



REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION A18-04

Phraseology for use in safety-critical scenarios

Background

Air Transportation Safety Issue Investigation A17O0038 examined 27 runway incursions that occurred between June 2012 and November 2017 at 2 closely spaced parallel runways known as the “south complex” at Toronto/Lester B. Pearson International Airport (CYYZ), Ontario. The 27 cases studied were not the only incursions at CYYZ during that period. However, their number and similarity raised concern and led the Transportation Safety Board of Canada (TSB) to examine them more closely as a group, in order to determine their systemic underlying causes and contributing factors and to assess the degree of ongoing risk.

All of the incursions occurred on the inner runway (Runway 06L/24R) after the flight crews involved had landed on the outer runway (Runway 06R/24L), had been instructed by air traffic control (ATC) to hold short of Runway 06L/24R, and, despite intending to stop, had missed the visual cues depicting the runway holding positions.

The taxiway layout between the runways has several characteristics that are uncommon compared to those at other airports, both within North America and internationally. The runways are spaced a relatively short distance (305 m [1000 feet]) apart, and the rapid exit taxiways (RETs) provide direct access to the adjacent runway without first progressing to another transitional surface. The runway holding positions are located immediately following a 65° curve and are situated at greater distances from the protected inner runway than they are at other airports.

Regional airlines that are based in the United States and that operate regional jets were involved in a disproportionate number of the incursions, both in total and in terms of the rate of incursions per landing. This was likely due to foreign flight crews being unfamiliar with the uncommon taxiway layout between the parallel runways at CYYZ and to the increased speed at which their smaller aircraft types often approached the runway holding positions.

It is for these reasons that some foreign flight crews did not anticipate the location of the stopping position on each RET and so did not direct their attention outside the aircraft at the required time to identify the visual cues indicating the runway holding positions.

Most of the flight crews were aware of the south complex areas at increased risk for runway incursions because they are designated as “hot spots” on the airport charts supplied to crews. However, that guidance, together with limitations in operators’ requirements for taxi briefings, did not bring crews’ attention to specific strategies to mitigate the risk of incursion. Instead, the crews followed their usual routines after exiting the landing runway and

proceeded with their post-landing checks. The timing of those tasks distracted them at a point when limited time was available to recognize the visual cues requiring them to stop, and contributed to their overlooking those cues.

In the occurrences examined in this study, ATC recognized the incursions quickly and took appropriate actions that either caused the incurring aircraft to stop or reduced the severity of the consequences. As a result, most of the aircraft did not reach the inner runway surface. Of the 3 that did reach the surface, 2 were at an intersection beyond the point at which the departing aircraft presented a risk of collision. In the 3rd case, ATC cancelled the takeoff clearance for the departing aircraft before it began its take-off roll.

In another occurrence, ATC instructed the incurring aircraft to stop before it had reached the runway surface, then immediately told the departing aircraft to abort its takeoff. The crew of the departing flight did not recognize the instruction to abort because the phraseology was unfamiliar and because it was not repeated as they were used to; as a result, they continued their departure. The incurring aircraft stopped before reaching the runway surface, and the departing aircraft overflew the intersection without further event.

International guidance for the prevention of runway incursions recommends that, once areas presenting a hazard of incursion have been identified, strategies to manage or mitigate that risk should be implemented and should include awareness campaigns, additional visual aids, alternate routings, or, ultimately, the construction of new taxiways.

Various awareness campaigns and advisories have been issued since 2012, and visual aids have undergone progressive but significant improvements. Those strategies have likely resulted in periodic, but not permanent, reductions in the incidence of incursions.

Revising the post-landing procedures of flight crews may lead to increased vigilance and reduced distraction, but it is unlikely to eliminate crews' expectations that visual cues will be situated in common locations or induce crews to reduce their taxiing speeds so that they have more time to recognize the cues.

