Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

TRANSPORTATION SAFETY BOARD OF CANADA

ANNUAL REPORT TO PARLIAMENT 2020–21

Canada

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16 June 2021

The Honourable Dominic LeBlanc, P.C., M.P.
President of the Queen's Privy Council for Canada
House of Commons
Ottawa ON K1A 0A3

Dear Minister,

In accordance with subsection 13(3) of the *Canadian Transportation Accident Investigation and Safety Board Act*, the Board is pleased to submit, through you, its Annual Report to Parliament for the period 1 April 2020 to 31 March 2021.

Yours sincerely,

Original signed by

Kathleen Fox
Chair

Canada

Message from the Chair

When penning my message for our annual report last year, I would not have guessed what 2020–21 would bring—for our organization, for the transportation industry and, indeed, for the world. As an organization, we showed remarkable resilience, with employees switching to working remotely and even deploying virtually to occurrence sites on occasion. The subsequent 12 months saw us continue our work undaunted.

With the pandemic curtailing activity in the transportation industry, the number of occurrences reported to us in 2020–21 dropped by 22% from the previous reporting year. This gave us some welcome breathing room to complete 66 investigations, one third more than in 2019–20.

We also pursued with undiminished attention Iran's investigation into the downing of Ukraine International Airlines Flight 752. Through collaboration with international counterparts, particularly in Ukraine, we were involved at key stages of the investigation and able to comment on the draft final report. For those of us in the business of finding answers—and especially for the families of the victims—Iran's report was disappointingly lacking in details, leaving more questions than answers. Looking ahead, we are committed to advocating for a review of international protocols in order to improve the independence, credibility and transparency of similar investigations, so families and the public can have confidence in the findings and recommendations.

Meanwhile at home, we issued Watchlist 2020. Our list of key safety issues now includes *unplanned/uncontrolled movement of railway equipment,* which was added in response to the growing frequency of such occurrences. We separated *safety management* and *regulatory surveillance*, since the improvements needed, and the change agents involved, are different. Finally, recent efforts by Transport Canada and other stakeholders to remedy longstanding safety deficiencies meant we could remove *slow progress on recommendations* from the list.

This year saw planning continue for our new lab location and head office, and the completion of our 2016–17 to 2020–21 strategic plan. As we turn to our new strategic plan for 2021-22 to 2025-26, we seek to sustain our vision to be a world-leading investigation organization that influences change to advance transportation safety. To that end, our new data management team is focused on improving how we collect and manage data throughout its lifecycle in order to better leverage data to support evidence-based decisions.

To better support our workforce, our new mental health strategy aims to ensure staff have the support they need to continue to perform at their best, even in the trying circumstances our work sometimes presents. Our renewed employment equity plan reflects our commitment to build a diverse and representative workforce, provide members of the four designated groups with equal access to positions at the TSB, and maintain a respectful working environment.

I am very grateful for everything our team accomplished in a most unusual year. Whatever lies ahead, I am confident we will continue to influence change that advances transportation safety in Canada.

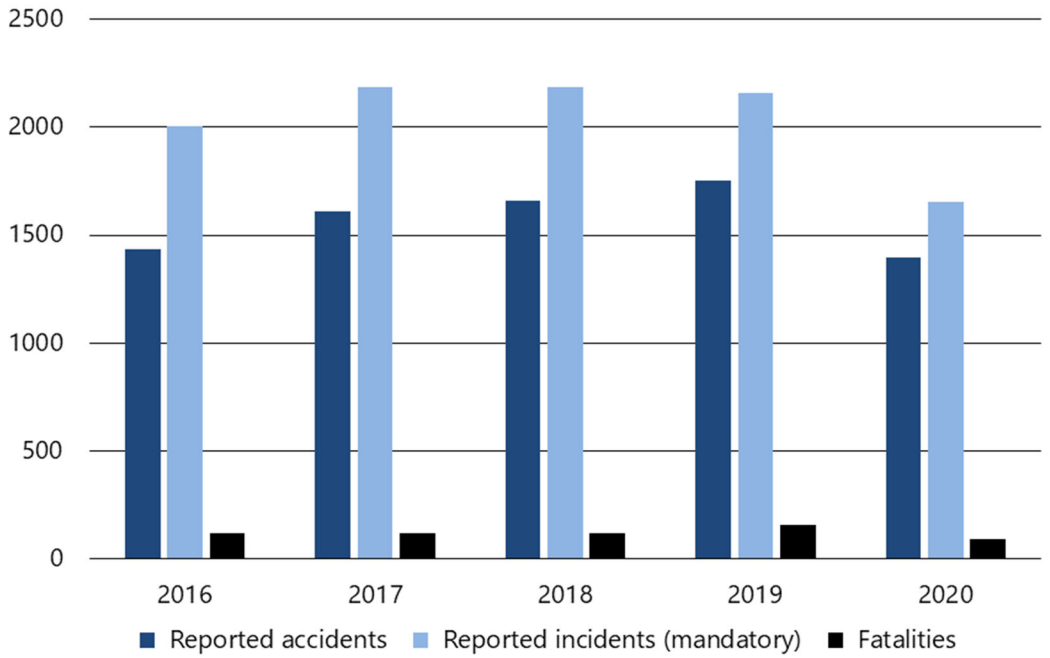
Kathleen Fox

The year in results

In 2020–21, staff from the Transportation Safety Board of Canada (TSB) assessed thousands of accidents and incidents that occurred across Canada in the air, marine, pipeline and rail transportation sectors (see the definitions in the Policy on Occurrence Classification).

TSB personnel then deployed to the sites of some of these occurrences, virtually or in person, to collect data and carry out analysis in order to identify the causes and contributing factors, and highlight known and emerging safety concerns—all in an effort to improve transportation safety in Canada.

Figure 1. Transportation accidents, incidents and fatalities reported to the TSB, 2016 to 2020



The total number of occurrences reported to the TSB (as required under the *Transportation Safety Board Regulations*) in the 2020 calendar year (3050) was 22% lower than the 2019 total of 3908.

In 2020, there were 1397 accidents reported, 20% below the 2019 total of 1750, and 14% below the 10-year average of 1628.

There were 42% fewer fatalities (93) across all transportation sectors in 2020 than there were in 2019 (159). The 2020 total represents a 34% decrease in fatalities from the 10-year average of 141.

The total of 1653 incidents reported to the TSB in 2020 is a 23% decrease from the 2019 total of 2158, and a 9% decrease from the 10-year average of 1,826. The latter partly results from changes made in 2014 to TSB reporting requirements.

The TSB at work

Deployments

TSB investigators deployed 29 times during 2020–21 (down from 60 the previous year) in response to occurrences in all sectors. These deployments took staff from the TSB regional offices and head office to locations across the country.

Due to travel and other restrictions stemming from the COVID-19 pandemic, the TSB had to minimize in-person deployments and, when feasible, rely on other methods to gather information. When investigators did deploy on site, every step of the deployment process was assessed and adapted to ensure employee health and safety.

The TSB also turned to virtual deployments on a few occasions. While these deployments were not without their challenges, investigators found that they could conduct interviews by videoconference and solicit local assistance to take photographs or gather logbooks or other documentation.

Investigations

Table 1. TSB caseload, 2019–20 and 2020–21

Investigations	2019–20	2020–21
Started during year	66	41
Completed during year	50	66
In progress on 31 March of each year	85*	60

*84 were reported in the 2019–20 annual report, due to one occurrence that took place on the last day of the reporting year not being entered into the TSB's case management system until the early days of 2020–21.

In 2020–21, the TSB began 41 new investigations and completed 66 across all four transportation sectors (air; marine; pipeline; rail) and in all four investigative classes (from in-depth and complex to limited scope).

Average completion times increased, both overall and for the various classes of investigations. Class 4 investigations accounted for 48% of the total investigations completed during the reporting year. In these limited scope investigations, the TSB gathers, conducts limited analysis and reports the facts of straightforward occurrences to raise awareness of possible safety issues.

In support of TSB investigations, engineers, technicians and human factors specialists began 145 projects and completed 152 technical reports in 2020–21. They also began three projects and completed eight technical reports for foreign investigation agencies.

Safety communications products

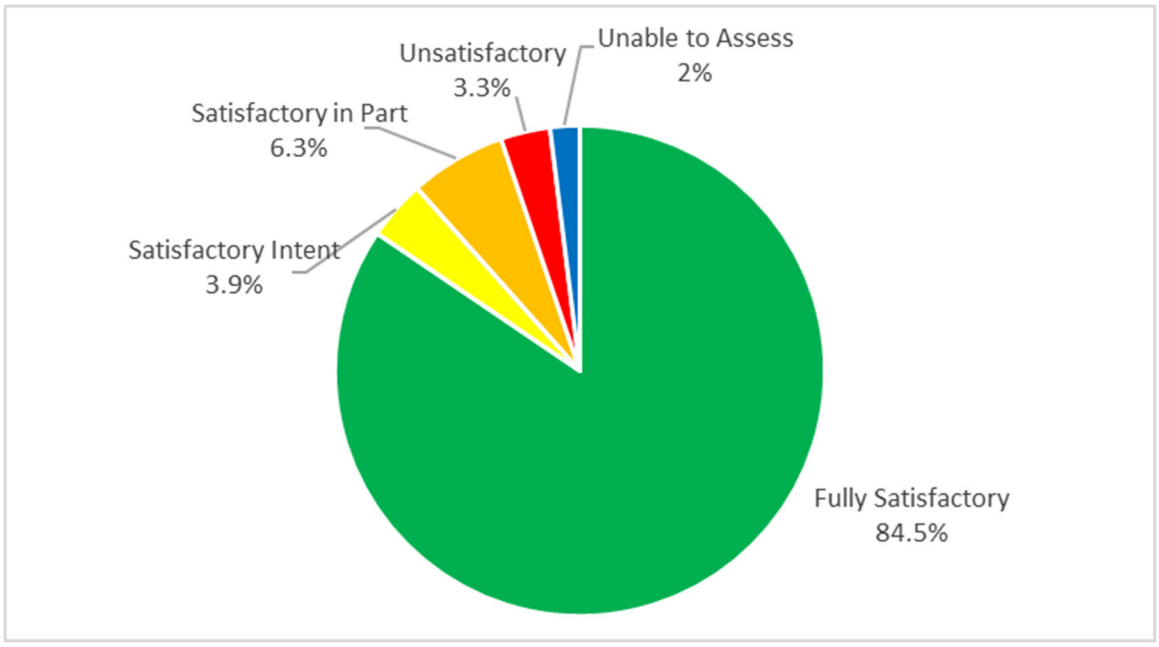
Table 2. Safety communications products issued, 2020–21

Safety advisories	Safety information letters	Safety concerns	Recommendations
10	5	5	3

Each year, the Board reassesses progress made on outstanding recommendations as part of ongoing efforts to urge stakeholders to act on the safety issues TSB investigations have identified. In 2020–21, the Board reassessed 12 outstanding recommendations as Fully Satisfactory: five in air, four in marine and three in rail transportation.

Since 1990, the Board has made 612 recommendations. By the end of 2020–21, it had given 84.5% of the responses to these recommendations the highest rating of Fully Satisfactory (up from 83% at the end of 2019–20). This means that stakeholders, including Transport Canada, have acted to substantially reduce the safety deficiencies the Board identified.

