



ASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION A18-05

Timing of post-landing procedures

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 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 A18-05 (January 2019)

Once an aircraft has landed on a runway and the landing roll is complete, the flight crew must perform a series of post-landing tasks. As detailed in this investigation, during normal operations, most flight crews begin these tasks when the aircraft is clear of the landing runway, in accordance with their operator's standard operating procedures (SOPs). These

tasks, or checklists, are usually brief and occupy only a small amount of one or both of the flight crew members' attention.

At airports that have closely spaced parallel runways, aircraft that have landed on the outer runway normally exit the runway via a rapid exit taxiway, which sometimes terminates directly on the inner runway. In most cases, ATC will instruct flight crews to hold short of this runway because the runway is in use by other departing or arriving traffic. In these cases, it is essential that, immediately after exiting the landing runway, flight crews focus their attention on acquiring the visual cues necessary to identify the runway holding position in order to prevent the aircraft from incurring on the other active runway.

Most operators' SOPs require that the post-landing checks be conducted once the aircraft is clear of the landing runway. However, as shown in this investigation, if these SOPs are followed when flight crews are operating on closely spaced parallel runways, they may focus their attention inside the cockpit at a time when their full attention and visual focus are required outside. As a result of this distraction, flight crews may miss the visual cues and incur on the active runway, which presents a significant risk of collision.

In 2012, the U.S. Federal Aviation Administration (FAA) published guidance for operators to help them develop and implement SOPs to prevent runway incursions. Although this guidance advises flight crews to initiate non-essential post-landing actions – such as raising flaps or adjusting trim – after the aircraft is clear of all active runways, it does not propose any specific amendments to post-landing SOPs that reflect this advice. None of the operators involved in the occurrences studied had incorporated any changes to their post-landing SOPs to address this concern.

Therefore, the Board recommended that

the Department of Transport work with operators to amend standard operating procedures so that post-landing checks are sequenced only after landing aircraft are clear of both active runways when closely spaced parallel runway operations are in effect, rather than the current common practice of sequencing the checks once landing aircraft are clear of the landing surface.

TSB Recommendation A18-05

Transport Canada's response to Recommendation A18-05 (May 2019)

Transport Canada (TC) agrees in principle with the recommendation.

Given the potentially catastrophic consequences associated with runway incursions, TC believes that continued efforts to further reduce the likelihood of these serious occurrences are warranted. The report identifies actions already taken by multiple stakeholders, including operators, the airport authority and NAV CANADA to mitigate the risks of runway incursions in the South Complex. The report also states that, post-landing checks are "usually brief and occupy only a small amount of one or both of the flight crew member's attention" (Section 4.2.2) and there are many factors that crews will take into account in managing the timing of these checks.

As such, a blanket provision requiring crews to delay post-landing checks could also introduce additional risks to the system. For example, during winter weather, delaying the retraction of flaps and spoilers could lead to issues related to contamination of retraction mechanisms.

TC believes that the most effective means to prevent these and other incidents is to provide crews with the information to proactively manage threats in their operating environment. To this end TC has:

- Incorporated Threat and Error Management (TEM) as a key component of AC700-042 Crew Resource Management (CRM). In keeping with the latest developments in CRM training, crews will receive regular training in threat and error management to assist with the identification and analysis of potential hazards and the implementation of appropriate strategies to handle threats.
- Consulted with airline operators on this recommendation to ensure they are aware of the potential for runway incursions in the South Complex at CYYZ and continue to monitor the situation through their Safety Management Systems (SMS). These consultations served to confirm that operators have best practices for preventing runway incursions incorporated into their SOPs (e.g., briefing of hot spots in the taxi route; both crew members to be heads up approaching and crossing a runway). These consultations also indicated that several major operators SOPs already include provisions for timing checks once cleared of both parallel runways. TC will continue to work with operators to monitor the effectiveness of operator SOPs in the prevention of runway incursions in the South Complex.
- Consulted with counterparts at the Federal Aviation Administration (FAA). TC facilitated identifying the United States operators who were predominantly involved in these occurrences so that the FAA flight operations inspectors were able to effectively target their follow up activities.

Furthermore, the report identifies the role of flight crew expectancy as a principal contributor to these runway incursions. Simply stated, the crews involved were aware of the need to hold short of runway 24R/06L and were planning to do so, but were not expecting to reach the hold line as quickly as they did. Section 3.1.2 identifies the following contributing factors:

- All crews involved were aware of need to stop but did not recognize the hold line position (Finding 1);
- Airport charts included general warnings of incursions in these locations but “lacked sufficient information to impart a clear understanding of the risk or lead the crews to take effective mitigating measures.” (Finding 2);
- Operator SOPs did not require crews to discuss how situations would be addressed in approach briefs (no management of threats) (Finding 3). As a result, crews did not adjust normal routines and one crew member was heads down when approaching the hold line (Finding 4);
- Many operators had SOPs requiring both crew members to be heads up approaching hot spots and runway crossings (Finding 5);
- Due to the uncommon location of runway holding positions crew members who were looking outside were not looking in the right place for hold lines and available visual

cues were dismissed because they did not conform to the crew's mental model of the situation (Findings 6 & 7).

These findings emphasize that being heads up is important, but not sufficient, to prevent these types of runway incursions. Crews must be anticipating the need to stop at the appropriate hold location. The role of crew expectations is also demonstrated by the fact that Canadian operators were under-represented in these occurrences with only 5 of the 27 occurrences examined involving Canadian operators.

