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, aircraft sometimes depart from the end of the runway surface during landings or rejected takeoffs. These events, known as runway overruns, can result in aircraft damage, injuries, and even loss of life—and the consequences can be particularly serious when there is no adequate runway end safety area or suitable arresting system designed to stop an aircraft.

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

Number of occurrences in Canada

Since 2005, there have been on average 9.7 runway overrun occurrences per year at Canadian airports (Table 1), of which 7.5 occur during landing. Additionally, from 2005 to 2019 the TSB investigated 19 such occurrences and issued four recommendations to Canadian authorities, of which three remain active[1] and one is closed.[2]

One of the active recommendations to TC is A07-06, in which the Board recommended that

> the Department of Transport require all Code 4[3] runways to have a 300 m runway end safety area (RESA) or a means of stopping aircraft that provides an equivalent level of safety.

Table 1. Runway overrun accidents and incidents in Canada from 2005 to 2019

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	15-year average
Total of runway overruns	**11**	**11**	**9**	**13**	**4**	**15**	**8**	**11**	**5**	**9**	**11**	**11**	**7**	**9**	**12**	**9.7**
Runway overrun on landing	10	9	7	9	3	13	7	8	3	7	6	8	5	7	10	7.5
Runway overrun on takeoff	1	2	2	4	1	2	1	3	2	2	5	3	2	2	2	2.3

[1] TSB recommendations A07-06, A07-05, and A07-01.

[2] TSB Recommendation A07-03.

[3] Code 4 runways are those with a length greater than 1800 m.

Table 2. Conditions present during runway overrun accidents and incidents in Canada from 2005 to 2019

Condition	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	15-year average
Unstable/Long landing	3	2	3	5	0	3	3	4	0	3	4	1	2	2	4	2.6
Weather below published approach recommendation	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0.3
Contaminated runway / Runway condition	6	4	5	5	0	6	1	1	1	2	1	4	2	3	2	2.9
Mechanical issue	0	4	1	1	0	2	1	3	1	2	2	2	0	0	0	1.3
Weather/wind	4	2	2	2	0	2	0	1	0	0	0	0	0	1	1	1.0

The risks to people, property and the environment

When an aircraft leaves the end of a runway surface, the terrain and obstacles could cause aircraft damage, injuries, and even loss of life. As such, runway end safety areas (RESAs) must be of sufficient length or otherwise designed to safely stop an airplane should a runway overrun occur.

In recent years, the aviation industry has mainly taken preventive steps to reduce the likelihood of an overrun before it occurs. However, when prevention fails, the severity of damage and the likelihood of injuries and casualties must be minimized.

While some large Canadian airports[4] have implemented 300 m RESAs, many other airports have not. Unless all large airports follow suit or provide a suitable arresting system designed to stop aircraft, the risks remain.

Actions taken

In 2017, the House of Commons Standing Committee on Transport, Infrastructure and Communities recommended the implementation of 300 m RESAs, as supported by the TSB and the International Civil Aviation Organization (ICAO).[5]

In March 2020, TC proposed regulations that would, among other things:

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

According to TC, these regulations, once implemented, would increase runway overrun protection to passengers from 75% of passenger traffic in 2017 to 95% by 2038. However, these regulations focus only on the risk to a majority of, but not all, passengers and do not consider non-passenger air traffic or the terrain at the end of all runways. Also, the proposed regulations do not meet the ICAO standard, which requires a 150 m

[4] Ottawa/Macdonald-Cartier International Airport, Vancouver International Airport, and Montréal/Pierre Elliott Trudeau International Airport.

[5] Canada, Parliament, House of Commons. Standing Committee on Transport, Infrastructure and Communities, *Aviation Safety in Canada*, 42nd Parliament, 1st session, Report 14 (June 2017).

RESA for all runways 1200 m in length and longer, and provisions for other types of runways.[6] Therefore, the TSB remains concerned that, without further action, risks to the public, property, and the environment remain.

An additional action that is expected to improve safety by reducing the risk of overruns is that, as of 2021, TC will require the use of the Global Reporting Format (GRF),[7] 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.

In-cockpit technological defenses have also advanced. Runway overrun awareness and alerting systems (ROAAS) are now in wide use in many Airbus and Boeing fleets and can be integrated into other aircraft types. Prior to touchdown, ROAAS 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, ROAAS monitor braking performance and send alerts to pilots if aircraft cannot be stopped within in the remaining distance on the runway.

By the end of 2020, the European Union Aviation Safety Agency (EASA) is expected to decide on ROAAS requirements.[8] ROAAS have not been widely adopted by Canadian operators; however, some operators have informed the TSB that they are planning to install it over the next few years. There is currently no regulatory requirement for ROAAS in Canada.

Many airport runways have geographic constraints that limit the design and construction of adequate RESAs. In such cases, technical solutions, such as an engineered material arresting system, could be implemented. For example, in 2020, according to the Federal Aviation Administration, there were 115 arresting systems installed at 66 airports in the U.S.[9] None have been installed in Canada to date.

Actions required

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

---

[6] International Civil Aviation Organization (ICAO), *Convention on International Civil Aviation*, Annex 14, Volume 1, Section 3.5.3.

[7] TC's global reporting format differs from ICAO's as TC will allow the reporting of two surface contaminants rather than the one contaminant allowed by ICAO. This difference will make Canada more consistent with the U.S. Federal Aviation Administration's Takeoff and Landing Performance Assessment, which also allows two contaminants to be reported.

[8] EASA has issued a notice of proposed amendment (NPA 2018-12) to require runway overrun awareness and alerting systems on large airplanes operated in commercial air transportation. EASA indicated that the proposed regulatory changes are "expected to increase safety by supporting the flight crew during the landing phase in identifying and managing the risk of a runway excursion."

[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 09 October 2020)

Operators of airports with runways longer than 1800 m must conduct formal runway-specific risk assessments and take action to mitigate the risks of overruns to the public, property, and the environment.

TC must adopt at a minimum the ICAO standard for RESAs, or a suitable arresting system designed to stop an aircraft.