Figure 2. Board assessments of responses to recommendations, 29 March 1990 to 31 March 2021



At 31 March 2021, there were 82 outstanding recommendations, slightly less than half of which date from 10 years ago or more.

Table 3. Age of outstanding recommendations, 31 March 2021

Age of recommendations	Air	Marine	Rail	Total
Less than 1 year	2	0	1	3 (3.7%)
1 year to less than 7 years	21	9	6	36 (43.9%)
7 years to less than 10 years	1	2	2	5 (6.1%)
Sub-total	24	11	9	44 (53.7%)
10 years to less than 15 years	16	1	0	17 (20.7%)
15 years to less than 20 years	5	2	0	7 (8.5%)
20 years or more	7	4	3	14 (17.1%)
Sub-total	28	7	3	38 (46.3%)
Total	52	18	12	82 (100%)

Watchlist 2020

As it has every two years for the last decade, the TSB issued a new edition of its Watchlist on 29 October 2020. Watchlist 2020 identifies eight key safety issues that require government and industry attention. The TSB chooses the issues that appear on each Watchlist based on the results of hundreds of investigations, compelling findings and data, and active TSB recommendations. Watchlist 2020 benefited from input from companies and associations in the air, marine and rail transportation sectors, which the TSB had consulted in 2019–20.

The eight Watchlist issues are a combination of new and ongoing safety concerns:

- The TSB added the risk of unplanned or uncontrolled movement of railway equipment as an issue, in response to a significant increase in these occurrences in the last decade.
- Safety management and regulatory oversight or surveillance remain on the list but are now separate issues requiring unique solutions in the air, marine and rail transportation modes.
- Commercial fishing safety continues to be a significant concern for the TSB, and has been on the Watchlist since it was introduced in 2010.
- Runway overruns remains on the Watchlist, since the number of occurrences has been largely unchanged since 2005.
- Runway incursions (aircraft or vehicles mistakenly occupying an active runway) have increased by 86% over the last decade.

- The number of reported occurrences of railway signals not being followed has grown, with train crews misinterpreting or misperceiving signal indications.
- Fatigue poses a risk to the safety of air, marine and freight train operations because of its potential to degrade several aspects of human performance.

Finally, the Board determined that stakeholders had made sufficient progress in response to 52 outstanding recommendations that were at least 10 years old. As a result, the Board removed slow progress responding to TSB recommendations from the Watchlist. The Board will continue to monitor the remaining outstanding recommendations.

SECURITAS

Through the TSB's SECURITAS program, transportation industry employees and the public can report, in confidence, unsafe actions and conditions they observe.

Table 4. SECURITAS reports received and closed in 2020–21

	Air	Marine	Pipeline	Rail
Reports received	102	25	0	62
Reports closed	102	23	0	62

The number of SECURITAS reports the TSB received in 2020–21 dropped by 85 (31%) to 189 from 274 the previous year, likely the result of the decrease in transportation activity due to the COVID-19 pandemic.

A large majority (95%) of the air transportation-related reports were about low-flying aircraft or commercial passenger complaints. The trusted agents who handle SECURITAS reports on behalf of the TSB redirected these reports to Transport Canada.

Likewise, five of the marine reports dealt with regulatory matters and were resolved in collaboration with Transport Canada. In addition, the TSB issued eight safety communications to either Transport Canada or vessel owners/operators in response to SECURITAS reports.

Several of the rail reports dealt with workload and operational changes. The TSB has long stressed the importance of risk assessment as a key element of safe operations. The railways assured the TSB that they had taken appropriate actions in all cases.

By year-end, the trusted agents had closed all but two of the SECURITAS reports the TSB had received.

Communications and outreach

Regular communications and outreach are important aspects of the TSB's efforts to advance transportation safety. Through its website, social media channels and participation in in-person and virtual events, the TSB reaches industry and government stakeholders, as well as media and members of the public across Canada and around the world.

Table 5. TSB media and stakeholder outreach activities, 2020–21

Media requests	Statistics requests (media)	Interviews	News conferences	Industry outreach events
201	5	67	1	29

Table 6. TSB communications products, 2020–21

Deployment notices	Investigation webpages	Media advisories	News releases	Investigation reports
43	38	4	76	66

Table 7. TSB social media presence, 2020–21

Lifetime views on YouTube	Lifetime views on Flickr	Twitter followers
5 318 656	9 064 586	24 982

To increase its social media presence and reach a larger audience for its investigation reports, safety messages and news about its corporate and outreach activities, the TSB launched both a Facebook and a LinkedIn account in 2020–21.

Outreach activities

The TSB took part in 29 **industry events and meetings** during the year, all of which moved online because of the pandemic.

Among these was National Railway Day on November 4, 2020. Board member Faye Ackermans addressed participants at this annual event hosted by the Canadian Association of Railway Suppliers. In her speech, Member Ackermans presented the new Watchlist issue of unplanned or uncontrolled movement of rail equipment.

Also in the fall of 2020, Chair Kathy Fox was a keynote speaker at the International Air Safety Summit. In the subsequent months, she spoke to the annual convention of the Helicopter Association of Canada about Watchlist 2020 and recent key investigations, and addressed the Northern Air Transport Association.

In conjunction with the release of an investigation report focussed on factors associated with runway overruns (A18Q0030), Chair Fox authored an **article for Wings magazine** on this longstanding Watchlist issue. The TSB also shared its expertise in an **article for Chronobiology International** by Dr. Missy Rudin-Brown, Manager, Human Factors and Macro Analysis Division, on applying the principles of fatigue science to accident investigations.

Stakeholder survey

The TSB surveys its stakeholders, including regulators, operators and industry associations, every five years. The 2020 survey and telephone interviews sought to gather perspectives and opinions to inform the TSB's future direction and the development of its new five-year strategic plan. Respondents offered their views on the TSB's overall effectiveness and credibility, as well as their satisfaction with the information the TSB publishes. Other comments focused on the TSB's timeliness when issuing reports and deployment notices, and when establishing investigation pages on its website.

Generally, the survey results were positive, with stakeholders understanding the TSB's role and its need to remain independent from government, and noting that it conveys an image of expertise, professionalism and rigour. However, respondents did express concern that the TSB is not as effective as it could be in improving transportation safety. This feedback was particularly focused on the need for the TSB to issue its reports faster. Respondents did acknowledge the consistently high quality of investigation reports.

Behind the scenes

The TSB launched its 2021–22 to 2025–26 strategic plan to guide its work as it begins its fourth decade of influencing change to advance transportation safety in Canada. The TSB will pursue this vision guided by these six strategic objectives:

- strengthen the impact of investigations;
- foster an inclusive, diversified and respectful workplace;
- employ a knowledgeable and highly skilled workforce;
- leverage data to drive choices and decisions;
- be digital by default; and
- communicate with impact.

With the objective of fostering a culture of respect, empathy, and openness in the workplace as a shared responsibility of all employees, the TSB implemented a **mental health strategy**, recognizing that the work employees carry out can be very stressful. The TSB has begun to put additional support mechanisms in place to mitigate work-related mental health risks and help build resilience in TSB employees and support their recovery from mental health issues.

The TSB also unveiled its updated **employment equity plan**, covering the period from April 1, 2020, to March 31, 2023. This plan will guide the TSB's efforts to ensure its workforce reflects the diversity of Canadian society and that members of the four employment equity groups (women, Indigenous persons, individuals with disabilities and members of visible minority groups) have equal access to employment opportunities with the TSB.

The TSB's new **data strategy** will help the organization manage its considerable data holdings throughout their lifecycle and capitalize on them as a shared business asset to support evidence-based decision making, meet strategic business needs and objectives, and enable collaboration with stakeholders.

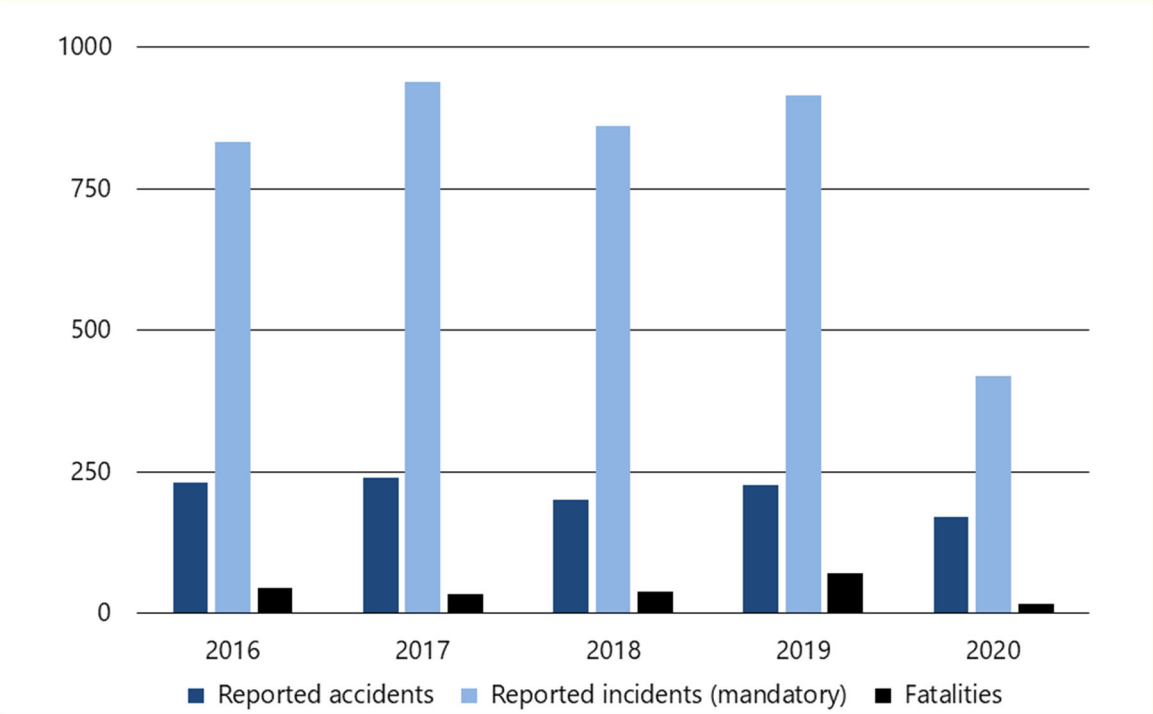
The TSB continued its work to enhance its **interactions with Indigenous peoples**, with a cross-organization working group meeting throughout 2020–21. Group members have, for example, identified gaps in Board policies and in TSB procedures and tools with regard to interactions with Indigenous peoples. The group is considering how to address those gaps, including with new and revised policies and training. The group has prepared maps locating Indigenous communities across Canada, a list of key Indigenous organizations and a guide for communicating with Indigenous people.

Air transportation safety

The year in review

The TSB received 590 reports of air occurrences in 2020 (170 accidents and 420 incidents), including 16 fatalities.

Figure 3. Air transportation accidents, incidents and fatalities, 2016 to 2020



A total of 170 accidents were reported in 2020. This represents a 25% decrease from 2019 and is lower than the 10-year average of 251. Nearly all the accidents (165 out of 170) took place in Canada, all involving Canadian-registered aircraft.