All but one of the applicable strategies recommended by international guidance have been implemented on the south complex; the remaining strategy is to make physical changes to the taxiway layout. A change of this scale may be required to increase the distance and taxiing time between runway holding positions, reduce the taxiing speeds of aircraft approaching hold-short locations, and prevent direct access to adjacent runways from RETs. Among the possible reconfigurations for achieving these objectives is the addition of an intermediate taxiway between the runways and parallel to them, as found at numerous airports with parallel runways, and the re-situating of visual cues in common locations.

The Board concluded its investigation and released report A17O0038 on 31 January 2019.

TSB Recommendation A18-04 (January 2019)

Over the past 5 years, the TSB has investigated 3 events in Ontario¹—including one of the incursions detailed in report A17O0038—in which air traffic control (ATC) instructions issued to flight crews to address a conflict were not recognized or acted on.

When air traffic controllers recognize a conflict between aircraft or vehicles—such as when an aircraft is on the take-off roll and another aircraft incurs on the runway—they must issue prompt instructions to resolve the conflict. These instructions need to be recognized and understood by the intended recipients so that the safest course of action can be taken. If these instructions are not actioned, there is a risk that the conflict may result in a collision.

The current guidance provided to air traffic controllers in Canada with respect to the phraseology to be used in these safety-critical situations is different from international guidance. It does not prescribe any attention-getting enhancements, such as using the word “immediately” or repeating the instruction. Without these enhancements, the instruction may not be compelling enough to attract the intended recipient’s attention, and, as the phraseology may be different from what flight crews are expecting, there is a risk that the instruction will not be immediately understood, particularly during periods of high workload. These 2 factors may result in the instruction not being actioned and an increased risk of collision.

Therefore, the Board recommended that

NAV CANADA amend its phraseology guidance so that safety-critical transmissions issued to address recognized conflicts, such as those instructing aircraft to abort takeoff or pull up and go around, are sufficiently compelling to attract the flight crew’s attention, particularly during periods of high workload.

TSB Recommendation A18-04

NAV CANADA’s response to Recommendation A18-04 (May 2019)

NAV CANADA’s ATS [air traffic service] Standards department conducted a hazard identification activity and industry stakeholder consultation in 2018 to assess retaining the Canadian phraseology used to issue an abort takeoff instruction “ABORT TAKEOFF” versus adopting the ICAO [International Civil Aviation Organization] phraseology “STOP IMMEDIATELY” contained in Doc 4444.

Through the Canadian Aviation Best Practice Working Group forum, which includes many airlines and air traffic controllers, it was identified that “ABORT TAKEOFF” was more compelling to crews beginning their takeoff roll on a runway than “STOP”. Stakeholders viewed “STOP” as a common instruction used on taxiways. Pilots indicated that if they were on the takeoff roll and needed to abort immediately due to a hazard, “ABORT TAKEOFF” was clearly aimed at an aircraft having commenced take-off roll, whereas if “STOP” was heard on the frequency, the crew could possibly believe that it is intended for an aircraft on a

¹ TSB aviation investigation reports A13O0049 and A13O0045, and the 02 August 2015 incursion examined in report A17O0038.

taxiway and would possibly question whether the instruction was for them, wasting crucial time.

MATS [*Manual of Air Traffic Services*] Tower states that aborting a takeoff is an emergency procedure used when continuing would present a grave hazard to the aircraft. A controller-initiated aborted takeoff is an extreme measure used only where no clear alternative exists. Therefore, based on stakeholder feedback and the result of the hazard identification activity, in the interest of safety, NAV CANADA elected to maintain its current phraseology.

Although NAV CANADA considers that the current defense barriers, based on procedures and practices, are effective, the company is looking into aligning “ABORT” phraseology with “MAYDAY” by repeating the spoken words three times. From a human factors perspective, the repetition would orient the pilot to the transmission, thus compelling the pilot to the immediate action that is required. A safety assessment will need to be completed prior to performing any change.

