calculation error was mis-selection of Q3 by both pilots. It was not determined why the '*departure point distance confirmation*' check referred to by the commander did not alert the crew to the mis-selections. This incident showed that simultaneous independent errors were possible and that an EFB output cross-check and TORA cross-check would not necessarily trap them.

The aircraft commander reported that the EFB software user-interface was "clumsy"and prone to errors which, once made, were difficult to detect. The operator's proposed EFB software update would bring an improved graphical user-interface. The limitations of human performance mean that any system relying on user-entered data is unlikely to be infallible.

An independent automated check, such as the Airbus TOS2 function, could provide an additional barrier to prevent a performance calculation error contributing to an accident.

Conclusion

This incident resulted from identical independent errors not being trapped by a TORA cross-check or by EFB output validation. While revised software with a graphical runway presentation could have helped reduce the likelihood of this occurrence. Automated systems, such as TOS2, could, in the future, provide an effective barrier to incidents of this nature.