In general, the number of air transportation accidents in Canada per year has been declining over the past decade. However, the significant reduction in 2020 relative to 2019 is largely due to the impact of COVID-19 travel restrictions. These greatly reduced commercial aviation activity in Canada during most of 2020.

That year, there were 12 fatal accidents involving Canadian-registered aircraft of all types. However, none of these involved airliners or commuter aircraft. Rather, the majority involved privately owned aircraft. Fatalities involving commercially operated flights occurred in the air-taxi and aerial work sectors. The total number of resulting fatalities (16) was the lowest since the inception of the TSB, and included no deaths in foreign-registered aircraft operating in Canada.

One accident in 2020 involved a release of dangerous goods. This is fewer than in 2019 (8) and less than the average of about five per year over the previous decade.

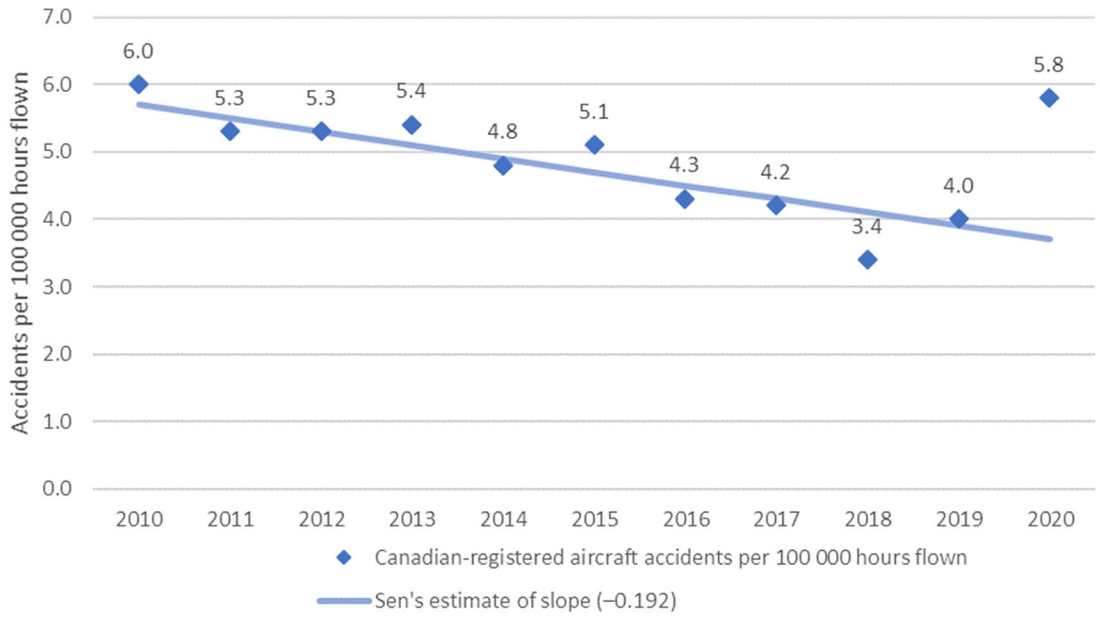
In addition, 420 air transportation incidents were reported to the TSB in 2020. This represents a drop from 915 in 2019 due to the pandemic and is below the yearly average of 790 observed between 2010 and 2019.

Over 91% of incidents (384) involved Canadian-registered aircraft and 318 occurred in Canada. The number of incidents that took place elsewhere (66) is below the 10-year average of 97.

Accident rate: A measure of air transportation safety

The overall air transportation accident rate of 5.8 per 100 000 hours flown in 2020 is based on 149 accidents in Canada and abroad involving Canadian-registered airplanes and helicopters (ultralights, gyroplanes, gliders and Unmanned Air Vehicles are excluded) and the estimated 2.55 million hours flown by Canadian-registered aircraft. This rate is above the 2019 rate of 4.0 and 24% above the average rate of 4.7 over the previous 10 years. While the number of hours flown decreased by almost half in 2020 compared to 2019, the number of reported accidents decreased by only around 25%. Taken together, this explains why the accident rate increased in 2020.

Figure 4. Accident rate for Canadian-registered airplanes and helicopters, 2010 to 2020



Investigations

TSB staff deployed to 15 air transportation occurrences in 2020–21 (21 fewer than in 2019–20), began 16 investigations and completed 31.

Table 8. TSB air transportation investigation activities, 2019–20 and 2020–21

Activities	2019–20	2020–21
Deployments	36	15
Investigations started	39	16
Investigations completed	28	31
Investigations in progress on 31 March of each year	36	21

Table 9. Air transportation investigations completed, 2019–20 and 2020–21

Class (investigation type)	Completed		Completion target (days)	Average duration (days)	
	2019–20	2020–21		2019–20	2020–21
1 (safety issue)	1*	0	730	1696	n/a
2 (complex)	1	2	600	686	704
3 (detailed)	8	17	450	428	488
4 (limited scope)	18	12	220	212	198

*This was a comprehensive, five-year study of safety issues in the air-taxi sector.

Few answers for the TSB or families in Iranian investigation report

The 8 January 2020 missile strike and downing of a Ukraine International Airlines Boeing 737-800 near Tehran Imam Khomeini International Airport highlighted the need for action to protect civilian aircraft in conflict zones and ensure credibility and transparency in safety investigations.

There were 176 passengers and crew on board flight PS752, 55 of whom were Canadian. All were fatally injured. The Islamic Republic of Iran announced that its own military had accidently fired missiles at the aircraft, which led to the crash.

As per Annex 13 of the *Convention on International Civil Aviation*, the safety investigation was led by the Aircraft Accident Investigation Board of the Islamic Republic of Iran (AAIB), as the state of occurrence. Although Annex 13 does not explicitly entitle states that suffered citizen fatalities to actively participate in the safety investigation, Canada requested the elevated status of Accredited Representative. The AAIB did not acknowledge this request. As such, the TSB was only entitled to appoint an Expert. The AAIB did offer the TSB more access to the investigation activities than technically entitled.

Throughout the investigation, the TSB asked the AAIB to answer three important questions:

1. What was the sequence of events, including the technical, human and organizational factors, that led to the missiles being fired and ultimately the downing of PS752?
2. What was the basis for the decision to keep Iran's airspace open during a period of heightened military alert after Iran had launched missiles into Iraq?
3. Why did civilian airlines continue to operate in Iran's airspace in the hours following Iran's launch of missiles into Iraq?

Timeline of the TSB's involvement in the PS752 investigation

- **8 January 2020**: Occurrence
- **9 January 2020**: The TSB confirms role as Expert and accepts Iran's invitation to visit crash site
- **13 January 2020**: Two TSB investigators arrive in Iran to visit site and meet with Iranian investigators
- **13 January 2020**: Chair Kathy Fox holds press conference to brief Canadians on limits of role the TSB can play and commits to seek answers for victims' families by all possible means
- **22–23 January 2020**: TSB investigators meet with Iranian, Ukrainian and French investigators in Kiev
- **18–19 July 2020**: TSB team deploys to Paris to participate in download of flight recorders
- **23 August 2020**: The TSB confirms receipt of flight recorder readout report from Iran's Civil Aviation Organization
- **16 February 2021**: A TSB expert is appointed as technical adviser to Ukraine's Accredited Representative; Ukraine provides the TSB with copy of draft investigation report
- **18 March 2021**: Chair Kathy Fox offers public comments on investigation report

More information

The final report only partially explained why the airspace remained open and why operators continued to fly after Iran had launched missiles into Iraq. It did not explain any of the underlying factors behind why the missiles were launched at PS752, the stated cause of this tragedy.

The report indicated that some unspecified safety actions had been taken to reduce the risk of this happening again. However, due to lack of detail the TSB cannot confirm that those actions will actually reduce the risks to civil aviation operations within Iran's airspace.

The TSB remains committed to advocating for a review of the provisions of Annex 13 to improve the credibility and transparency of future safety investigations.

Rules that are too complex to follow are ineffective

The TSB's investigation into a February 2018 runway overrun in Havre-Saint-Pierre, Quebec, highlighted the safety risks associated with rules governing instrument approaches in Canada as being too complex, confusing and ineffective. As a result, these rules do not prevent pilots from conducting approaches that are not allowed or banned when they are below the minimum weather limits (A18Q0030).

> Runway overruns pose a risk to people, property and the environment. They have been an issue on the **TSB's Watchlist** for a decade, with no significant change in the number of these occurrences since 2005.

The Beechcraft King Air A100 involved in this occurrence approached the Havre St-Pierre Airport with visibility decreasing to well below the minimum allowed to conduct an approach. The pilot believed he could continue with the approach safely and touched down just 700 feet before the end of the runway, eventually coming to a stop in a large snowbank.

Unlike elsewhere in the world, flight crews in Canada are permitted to conduct approaches in visibility conditions that are below what is published, but must consult multiple reference documents and consider a variety of factors to determine whether an approach is allowed. Transport Canada's current rules also make it difficult for air traffic controllers to determine whether an approach is authorized.

In this case, the TSB found that, based on the pilot's interpretation of the various factors and exceptions relating to the approach ban, he incorrectly believed he was allowed to conduct the approach. Moreover, the rules did not prevent him from continuing the approach in weather conditions that were below the minimum limits.

The Board's two recommendations to Transport Canada (Recommendation A20-01 and Recommendation A20-02) directly address the circumstances of this occurrence. Transport Canada subsequently signalled its agreement with the recommendations and has already begun work to implement improvements to the regulations governing approaches and landings at Canadian aerodromes.

Inspections failed to detect cracks that led to wing strut separation

A fatigue fracture in a wing lift strut attachment fitting led to the in-flight breakup of a DHC-3 floatplane near Little Grand Rapids, Manitoba (A19C0138). The pilot and two passengers were fatally injured in the October 2019 occurrence.

The investigation found that the fatigue fracture had developed in one of the two upper right-hand wing lift strut attachment fittings. This fracture eventually led to an overstress failure of the other fitting during the left turn prior to final approach. The right wing strut then separated from the wing.

The TSB determined that the detailed visual inspections carried out on the aircraft, which were required by maintenance manual procedures and a Transport Canada airworthiness directive,

were not robust enough to identify cracks that could form in the wing lift strut attachment fittings.

The TSB issued Aviation Safety Advisory A19C0138-D1-A1 as part of this investigation. In it, the TSB requested that Transport Canada work with the aircraft manufacturer, Viking Air Ltd., to amend its maintenance manuals. Alternatively, Transport Canada could issue a new airworthiness directive to include the amended inspection requirements outlined in the Alert Service Bulletin Viking had issued after the occurrence. Transport Canada chose the latter option, issuing an airworthiness directive requiring enhanced inspections of DHC-3 wing lift strut assemblies.

Poor conditions, ineffective avionics, fatigue all factors in fatal crash

A TSB investigation, completed in March 2021, found that a flight continued in poor weather conditions, leading to a fatal controlled flight into terrain on Addenbroke Island, B.C., in July 2019 (A19P0112). The pilot and three of the passengers were fatally injured.