Recognizing the multiple causal factors that contribute to this safety issue, TC recognizes the importance and will continue to work with airports, NAV Canada, and airlines to look at other opportunities to reduce the number of incursions.

We thank the TSB for their comprehensive work on this important issue and we continue to work with stakeholders to reduce the risks associated with runway incursions.

TSB assessment of Transport Canada's response to Recommendation A18-05 (August 2019)

In its response, Transport Canada (TC) indicated that it agrees in principle with Recommendation A18-05. However, TC is concerned that a blanket provision requiring crews to delay post-landing checks could introduce additional risks to the system. TC believes that the most effective means to prevent runway incursions and other serious incidents is to provide crews with information to proactively manage threats in their operating environment. To this end, the following actions have been taken:

- TC has consulted with air operators to ensure they are aware of the potential for runway incursions in the south complex at CYYZ and are monitoring the situation through their company SMS.
- TC has consulted with the U.S. Federal Aviation Administration (FAA) and assisted in the identification of the U.S. air operators involved in the occurrences examined by the TSB so that FAA flight operations inspectors are able to effectively target their follow-up activities.

TC's response accurately details the fact that the incursions examined in this investigation have many underlying contributory factors. To address the on-going risk, each of these factors needs to be addressed to ensure that the overall risk is reduced as much as possible.

One significant contributing factor identified in the investigation was that flight crews were distracted by completing post-landing checks during the brief amount of time they had available to identify the holding position. The crews executed these checks at this specific time as this was the practice outlined in their standard operating procedures.

As stated in TC's response, and in the investigation report, several major operators have already amended their procedures to include provisions for timing these checks once clear of both parallel runways. These amendments indicate that the operators assessed that the additional potential risks created by delaying the checks, such as the contamination issue suggested in TC's response, was less than the known risk of distraction at a time that is critical to preventing runway incursions.

Although TC has consulted with air operators and the FAA, and the actions taken may help mitigate the risk of runway incursions, further safety action needs to be taken by TC to ensure that the safety benefits of re-examining the timing of completing post-landing checks are not isolated to these individual operators.

Therefore, the Board considers the response to Recommendation A18-05 to be **Satisfactory in Part**.

Transport Canada's response to Recommendation A18-05 (September 2020)

Transport Canada (TC) agrees in principle with the recommendation.

In its initial response to this recommendation TC indicated that, although it agrees in principle with the recommendation, it would not require operators to modify their Standard Operating Procedures (SOPs) to address an issue at a single airport. Instead, TC outlined multiple actions taken to reduce the risks of runway incursions and committed to continuing to work with stakeholders to reduce the risks associated with runway incursions.

TC recognizes the need for continuous efforts to reduce the risk of runway incursions and has committed to work with airports, NAV CANADA, and airlines to look at opportunities to reduce the number of incursions. These collaborative efforts are now being coordinated through the auspices of the newly formed Runway Safety Action Team Sub-Committee on Runway Incursions (RSATSC)¹ – a committee co-chaired by TC and NAV CANADA, with membership from affected airports and airlines. RSAT-SC held its first meeting on 14 July 2020, and intends to meet on a monthly basis through 2021.

While the core purpose of RSAT-SC is to reduce the risks of runway incursions, the sub-committee was created as part of a data-sharing pilot project being led by TC and NAV CANADA through the NAV CANADA chaired Runway Safety Action Team (RSAT). The TCCARSAT Data and Information Sharing Pilot² is intended to enable active government-industry aviation safety data and information sharing by addressing data protection concerns (RSAT-SC presents a test case for this collaboration).

Getting underway in the summer of 2020 and running through 2021, the objectives of the pilot project are to: identify basic conditions necessary for voluntary industry/regulator data and information sharing; allow initial data and information sharing to begin on an experimental basis in a manner that supports RSAT and TCCA priorities; and, to collaboratively develop a model for broader data and information sharing in the future. Given the importance of collaboration between operators, airports, air navigation services and the regulator to reduce the risks of runway incursions, the pilot project is seen as an important initiative.

¹ Runway Safety Action Team Sub-Committee on Runway Incursions (RSAT-SC) – Terms of Reference, [RDIMS 16743534](#).

² TCCA-RSAT Data and Information Sharing Pilot – Terms of Reference, [RDIMS 16743523](#).

TSB reassessment of Transport Canada's response to Recommendation A18-05 (December 2020)

In its latest response, Transport Canada (TC) reiterated that it agrees in principle with this recommendation; however, it will not require operators to modify their standard operating procedures (SOPs) to address an issue at a single airport. Instead, TC will continue work to address runway incursions in general, through continued work with stakeholders.

While the progress made toward addressing runway incursions in general, as detailed in the response, is notable, it should be clarified that TSB Recommendation A18-05 does not address a single airport as stated in TC's response. Recommendation A18-05 is meant to address operations of Canadian carriers into any airport worldwide where closely spaced parallel runway operations are in effect.

While this runway arrangement may be uncommon in Canada, it is more common at busy airports around the world, which are frequented by Canadian air operators. As these Canadian air operators use SOPs that follow standards and regulations laid out by TC, the TSB recommended that TC work with operators to amend and improve these SOPs.

Therefore, the response to Recommendation A18-05 is assessed as **Satisfactory in Part**.

Next TSB action

The TSB will await further response from TC with regards to how it intends to address the identified safety deficiency, and will reassess the deficiency on an annual basis or when otherwise warranted.

This deficiency file is **Active**.