We will keep you informed on our findings, following the safety assessment on the proposed adjustment to our procedures.

Update (July 2019)

On 02 July 2019, NAV CANADA issued a National Operation[s] Directive to amend the phraseology for cancelling a take-off clearance, effective immediately.

The new required phraseology described in the directive is “(aircraft id), ABORT TAKEOFF ABORT, (aircraft id), ABORT ABORT [reason]”.

TSB assessment of NAV CANADA’s response to Recommendation A18-04 (September 2019)

In its response, NAV CANADA indicates that in 2018, it conducted a hazard identification activity and consulted with industry stakeholders on the phraseology to use in situations of aborted takeoffs.

This exercise determined that the current NAV CANADA phraseology, “ABORT TAKEOFF,” is more compelling than “STOP IMMEDIATELY,” which is the phraseology proposed by the International Civil Aviation Organization (ICAO) in its Doc 4444, *Procedures for Air Navigation Services – Air Traffic Management*. As a result, NAV CANADA has decided to keep the phraseology currently used. However, it examined the possibility of aligning the use of “ABORT TAKEOFF” with that of “MAYDAY;” namely, by repeating the words three times. This repetition would likely make instructions to abort takeoff more compelling and would better attract the flight crews’ attention.

The National Operations Directive issued by NAV CANADA after its initial response to this recommendation has now changed the required phraseology to include an adaptation of this described repetition.

While this phraseology amendment is in keeping with the recommendation, the response only addresses aborted takeoffs. Two of the three examples described in the paragraphs preceding the recommendation involve safety critical situations where flight crews were

instructed to pull up and go around, but did not. To address this ongoing risk, a similar amendment may be needed to adjust the phraseology for go-arounds, especially those that occur near to the ground. The TSB has discussed this matter with NAV CANADA and a further response is expected from NAV CANADA.

The Board is very encouraged by NAV CANADA's expeditious work to date; however, until similar changes are made to the phraseology currently used to instruct aircraft to go-around in safety critical situations, the safety deficiency identified in Recommendation A18-04 remains.

Therefore, the Board considers the response to Recommendation A18-04 to be **Satisfactory in Part**.

NAV CANADA's response to Recommendation A18-04 (October 2019)

NAV CANADA recognizes the importance in using concise and clear phraseology to instruct aircraft to go-around in safety critical situations. The term "immediately" is an internationally used term to state that a manoeuvre must be conducted without delay. In saying that, NAV CANADA has amended its phraseology when preparing and instructing aircraft to overshoot in different risk situations to the following:

When Danger is Imminent

If the runway is obstructed and the aircraft is in imminent danger and cannot land, include the word IMMEDIATELY:

PULL UP AND GO AROUND IMMEDIATELY, [instructions] (reason)

AIR CANADA ONE-TWO-THREE, PULL UP AND GO AROUND IMMEDIATELY, AIRCRAFT ON THE RUNWAY

ALFA BRAVO CHARLIE, PULL UP AND GO AROUND IMMEDIATELY, FLY RUNWAY HEADING UNTIL ADVISED, AIRCRAFT STOPPED ON THE RUNWAY

This change has been published in the Aircraft Overshoot section of the *Manual of Air Traffic Services* (MATS) effective October 10, 2019.

TSB reassessment of NAV CANADA's response to Recommendation A18-04 (March 2020)

The Board is pleased with the quick action taken by NAV CANADA to revise the phraseology contained in the *Manual of Air Traffic Services* (MATS).

The amended standard phraseology for both aborted takeoffs and go-arounds should make the instructions sufficiently compelling to attract a flight crew's attention during periods of high workload. These changes should also reduce the likelihood that the instructions will not be actioned, and in doing so, reduce the risk of collision.

Therefore, the Board considers the response to the recommendation to be **Fully Satisfactory**.

Next TSB action

This deficiency file is **Closed**.