The investigation found that the Cessna 208 Caravan had departed the Vancouver International Water Aerodrome despite reported and forecasted weather conditions near the destination that were below visual flight rules requirements.

Fatigue, a likely factor in this occurrence, features on the **TSB's Watchlist** of safety issues, and is a concern in the aviation, marine and rail transportation modes.

Likewise, a lack of timely and effective **regulatory surveillance**, to ensure operators in all modes are compliant features on the **TSB's Watchlist**.

After encountering poor weather, the pilot continued the flight. Although the aircraft was equipped with advanced avionics devices, they were configured in a way that made the system ineffective at alerting the pilot to the rising terrain ahead. Additionally, the pilot's performance was likely influenced to some degree by fatigue.

Although the aircraft was equipped to capture flight data, the aircraft's operator, Seair Seaplanes, had not established a flight data monitoring program.

Regulators also have a role to play in monitoring for safe operations. Following this occurrence, Transport Canada did not conduct any reactive surveillance, initiate new surveillance activities, escalate upcoming surveillance activities, or conduct targeted or compliance inspections. The absence of such surveillance increases the risk that air operators will not comply with regulations or will drift toward unsafe practices, thereby reducing safety margins.

The acceptance of unsafe practices is one of the factors the TSB identified in its safety issue investigation Raising the bar on safety: Reducing the risks associated with air-taxi operations in Canada.

Following the occurrence, Seair contracted an aviation consulting company to conduct an operational and maintenance review, updated its standard operating procedures to highlight the limitations of the autopilot system, and added an acceptable use policy on personal electronic devices in the cockpit.

Failure of the ELT switch locking system hampered search for downed helicopter

The TSB's investigation into a July 2019 fatal impact with the ground near Lac Valtrie in Quebec's Rouge-Matawin Wildlife Reserve raised issues about the failure of the emergency locator transmitter (ELT) switch locking system (A19Q0109).

No ELT signal was detected from the privately registered Robinson R44 helicopter. Instead, it was located 14 days after being reported missing by using historical data from the occupants' cellphones to triangulate the crash site.

The investigation found that no flight plan or flight itinerary had been filed. In such situations, there is a risk that a search will not be initiated within a reasonable timeframe, especially when no ELT signal is detected. This reduces the occupants' chances of survival and deprives search and rescue teams of important information needed for the search.

Following the accident, the TSB issued Air Safety Advisory A19Q0109-D1-A1 suggesting that Orolia, the manufacturer of Kannad ELTs, and Transport Canada revise the periodic inspection procedures for these devices so that a failure of the switch locking system can be detected and corrected in the future.

In response, Orolia indicated that it had clarified its switch operating instructions and added a warning to avoid inappropriate manoeuvres that could result in the switch locking latches breaking. For its part, Transport Canada published a civil aviation safety alert directing operators to pay particular attention to ELT switches during inspections.

Safety advisories and safety information letters

The TSB issued safety advisories and safety information letters as part of investigations in 2020–21.

- March 2020 bird strike/rejected takeoffs, Toronto/Lester B. Pearson International Airport, Ontario (A20O0029): The TSB sent Aviation Safety Advisory A20O0029-D1-A1 to Transport Canada to highlight the effect of inaccurate airborne status transmitted by transponders on runway monitoring and conflict alert systems.
- July 2020 loss of control during rejected takeoff of a Cessna 140 at Stave Lake abandoned aerodrome in B.C. (A20P0071): In Air Safety Advisory Letter A20P0071-D4-A1, the TSB suggested that Transport Canada should address the safety issue of potential aluminum centre seat belt bracket failure in all affected Cessna 120 and 140 aircraft.
- February 2020 hard landing of Bombardier Challenger 605 at Calgary International Airport, Alberta (A20W0016): With Air Safety Information Letter A20W0016-D1-L1, the TSB communicated to Bombardier that its service bulletin to address contamination and corrosion of the flap flexible drive shaft assemblies on its CRJ 100/200 series aircraft was not applied to the Challenger 605 series flap system, even though the flap systems are nearly identical in design and construction for both series of aircraft.

- August 2019 aileron control difficulty leading to aircraft flipping over upon landing (A19A0062, a Class 5 investigation): In Air Safety Information Letter A19A0062-D1-L1, the TSB advised Transport Canada that deviation from Murphy Rebel kit assembly or rigging instructions can cause an aileron control geometry issue that could make the aircraft difficult to control as a result of jamming or rod end failure.

Progress on outstanding recommendations

Of the 28 air transportation safety recommendations the Board assessed and reassessed in 2020–21, six were closed. Among these, five were closed as Fully Satisfactory and one as Unsatisfactory.

Four of the five recommendations the Board closed as Fully Satisfactory related to ELTs and resulted from the TSB's investigation into the May 2013 fatal crash of a Sikorsky S-76A helicopter north of Moosonee (A13H0001). Transport Canada and the International Civil Aviation Organization (ICAO) satisfied the requirements of Recommendation A16-01 and Recommendation A16-02 within five years.

Amendments to the *Canadian Aviation Regulations* will mandate that most Canadian registered aircraft and foreign aircraft operating in Canada be equipped with one or more ELTs capable of broadcasting simultaneously on frequencies of 406 MHz and 121.5 MHz. For its part, ICAO has been actively involved in developing rigorous ELT system crash survivability standards, with which the Federal Aviation Administration, European Aviation Safety Agency and Transport Canada have taken regulatory steps to comply.

Rigorous ELT system crash survivability requirements were also the focus of Recommendation A16-05 to Transport Canada. As of September 2020, the *Canadian Aviation Regulations* require new applications for design approval of an ELT to meet the latest Canadian Technical Standard Order CAN-TSO-C126c, which incorporates the standard ICAO helped establish.

Finally, in Recommendation A16-07, the Board recommended that Transport Canada prohibit the use of hook-and-loop fasteners to secure an ELT to an airframe. In November 2020, Transport Canada updated Airworthiness Manual 551.104 to prohibit the use of hook-and-loop fasteners for all new ELT installations.

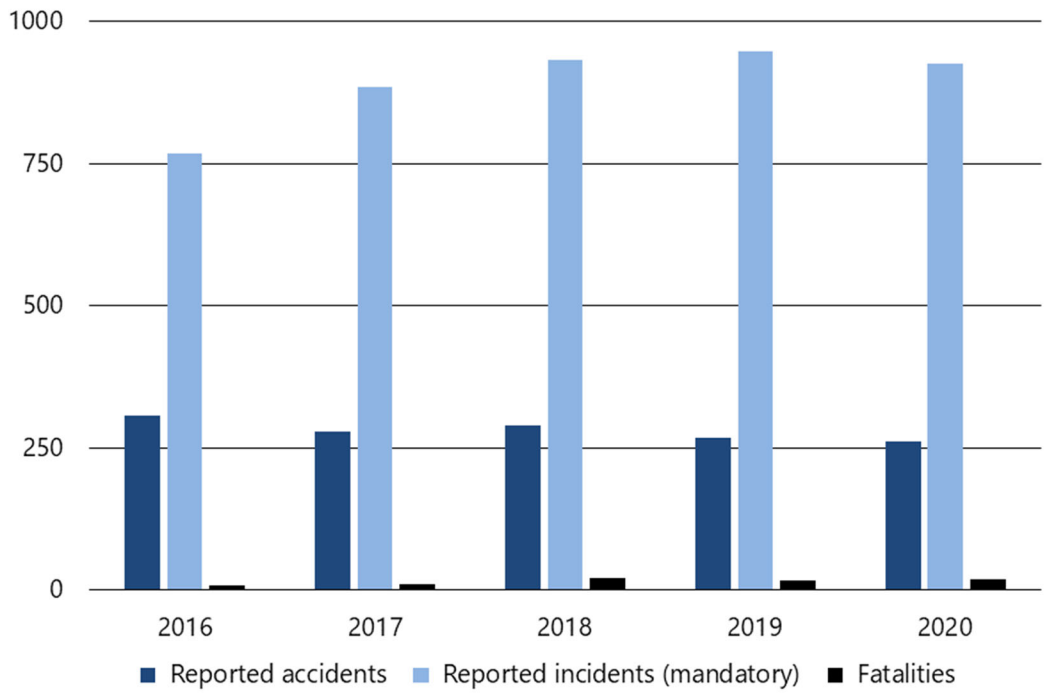
The remaining 22 recommendations the Board assessed and reassessed in 2020–21 obtained the following ratings: Satisfactory Intent (11); Satisfactory in Part (6); Unsatisfactory (2) and Unable to Assess (3).

Marine transportation safety

The year in review

The TSB received 1187 reports of marine transportation occurrences in 2020 (262 accidents and 925 incidents), including 18 fatalities.

Figure 5. Marine transportation accidents, incidents and fatalities, 2016 to 2020



The total of 262 marine transportation accidents represents a slight decrease from the 267 accidents in 2019 and is lower than the 10-year average of 289. In 2020, 84% of accidents were shipping accidents (when a ship, for example, sinks, founders or capsizes), compared to 82% on average over the previous 10 years. The remaining 16% of accidents in 2020 were accidents aboard ship (when a person is killed or seriously injured when, for example, boarding a ship or by falling overboard), compared to the 10-year annual average of 18%.

The 18 marine transportation fatalities exceed the 2019 total of 17 and the 10-year average of 15.4. Of the 18 fatalities, 12 involved shipping accidents, in contrast to 2019 when most fatalities (13 of 17) occurred aboard ship. Over the previous 10 years, fatalities have been fairly evenly divided between shipping accidents and accidents aboard ship.

As in previous years, the majority of the fatalities (16 of the 18) were related to commercial fishing (Canadian-flag vessels in Canadian waters). Due to this continuing trend, commercial fishing safety remains a key safety issue on the TSB's Watchlist.

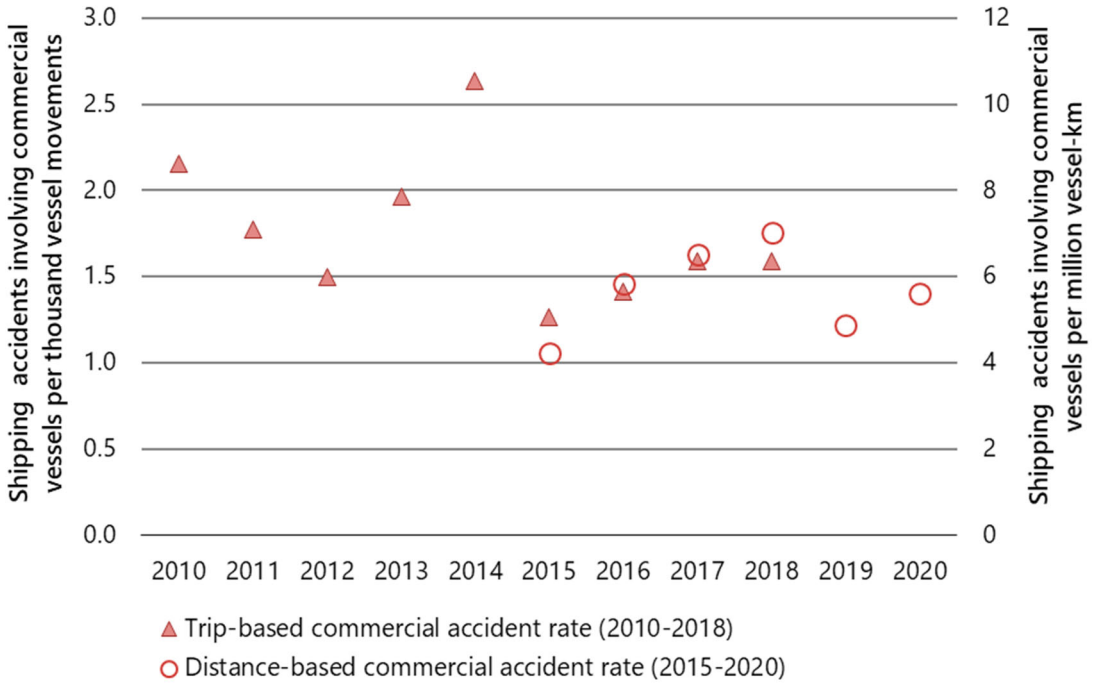
There were 254 vessels involved in the 219 shipping accidents that took place in 2020. In 2019, 230 vessels were involved in 207 shipping accidents. The highest increase was observed in the Pacific region (to 101 vessels from 90).

