



RUNWAY OVERRUNS

Runway overruns continue to pose a risk to people, property, and the environment.

The situation

Despite the millions of successful movements on Canadian runways each year, airplanes sometimes go past the end of a runway surface during landings or rejected takeoffs. These events, known as runway overruns, can result in damage to airplanes and the environment, injuries, and even loss of life—and the consequences can be particularly serious when there is no adequate runway-end safety area (RESA) or suitable arresting system designed to stop an airplane.

Since 2010, the Transportation Safety Board of Canada (TSB) Watchlist has identified the risks to safety that runway overruns pose and what is needed to address them. Although action has been taken by some airport operators and Transport Canada (TC), runway overruns continue to occur at Canadian airports.

Number of occurrences in Canada

From 01 January 2005 to 30 June 2022, there were on average 9.3 runway overrun occurrences per year at Canadian aerodromes (Figure 1). Of these occurrences, 6.7 occurred during landing. Although the count varies from year to year, there is no statistically significant trend. The TSB investigated 24 of these occurrences in this period, issuing six recommendations to Canadian authorities. Five recommendations are still active¹ and one is closed.²

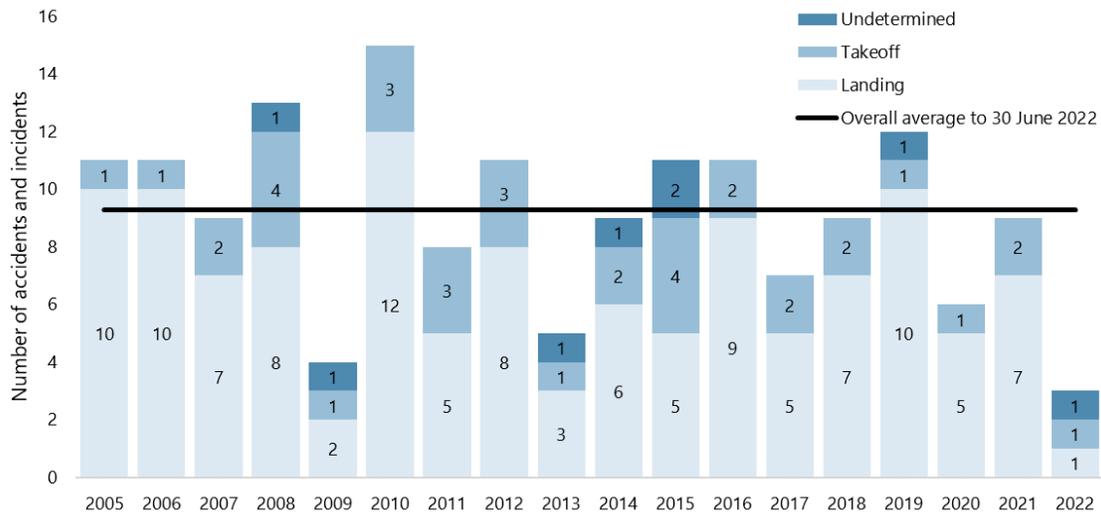
¹ TSB recommendations A20-02, A20-01, A07-06, A07-05, and A07-01.

² TSB Recommendation A07-03.





Figure 1. Runway overrun accidents and incidents in Canada, 01 January 2005 to 30 June 2022 (Source: TSB)



The risks to people, property, and the environment

When an airplane goes past the end of a runway surface, the overrun can result in damage to the airplane and the environment, injuries, and even loss of life. Therefore, mitigating such an occurrence is paramount: a RESA must be of sufficient length or the runway must be serviced by an arresting system designed to safely stop an airplane. Nonetheless, it is equally important to take preventive actions to reduce the likelihood of an overrun before it occurs.

Action taken

Issues on the Watchlist are complex and difficult to solve, requiring action from many stakeholders, including operators and the regulator. Although some steps may have been taken, more needs to be done. These are some of the steps that have been taken to date.

Mitigation

In January 2022, in response to [TSB Recommendation A07-06](#), TC published regulations³ that will

- require a 150 m RESA at airports with over 325 000 commercial passengers annually;
- require the use of an arresting system on runways where a 150 m RESA cannot be implemented; and
- be limited to runways serving commercial passenger services.

³ Transport Canada, SOR/96-433, *Canadian Aviation Regulations* (CARs), sections 302.600 to 302.604.



These regulations apply only to certain runways at airports that meet the specific annual commercial passenger volume criterion and not to all runways 1200 m in length or longer in accordance with the International Civil Aviation Organization (ICAO) standard of 150 m.^{4,5} The gap between TC regulation and ICAO standard widens further when considering that these regulations do not address ICAO's recommendation that a RESA should extend to 300 m for runways 1200 m in length or longer. TC states that the regulations will increase runway overrun protection to passengers from 75% of passenger traffic in 2017 to 95% by 2038.

It is encouraging to see that activity to meet ICAO's 150 m RESA standard has begun at some airports,⁶ and that others⁷ have already implemented ICAO's 300 m RESA recommendation. However, TC's regulations do not extend runway overrun protection to all passengers, and they consider neither non-passenger air traffic nor the terrain at the end of all runways. In fact, of the 24 runway overrun occurrences⁸ investigated by the TSB from 01 January 2005 to 30 June 2022, 17 of them occurred at airports that had passenger volumes less than 325 000. Therefore, the TSB remains concerned that risks to the public, property, and the environment persist, and it will seek additional information from TC regarding the residual risk represented by the gap between TC's regulations and the ICAO standard and recommendation.