The 925 marine transportation incidents reported to the TSB in 2020 represents a 2% decrease from 2019 but a 44% increase from the 10-year average of 643. As in previous years, most reportable incidents (82%) were related to the total failure of machinery or technical systems. The increase in incidents of this type is due largely to changes made in 2014 to TSB reporting requirements.

Accident rate: A measure of marine transportation safety

According to Transport Canada, 2020 marine activity (commercial vessel-kilometres) for Canadian commercial non-fishing vessels with a gross tonnage of over 15 (excluding passenger vessels and cruise ships) was 17% above the 2015-to-2019 average. The 2020 accident rate was 5.6 accidents per million commercial vessel-kilometres, slightly lower than the 2015-to-2019 average of 5.7. (Transport Canada now provides a comprehensive distance-based metric of commercial marine activity in Canadian waters beginning from 2015. However, a six-year series is too short to test for meaningful trends, and vessel movements are no longer captured.)

Figure 6. Shipping accident rate, Canadian commercial non-fishing vessels, 2010 to 2020



Investigations

TSB staff deployed to eight marine transportation occurrences in 2020–21—the same as in 2019–20—and began 13 investigations.

Table 10. TSB marine transportation investigation activities, 2019–20 and 2020–21

Activities	2019–20	2020–21
Deployments	8	8
Investigations started	7	13
Investigations completed	8	15
Investigations in progress on 31 March of each year	18	16

Of the 15 marine investigations completed in 2020–21, two were complex class 2 investigations, four were detailed class 3 investigations and nine were limited-scope class 4s. The average time to complete the class 2 investigations was 953 days. The average time to complete the class 3 investigations was 708 days (up from 548 in 2019–20). The average duration of the class 4 investigations was 370 days, an increase from 341 days the previous year.

Table 11. Marine transportation investigations completed, 2019–20 and 2020–21

Class (investigation type)	Completed		Completion target (days)	Average duration (days)	
	2019–20	2020–21		2019–20	2020–21
2 (complex)	0	2	600	n/a	953
3 (detailed)	5	4	450	548	708
4 (limited scope)	3	9	220	341	370

Speed guidance and operating instructions must be clear and followed

The TSB investigated why the passenger ferry *Spirit of Vancouver Island* struck the dock while berthing at Tsawwassen Terminal, British Columbia, in April 2020. The investigation highlighted the importance of vessel bridge teams adhering to the recommended speeds and guidance set out in a vessel's safety management system (M20P0110).

Safety management is a longstanding issue on the **TSB's Watchlist**. In the marine sector, TSB investigations have found that, even when formal processes are present, they are often not effective in identifying hazards or reducing risks.

Each vessel within the BC Ferries fleet maintains a vessel-specific manual (VSM), which the senior master regularly updates. On the day of the occurrence, the vessel's speed and propeller pitch settings during the approach to the berth were higher than what the VSM recommended.

Although the VSM did not specify a speed limit for the vessel when transiting the particular marker, the general practice was to proceed at no faster than 6 knots. However, on the day of the occurrence, the vessel was travelling at 6.2 knots. Higher speeds, particularly during docking, can reduce the time available to respond to any changes in environmental factors and result in a loss of control over a vessel's movements.

An approved authority certified and audited the *Spirit of Vancouver Island*'s safety management system. However, the investigation identified gaps in the effectiveness of guidance provided to crews regarding recommended vessel speeds and critical vessel operations (including remotely releasing the anchors, which did not work in this case), which was not well documented or understood by the crew. Clearly posted operating instructions are essential to increase the likelihood that critical safety equipment will be operated successfully in emergency situations.

Among the safety actions BC Ferries took after the occurrence was to re-create the incident in a simulator and review the stages of the incident and lessons learned. It also updated the anchor documentation and training manual to clarify the anchor release method, and all crews have been practising proper stowage of the anchors on board Spirit-class vessels.

Safety deficiencies indicate weak emergency preparedness on passenger vessel

The TSB's investigation into the August 2017 bottom contact of the passenger vessel *Island Queen III* off Kingston, Ontario (M17C0179) uncovered a series of safety deficiencies related to responding to emergencies on board passenger vessels.

After deviating from its planned route to avoid marine traffic, the *Island Queen III* strayed into shallow water and struck bottom, breaching the hull and causing water to flood a compartment below the main deck.

While the voyage ended with no injuries or loss of life, the safety deficiencies uncovered by the investigation prompted the TSB to issue Marine Safety Advisory Letter No. 02/18 to Transport Canada and several Kingston area boat lines outlining safety actions they should take prior to the next cruise season.

In addition, the Board issued three safety concerns intended to spur action by the vessel operator, the commercial passenger vessel industry at large and Transport Canada:

- that Transport Canada does not require vessels to have as many or more child and infant-sized lifejackets on board as children and infants on board;
- that until Transport Canada implements a formal validation and approval process for passenger vessel evacuation procedures, crews and passengers may not be prepared to evacuate safely in an emergency; and
- that crew members are not required to be trained in passenger safety management, so there remains a risk that they will not be adequately prepared to manage passengers effectively in emergencies.

Since the occurrence, the operator of the *Island Queen III* has, among other things, changed how it gives the pre-departure safety briefing to passengers, including having crew members demonstrate how to put on lifejackets. The company has also reviewed its safety management system and developed detailed evacuation procedures.

Lack of headgear, training and adequate procedures contributed to serious injury

The TSB's investigation into the serious injury of a crew member while stowing a lifeboat on the passenger vessel *Amadea* in the Port of Québec, Quebec, underlines the importance of vessels having adequate procedures and of crew members being properly trained (M18C0240).

The TSB found that manually overriding a winch system's built-in safety feature and not wearing protective headgear played a role in a crew member's serious head injury in September 2018 during a scheduled lifeboat drill. In addition, the crew member was not trained on or familiarized with how to stow a lifeboat, and was unaware of the associated risks and hazards.

The investigation also found that the on-board safety management system did not include training or any formal operating procedures on lifeboat recovery and stowage, or on operating the davit winches. If crew members are not trained in the safe operation of critical shipboard equipment, such as life saving appliances, there is a risk they will not operate such equipment in a safe manner.

Following the occurrence, the vessel's manager, Bernhard Schulte Cruise Services, updated the *Amadea*'s training manual to include a procedure for lifeboat recovery. This procedure specifies that crew members must wear protective headgear (a helmet), gloves and safety shoes when performing any activity involving lifeboat winches, davits and lashings.

PFDs and EPIRBs essential for safety on commercial fishing vessels

The TSB's investigation into the May 2018 capsizing of an unnamed fishing vessel in Medway Harbour, Nova Scotia, with the loss of two lives, highlighted a number of ongoing concerns the TSB has related to safety in the commercial fishing industry (M18A0076).

Neither of the individuals who perished in the occurrence—the crew member or the master—were wearing a lifejacket or a personal flotation device (PFD).

Commercial fishing safety has been on the **TSB's Watchlist** since 2010. Every year, the same safety deficiencies on board fishing vessels continue to put at risk the lives of thousands of Canadian fish harvesters and the livelihoods of their families and communities.

The TSB has singled out not wearing a PFD on a fishing vessel as an unsafe practice for the past 20 years and has recommended that Transport Canada require them to be worn at all times while on deck on certain vessels (Recommendation M16-05). The TSB also recommended that Transport Canada ensure programs are developed to confirm compliance with the requirements.

The vessel in this occurrence did not have an emergency position-indicating radio beacon (EPIRB) or a very high frequency radiotelephone on board. Rather, both individuals carried a cellphone, which met regulatory requirements at the time of the occurrence, although cellphones have limitations in emergencies. Under the *Navigation Safety Regulations*, 2020, some fishing vessels are now required to carry an EPIRB or similar device.

It is important that fish harvesters take responsibility for their safety and the safety of their crews by ensuring that PFDs are worn on board their vessels. Wearing a PFD can minimize the adverse consequences of being immersed in water and increase a person's chances of survival until help arrives. When the vessel is equipped with a functioning EPRIB or Personal Locator Beacon, life-saving assistance can arrive that much faster.

Safety advisories and safety information letters

The TSB issued safety advisories and safety information letters as part of investigations in 2020–21.

- February 2019 grounding of Royal Canadian Marine Search and Rescue vessel *Spirit of Sooke* in Sooke Harbour, B.C. (M19P0029): With Marine Safety Advisory Letter 01/20, the TSB requested that the Canadian Coast Guard cease its formal investigation to determine causal and contributing factors associated with the accident. Carrying out such investigations is the TSB's exclusive jurisdiction.
- July 2020 collision between the Canadian-flagged general cargo vessel *Florence Spirit* and Antigua and Barbuda-flagged general cargo vessel *Alanis* in the Welland Canal, Ontario (M20C0188): In Marine Safety Advisory Letter No. 01/21, the TSB encouraged McKeil Marine Limited to review notices, training, equipment and/or procedures on board the *Florence Spirit* to ensure rudder angles are applied in a manner that yields the desired lift force.

- February 2020 bottom contact of passenger vehicle ferry *Veteran*, Farewell, Newfoundland and Labrador (M20A0048, a Class 5 investigation): In Marine Safety Information Letter No. 01/20, the TSB pointed out to the province's transportation and works department that without increased awareness of the need to immediately notify search and rescue authorities of a developing situation, occurrences may continue to go unreported.
- December 2019 engine room fire on board Canadian bulk carrier *Tecumseh* while transiting the Detroit River off Windsor, Ontario (M19C0403): With Marine Safety Information Letter No. 02/20, the TSB suggested that the Association of Canadian Port Authorities invite its members to ensure their local shore-based firefighting resources, either public or private, are properly trained and equipped to support crews in fighting shipboard fires.

Progress on outstanding recommendations

The Board reassessed 21 marine transportation safety recommendations in 2020–21, closing four as Fully Satisfactory.

Among these was Recommendation M17-03, which resulted from the 2015 capsizing of *Leviathan II* in Clayoquot Sound, B.C., with loss of life (M15P0347). The TSB recommended that Transport Canada require all commercial passenger vessels operating beyond sheltered waters to carry an EPIRB or other appropriate equipment. The *Navigation Safety Regulations*, 2020, which bring this requirement into law, were published in October 2020.

In Recommendation M94-34, the TSB recommended that Transport Canada require pilotage authorities to publish official passage plans for compulsory pilotage waters and make them available to masters. The recommendation came in the wake of the May 1991 bottom contact of the *Irving Nordic* in the St Lawrence River, near Grondines, Quebec (M91L3012). By February 2021, each of the four pilotage authorities in Canada (Crown corporations that are within the Minister of Transport's portfolio) had published the required plans.

In issuing Recommendation M92-07, the TSB recommended that Transport Canada expedite its revision of the *Small Fishing Vessel Safety Regulations* to require fishermen to carry anti-exposure worksuits or survival suits. This recommendation was in response to the December 1990 capsize and sinking of the *F.V. Straits Pride II* en route from the fishing grounds to St. John's, Newfoundland and Labrador, with three fatalities (M90N5017). The *Fishing Vessel Safety Regulations*, which came into force in 2017, require, based on exposure to risk, fishing vessels greater than 12 m to carry immersion suits or anti-exposure worksuits of an appropriate size for each person on board. The regulations allow smaller vessels to carry alternatives. In combination with the *Navigation Safety Regulations* that require EPIRBs, these measures substantially mitigate the risk the recommendation identified.

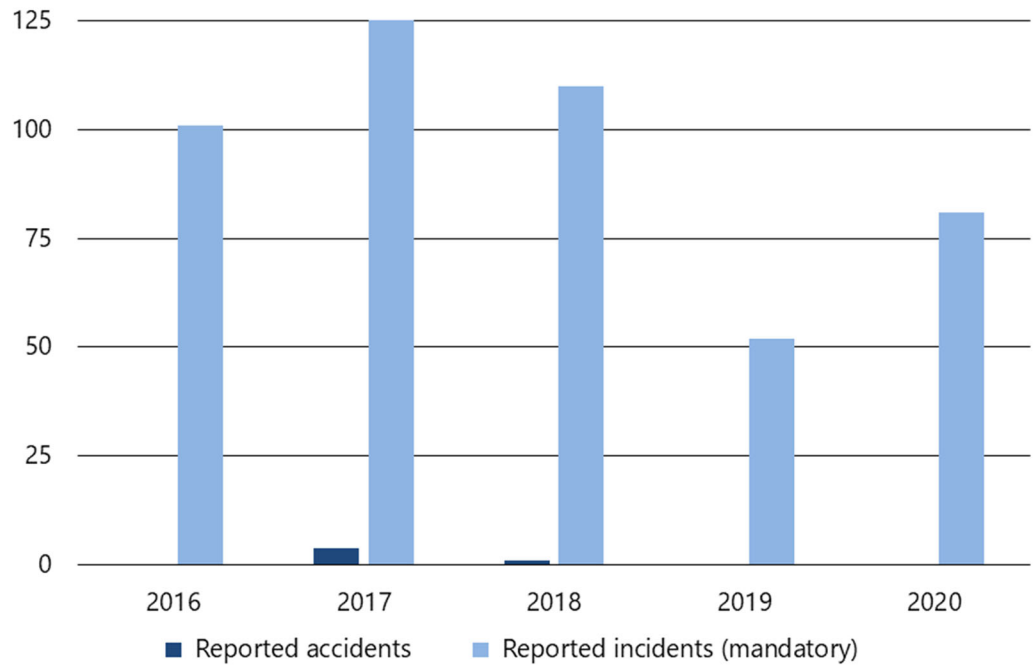
The remaining 17 recommendations the Board reassessed in 2020–21 obtained the following ratings: Satisfactory Intent (7), Satisfactory in Part (5), Unsatisfactory (2) and Unable to Assess (3).

Pipeline transportation safety

The year in review

The TSB received 81 reports of pipeline transportation occurrences in 2020, all of which were incidents rather than accidents. There were no fatalities arising directly from the operation of any federally regulated pipeline, as has been the case since the TSB's inception in 1990.

Figure 7. Pipeline transportation accidents and incidents, 2016 to 2020



This number of occurrences is 56% more than in 2019 but below the average of 120 for the previous 10 years, including an average of four accidents per year. The difference is mostly due to changes that were introduced in 2014 to the occurrence reporting criteria.

Of the 81 occurrences in 2020, 18 involved a release of product:

- This represents 22% of the occurrences in 2020, which is far below the 10-year average (71%).
- Most of these occurrences involved a release of hydrocarbon gas (66.7%), as has been the case each year since 2015.
- Four other occurrences involved the release of more than 1.5 m^3 of low vapour pressure hydrocarbons.

The TSB's *Statistical Summary: Pipeline Transportation Occurrences in 2020* contains more information on product releases during the year.

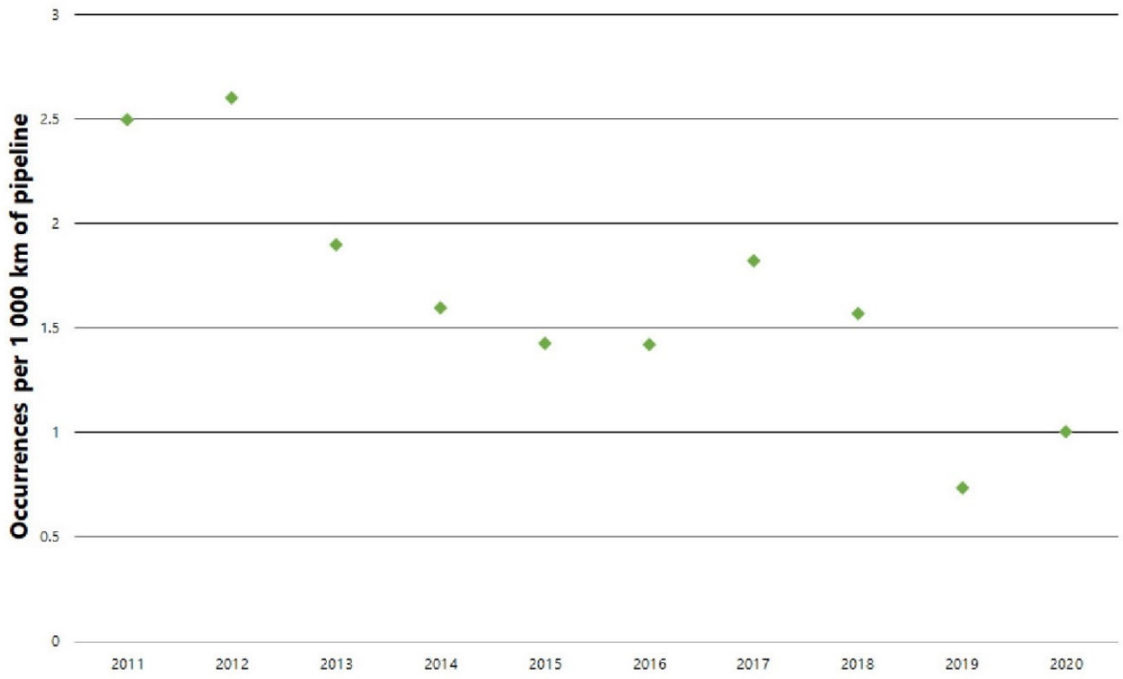
In 2020, 26 occurrences involved geotechnical, hydrotechnical or environmental activity—slope movements or river erosion, for example—twice the number reported in 2019, and well above the average of eight such events per year over the previous 10 years. The higher level of reported occurrences since 2017 may be related to increased regulatory oversight, company inspections and reporting, as well as varied weather patterns and hydrotechnical activity over the last four years.

Most occurrences in 2020 were in Alberta (29 out of 81), while there were 19 in Ontario and 15 in British Columbia. Of the 18 remaining occurrences, 15 took place in Quebec, Saskatchewan and Manitoba, while New Brunswick, Nova Scotia and the Northwest Territories had one each.

Occurrence rate: A measure of pipeline transportation safety

There were 80 500 km of federally regulated pipeline operating in Canada in 2020, according to the Canada Energy Regulator. The 81 pipeline transportation occurrences reported to the TSB for the year resulted in an occurrence rate per 1000 km of operating pipeline of 1.0. This is up from the 2019 rate of 0.7, but below the average of 1.6 occurrences per 1000 km since 2011.

Figure 8. Pipeline transportation occurrence rate, 2011 to 2020



Investigations

TSB staff deployed to one pipeline transportation occurrence and began two new investigations in 2020–21.

Table 12. TSB pipeline transportation investigation activities, 2019–20 and 2020–21

Activities	2019–20	2020–21
Deployments	0	1
Investigations started	0	2
Investigations completed	1	1
Investigations in progress on 31 March of each year	0	1

The TSB completed one pipeline investigation in 2020–21, a limited scope class 4 investigation that took 279 days.

Table 13. Pipeline transportation investigations completed, 2019–20 and 2020–21

Class (investigation type)	Completed		Completion target (days)	Average duration (days)	
	2019–20	2020–21		2019–20	2020–21
3 (detailed)	1	0	450	513	n/a
4 (limited scope)	0	1	220	n/a	279

Cracked hose and open valve lead to release of crude oil into nearby ditch

The TSB's investigation into the April 2020 release of crude oil at an Enbridge pump station near Herschel, Saskatchewan, highlights the importance of identifying and mitigating the hazards associated with all operating conditions, including the potential backflow of crude oil, to effectively evaluate and mitigate the risks related to auxiliary piping systems (P20H0017).

The crude oil was released from a ¾-inch flexible braided hose that is part of an above-ground auxiliary system used to inject drag reducing agents into a pipeline. The hose likely cracked when it froze, due to a heating trace system malfunction.

The Hazard and Operability Study Enbridge conducted did not identify that the design of the drag reducing agent injection system piping allows crude oil to backflow from the injection point to the check valve. Consequently, it also did not identify that, should the piping, including the ¾-inch flexible braided hose, freeze and rupture, there could be a release of crude oil.

Consequently, no control measures were implemented to prevent crude oil from being released should the piping or hose fail.

An estimated 50 m^3 of crude oil was released, with approximately 10 m^3 migrating via a valve used to drain accumulated storm water away from the station into an adjacent roadway ditch. The valve had inadvertently been left open at the end of a shift.

Through its investigation, the TSB learned that Enbridge's procedure for the discharge of storm water off site requires that a form be completed every time; however, this was not done when the storm water was discharged prior to the occurrence. In addition, Enbridge's storm water discharge procedure does not include detailed instructions on the operation of discharge valves, including when to open and close each valve.

Following the occurrence, Enbridge evaluated the need for drag reduction agent injection systems and isolated those that were no longer required. It also initiated a review of its storm water management procedures and documentation to identify areas for improvement.

Safety advisories and safety information letters

The TSB issued a safety information letter as part of an investigation in 2020–21.

- There were multiple instances of unauthorized activities (ground disturbance) by railway companies near operating pipelines since 2016. In 2 of these occurrences (P20H0010 and P17H0135, Class 5 investigations), the structural integrity of the pipeline was unintentionally affected. Through Pipeline Safety Information Letter No. 01/20, the TSB suggested that the Railway Association of Canada might wish to remind its members of their obligations to make locate requests when planning to undertake activities in the vicinity of operating pipelines.