Regarding the geographic constraints that limit the design and construction of adequate RESAs at many Canadian airports, one technical solution to mitigate the risk of an overrun is an engineered materials arresting system. For example, in 2022, there were 117 arresting systems installed at 69 airports in the U.S.⁹ To date, none has been installed in Canada.

Prevention

Since the issue of overruns first appeared on the Watchlist, there have been numerous initiatives to prevent their occurrence. Although most are still under development, they have the possibility, if fully implemented, to help reduce the potential for runway overruns to occur.

TSB Recommendation A07-01 calls for TC to establish clear standards limiting approaches and landings in convective weather for all air transport operators at Canadian airports. TC indicated that it will monitor scientific and technological developments related to this issue and that it will support international harmonization efforts when this issue gains active status at ICAO.

⁴ International Civil Aviation Organization (ICAO), *Convention on International Civil Aviation*, Annex 14, Vol. 1, Section 3.5.3.

⁵ ICAO's standard also includes RESA provisions for runways less than 1200 m in length.

⁶ At late June 2022, airports in Kelowna, Edmonton, Calgary, Waterloo, and Moncton had initiated activity.

⁷ Ottawa/Macdonald-Cartier International Airport, Vancouver International Airport, and Montréal/Pierre Elliott Trudeau International Airport.

⁸ TSB air transportation occurrences A22Q0025, A21O0066, A21O0127, A21Q0087, A20A0001, A18A0085, A18Q0030, A15Q0075, A12A0082, A12O0005, A12W0004, A11A0035, A11C0102, A10A0032, A10H0004, A10Q0162, A08O0035, A08O0333, A08W0001, A07A0029, A06P0036, A06Q0190, A05H0002, and A05O0257.

⁹ Federal Aviation Administration, "Fact Sheet – Engineered Material Arresting System (EMAS)," at https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=13754 (last accessed on 23 June 2022).



In 2019, in response to **TSB Recommendation A07-03**, which called for measures to improve pilot landing decisions in deteriorating weather, TC established new crew resource management training standards for aerial work, air taxi, commuter, and airline operators.

In response to **TSB Recommendation A07-05**, TC has initiated the regulatory process to require airline operators to put in place measures that help prevent runway overruns on landing by increasing calculated landing distance when runways are wet or contaminated.

In response to **TSB Recommendation A20-01**, TC has initiated the regulatory process to simplify the operational minima for approaches and landings at Canadian aerodromes.

In response to **TSB Recommendation A20-02**, TC is working to introduce a mechanism to stop approaches and landings that fall under an approach ban.

In 2021, TC introduced the requirement to use the Global Reporting Format (GRF),¹⁰ ICAO's globally harmonized means of runway surface condition assessment and reporting. It is anticipated that using GRF will reduce the risk of runway overruns by providing flight crews with improved information about expected braking action when they determine landing performance.

Globally, industry is also responding to address the issue of runway overruns with such efforts as in-cockpit technological defenses. For example, runway overrun awareness and alerting systems (ROAASs)¹¹ are now in use in many Airbus and Boeing fleets and can be integrated into other airplane types. As of 2025, the European Union Aviation Safety Agency will require¹² ROAASs on newly designed Part 25 large airplanes operated in commercial air transportation; however, currently, there is no regulatory requirement for ROAASs in Canada.

Lastly, Canadian aviation operators are acknowledging the issue. During a 2021 air transport industry conference, a TSB survey found that 62% of the responding participants indicated that their safety management processes identified the issue of runway overruns and that most had taken or were taking action to address the issue.

Action required

Despite the actions taken to date, the number of runway overruns in Canada has remained constant since 2005 and demands a concerted effort to be reduced.

¹⁰ TC's global reporting format allows the reporting of two surface contaminants rather than the one contaminant allowed by ICAO (Source: <https://www.icao.int/safety/Pages/GRF.aspx> [last accessed 02 August 2022]). This difference will make Canada's reporting more consistent with the U.S. Federal Aviation Administration's Takeoff and Landing Performance Assessment, which also allows two contaminants to be reported.

¹¹ Prior to touchdown, ROAASs monitor numerous in-flight parameters and send alerts to pilots if a landing cannot be completed in a runway's available landing distance. Post-touchdown, ROAASs monitor braking performance and send alerts to pilots if an airplane cannot be stopped within the remaining distance on the runway.

¹² European Union Aviation Safety Agency, *Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (CS-25)*, Amendment 27 (24 November 2021), at <https://www.easa.europa.eu/downloads/136622/en> (last accessed on 23 June 2022).



The issue of runway overruns will remain on the TSB Watchlist until

- TC demonstrates that the residual risk at airports with runways that are not required to comply with ICAO's 150 m standard is as low as reasonably practicable; and
- TC requires operators of airports with runways longer than 1800 m that have a RESA shorter than ICAO's recommended length of 300 m to conduct formal runway-specific risk assessments and to take action to mitigate the risks of overruns to the public, property, and the environment.