Progress on outstanding recommendations

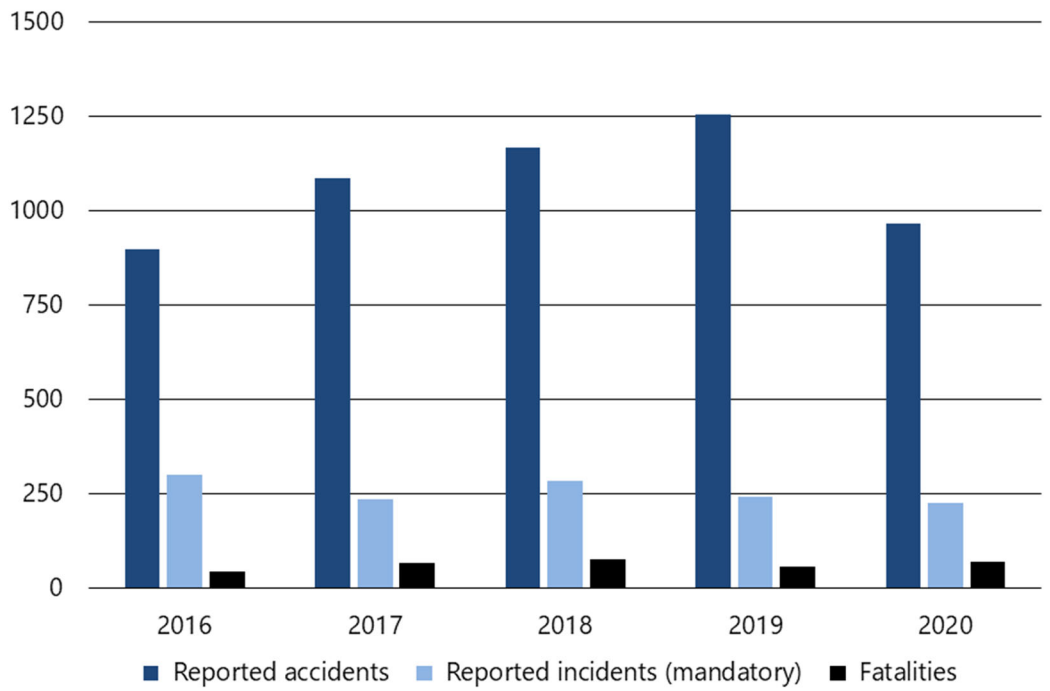
The Board issued no pipeline safety recommendations in 2020–21 and had previously assessed all pipeline recommendations as Fully Satisfactory.

Rail transportation safety

The year in review

The TSB received 1192 reports of rail transportation occurrences in 2020 (965 accidents and 227 incidents), including 59 fatalities.

Figure 9. Rail transportation accidents, incidents and fatalities, 2016 to 2020



The 965 accidents represent a 23% decrease from 2019 and an 11% decrease from the 10-year average of 1083.

The 59 rail transportation-related fatalities reported in 2020 are 13 fewer than in the previous year and below the 10-year average of 73. Among the fatalities, 39 involved trespassers, compared to 38 in 2019 and the 10-year average of 42.

The number of crossing accident fatalities decreased in 2020 (18) compared to 2019 (28) and is lower than the 10-year average of 23. The TSB is conducting ongoing research to better understand crossing accident data.

Among all rail transportation accidents, 82 involved dangerous goods. This is down from 171 in 2019 and from the 10-year average of 131. Three accidents in 2020 resulted in dangerous goods being released.

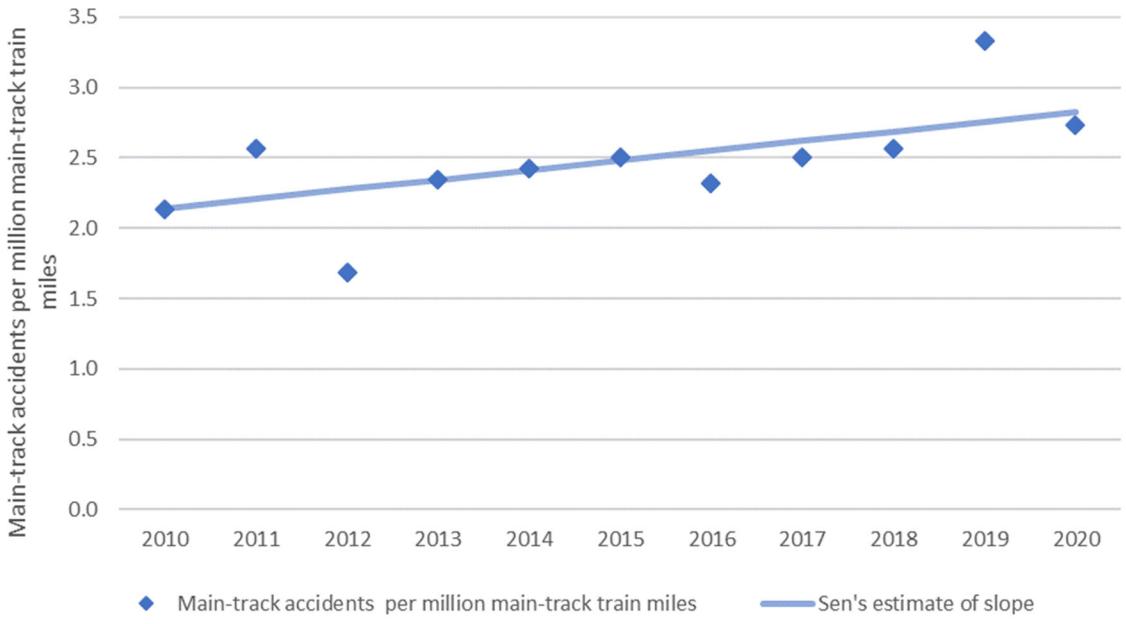
There were 227 rail transportation incidents reported to the TSB in 2020, a 7% decrease from 2019 (243), and a 17% decrease from the 10-year average (273). Incidents involving

movements that exceeded limits of authority accounted for 67% (151) of all rail transportation incidents in 2020—15 more than in 2019 and above the 10-year average of 124.

Accident rate: A measure of rail transportation safety

According to Transport Canada data, 2020 main-track (non-yard) rail activity decreased by 10% from 2019. The main-track accident rate in 2020 was 2.7 accidents per million main-track train-miles, down from 3.3 in 2019 but above the 10-year average of 2.4.

Figure 10. Main-track accident rate, 2010 to 2020



Investigations

TSB staff deployed to five rail transportation occurrences in 2020–21, 11 fewer than in 2019–20, and began 10 investigations.

Table 14. TSB rail transportation investigation activities, 2019–20 and 2020–21

Activities	2019–20	2020–21
Deployments	16	5
Investigations started	20	10
Investigations completed	13	19
Investigations in progress on 31 March of each year	30	21

Of the 19 rail transportation investigations the TSB completed in 2020–21, five were complex class 2 investigations, four were detailed class 3 investigations and 10 were limited-scope class 4s. The average time to complete the class 2 investigations was 811 days. The average time to complete the class 3 investigations was 540 days (up from 520 in 2019–20). The average duration of the class 4 investigations was 374 days, an increase from the previous year.

Table 15. Rail transportation investigations completed, 2019–20 and 2020–21

Class (investigation type)	Completed		Completion target (days)	Average duration (days)	
	2019–20	2020–21		2019–20	2020–21
2 (complex)	0	5	600	n/a	811
3 (detailed)	8	4	450	520	540
4 (limited scope)	5	10	220	219	374

Knowing the underlying causes and developing strategies essential to stopping uncontrolled movement of rail equipment

In December 2017, a foreman at the Canadian National Railway Company (CN) Melville Yard in Saskatchewan was pinned between a cut of three loaded cars rolling uncontrolled and backward downhill and a group of stationary cars, sustaining fatal injuries (R17W0267).

Unplanned or uncontrolled movement of rail equipment joined the **TSB's Watchlist** in 2020. These occurrences can and have had catastrophic consequences and are on the rise. The issue featured in three out of the four occurrences profiled in this annual report.

The investigation found that the crew's limited experience likely contributed to a decision to "kick" three loaded cars uphill (a manoeuvre involving a remotely controlled locomotive shoving the cars until they gain momentum). However, the cars did not develop sufficient speed and began to roll back down the grade.

In addition, neither of the crew members involved had received formal crew resource management training. Such training can help ensure individuals develop crew coordination and communication skills, the latter of which was found lacking in this occurrence.

The Board recommended that Transport Canada, railway companies and their labour representatives work to identify the underlying causes of uncontrolled movements that occur while switching without air, and develop and implement strategies and/or regulatory requirements to reduce their frequency (Recommendation R20-01).

In light of ongoing turnover in the railway industry, the Board also communicated its concern that, without additional mitigation, inexperienced personnel will continue to be paired together in yards, risking ongoing adverse outcomes.

Since the accident, CN has changed the track configuration at Melville Yard and prohibited crews to kick cars uphill.

Worn seals in air brake control valves shrinking in extreme cold temperatures led to uncontrolled movement of freight train

In a second investigation involving uncontrolled movement of rail equipment, the TSB determined that worn seals in air brake control valves that had shrunk during extreme cold weather operations led to a CN freight train reaching 53 mph as it travelled down the mountain grade to Leyland, Alberta, in January 2018 (R18E0007).

This type of failure is known to the industry and was the subject of an Association of American Railroads circular in 2013. Following the occurrence, CN implemented new air brake testing procedures for cold weather operations in the area of the occurrence and set temperature-based restrictions for operations. The railway also implemented enhanced air brake control valve testing and shortened the interval for replacing the valves.

In response to the TSB's Rail Safety Advisory Letter 617-04/18, Transport Canada indicated that it had issued a Rail Safety Bulletin in 2019 to advise railway companies and car owners to

examine the complete valve functionality of cars that had been in long-term storage before putting them back in service, especially in cold weather.

For its part, the Association of American Railroads changed its Field and Office Manuals of Interchange Rules to require operators to renew or replace brake control valves based on age and/or exposure to cold-weather operations.

Clear definitions of "attended" and "unattended" needed so crews can prevent uncontrolled movement of rail equipment

The safety of railway operations could be compromised if railway employees do not properly interpret or apply the directives, rules or operating instructions to which they are subject. This was among the TSB's conclusions after its investigation of a 2018 employee fatality at the CN Edmundston Yard in New Brunswick (R18M0037).

A cut of two cars ran uncontrolled, striking a trailing locomotive travelling in the opposite direction, and trapping and fatally injuring a conductor trainee. The two cars had been temporarily left with only the emergency brakes applied, since the crew considered them to be "attended" as per Rule 112 of the *Canadian Rail Operating Rules*.

However, the investigation found that CN's instructions and employee training on Rule 112 do not clearly define the factors and risks that employees must consider when determining whether they are in a position to stop equipment should it move unintentionally.

While both CN and Canadian Pacific Railway responded to the TSB's Rail Safety Advisory Letter 617-02/19 that Rule 112, including the definition of "unattended," was sufficiently clear, Transport Canada determined through its own investigation under Part II of the *Canada Labour Code* that the cars in this occurrence were unattended. Transport Canada issued a letter of non-compliance to CN and committed to engaging industry to ensure there is an accurate understanding of unattended equipment and to determine whether additional guidance is required.

Near-collision between two VIA trains highlights importance of following railway signal indications

The TSB's investigation of a near-collision between two VIA Rail Canada Inc. passenger trains near Drummondville, Quebec, in 2018 found that the crew members of the westbound train were unaware that they had passed a Stop signal or that the eastbound train had just cleared the main track (R18D0096).

Following railway signal indications is one of the key safety issues that needs to be addressed. It has been on the **TSB's Watchlist** since 2012.

Due to numerous recent nuisance/false alarms, the rail traffic controller did not immediately investigate the cause of the alarm that sounded when the train passed the Stop signal, but instead associated the alarm with a track vehicle working in the area. If rail traffic controllers do not fully investigate these alarms (set under Rule 439 of the *Canadian Rail Operating Rules*), an urgent situation could go unnoticed, increasing the risk of an accident.

This occurrence highlights once again that wayside signals and administrative defences, such as the requirement for train crews to follow signal indications, are not consistently applied. The TSB previously issued two related recommendations (Recommendation R13-01 and Recommendation R00-04).

VIA took several actions, including raising awareness with management and crews about the risks related to radio communications with locomotive engineers on non-urgent subjects and their possible distraction.

Management at the Montréal rail traffic control centre reviewed this occurrence with other rail traffic controllers, emphasizing that it is imperative to follow procedures when a Rule 439 alarm occurs.

Safety advisories and safety information letters

The TSB issued safety advisories and safety information letters as part of investigations in 2020–21.

- February 2019 uncontrolled movement and derailment near Field, B.C., with three fatalities (R19C0015): The TSB issued Rail Safety Advisory Letter 04/20 to advise Transport Canada that an alternative approach to determining the effectiveness of freight car air brakes is required to ensure trains have sufficient effective brakes to operate safely.
- March 2020 derailment of Canadian Pacific Railway (CP) freight train, CP Nemegos Subdivision, near Sultan, Ontario (R20H0031, a Class 5 investigation): In Rail Safety Advisory Letter 05/20, the TSB suggested that Transport Canada ensure inspectors remain aware of the potential for loose wheels to develop. In addition, railway wheel shops should identify and remove from service CNPU wheel sets assembled between April 1998 and February 2001.
- June 2019 derailment of CN freight train on the Canadian side of CN's St. Clair Tunnel between Sarnia, Ontario, and Port Huron, Michigan (R19T0107):
    - With Rail Safety Advisory 617-06/20, the TSB advised Transport Canada that it might wish to ensure all railways have adequate practices in place to effectively manage in-train longitudinal forces.
    - In Rail Safety Advisory 617-07/20, the TSB advised Transport Canada and the Federal Railroad Administration that they might wish to ensure all bathtub gondola cars built by Berwick Forge that operate in North America are identified, located and examined to ensure continued safe railway operations and reduce risk to the public, property and the environment.
- July 2020 discovery during maintenance activities of cracks on the outboard face of the wheel hub of two resilient wheels on an Ottawa Light Rail Transit light rail vehicle (R20H0079): With Rail Safety Advisory Letter 617-08/20, the TSB suggested that the transit agency and Alstom (the train car manufacturer) expedite the removal of all Lucchini resilient wheels installed on the fleet.

- November 2019 collision with pedestrians, Metrolinx GO Transit commuter train, Guelph Subdivision, Kitchener, Ontario (R19T0191): In Rail Safety Advisory Letter 01/21, the TSB advised Transport Canada that it might be prudent for it, railways and road authorities to identify multi-track crossings with frequent and extended crossing signal activations and a high level of pedestrian/cyclist traffic, assess the likelihood of a second-train event occurring and consider additional safety measures to minimize the risks of an accident.

Progress on outstanding recommendations

Of the 13 rail transportation recommendations the Board assessed and reassessed in 2020–21, three were closed as Fully Satisfactory.

Two of these (Recommendation R13-02 (R12T0038) and Recommendation R03-02 (R99T0017)) recommended that Transport Canada require locomotive voice and video recorders be installed in controlling locomotives in main line operation and establish comprehensive national standards that include a requirement for an on-board cab voice recording interfaced with on-board communications systems.

In 2018, the *Railway Safety Act* was amended to mandate locomotive voice and video recorder equipment in many locomotive cabs. Subsequently, Transport Canada published the *Locomotive Voice and Video Recorder Regulations* in the *Canada Gazette*, Part II in September 2020. These regulations will come into effect on 2 September 2022.

The third recommendation to be closed as Fully Satisfactory was Recommendation R17-01. The Board had issued this recommendation as part of its investigation into the 2015 derailment of 29 tank cars and the subsequent release and burning of 1.7 million litres of petroleum crude oil near Gogama, Ontario (R15H0013). It recommended that Transport Canada study the factors that increase the severity of the outcomes for derailments involving dangerous goods, identify appropriate mitigating strategies, including train speeds for various train risk profiles and amend the *Rules Respecting Key Trains and Key Routes* accordingly. A number of actions results from this recommendation:

- The National Research Council of Canada completed its report, *Study on the Factors that Increase the Severity of the Outcomes for Derailments Involving Dangerous Goods and Identification of Mitigation Measures*, and Transport Canada made it available to the public in September 2020.
- Based on this study, Transport Canada issued several Ministerial Orders aimed at reducing the likelihood and severity of derailments involving dangerous goods and enhancing rail safety in Canada. Specifically, Ministerial Order 20-06 required railway companies to update the *Rules Respecting Key Trains and Key Routes* that govern the movement of dangerous good by rail in Canada. Subsequently, the Railway Association of Canada, on behalf of the industry, submitted revised *Rules Respecting Key Trains and Key Routes* to Transport Canada.
- Transport Canada approved the revised *Rules*, with an effective date of 22 August 2021.

The Board downgraded its rating of Transport Canada's response to Recommendation R15-02 from Satisfactory Intent to Satisfactory in Part. The Board acknowledged that Transport Canada had made some progress with regards to commercial passenger bus safety in the wake of the 2013 collision between a VIA Rail Canada Inc. passenger train and an Ottawa city bus that resulted in six fatalities and nine serious injuries (R13T0192). The introduction of a new regulation mandating seat belts on medium and large highway buses (e.g. motor coaches) in September 2020 is a step forward. However, the proposed steps to improve crashworthiness requirements for commercial passenger buses under the Canada Motor Vehicle Safety Standards are unclear. Additionally, there is no projected timeline for developing occupant protection guidelines for commercial passenger buses.

The remaining 10 recommendations the Board assessed and reassessed in 2020–21 obtained the following ratings: Satisfactory Intent (4), Satisfactory in Part (5) and Unable to Assess (1).

Who we are and what we do

The Transportation Safety Board of Canada (TSB) advances transportation safety in the air, marine, pipeline and rail transportation sectors in Canada:

- It conducts independent investigations into selected occurrences and makes findings about their causes and any contributing factors.
- It identifies safety deficiencies arising in transportation occurrences and makes recommendations to eliminate or reduce them.
- It reports publicly about its investigations and findings.

As part of its investigations, the TSB reviews developments in transportation safety and identifies safety risks that governments and the transportation industry must address in order to reduce the risk of injury and loss.

Role of the Board

The Board, which comprises up to five members, including the Chair, approves all investigation reports, makes findings and issues recommendations.

The Board

Kathy Fox
Chair

Faye Ackermans
Board member

Paul Dittmann
Board member

Kenneth Potter
Board member

Yoan Marier
Board member

The TSB website contains biographies of each Board member.

In making findings, the Board does not assign fault or determine civil or criminal liability for an occurrence. Rather, it seeks to find out what happened and why in an objective manner, independent from government, and all other departments and agencies involved in transportation, and free from any conflict of interest. It also draws impartial conclusions and makes recommendations to those best placed to act.

About the TSB

A staff of 227, led by the Chief Operating Officer and senior management, supports the Board. The work of the organization is guided by a five-year strategic plan and five core values:

- Respect: We are committed to inclusiveness and to treating all individuals and organizations with consideration, courtesy, discretion, and fairness.
- Openness: We actively share and exchange information to advance transportation safety.
- Safety: We maintain and promote a positive and proactive safety culture.

- Integrity: We are guided by honesty, transparency, impartiality, propriety, and accountability for our actions and decisions.
- Excellence: We maintain a highly skilled and knowledgeable team of professionals through leadership, innovation, and commitment to continuous improvement in the delivery of our products and services.

TSB investigators are professionals with years of experience in the various transportation modes the TSB covers. They work in collaboration with engineering and technical specialists, human factors investigators and industry analysts, all of whom are supported by small teams of communications specialists, corporate services professionals and administrative officers.

The TSB's head office is in Gatineau, Quebec. The TSB also has a laboratory in Ottawa, and regional offices in Vancouver, Edmonton, Calgary, Winnipeg, Toronto, Montréal, Quebec City and Dartmouth.

The investigation process

There are three main phases of the investigation process. During the field phase, investigators collect data and assess the occurrence. This generally involves travelling to the scene of the occurrence, securing the site and documenting it, conducting interviews and selecting wreckage for further examination. Unless the investigation is limited to data collection, an investigation page is created and posted to the website, and is updated periodically as the investigation progresses.

During the examination and analysis phase, investigators review the data to determine the sequence of events leading to the occurrence and the underlying causes and contributing factors.

In the report phase, investigators draft a report on the investigation, which then goes through a review and approval process, prior to public release.

Figure 11. The TSB investigation process from occurrence to report

Appendices

Appendix A: Investigation reports released in 2020–21 and related safety actions

The following is a list of the investigation reports the Transportation Safety Board of Canada (TSB) released during 2020–21. Each entry includes details of any safety actions taken during the investigation and after the report was published, and a link to the main page for the investigation. The list is organized by transportation sector and in the order in which the occurrences took place.

Air transportation sector

INVESTIGATION REPORT A18Q0030: Runway overrun on landing, Strait Air (2000) Ltd. Beechcraft King Air A100, C-GJXF, Havre St-Pierre Airport, Quebec, 26 February 2018

SAFETY ACTIONS	**Transport Canada** conducted interviews, took enforcement action and, later in 2018, carried out further inspections of the company as part of its oversight activities. The **Board** issued two recommendations: • Recommendation A20-01: that the Department of Transport review and simplify operating minima for approaches and landings at Canadian aerodromes. • Recommendation A20-02: that the Department of Transport introduce a mechanism to stop approaches and landings that are actually banned. In its August 2020 response to both recommendations, Transport Canada stated that it agrees with Recommendation A20-01 and, as outlined below, has already initiated work to implement improvements to the regulations governing approaches and landings at Canadian aerodromes. Transport Canada also said that it agrees with Recommendation A20-02. While it recognized that it may be difficult to stop all approaches and landings that are prohibited through the regulations, introducing simpler regulations in keeping with Recommendation A20-01 will make them easier to follow and to enforce. Furthermore, Transport Canada said it will investigate possible improvements to education and enforcement as part of its upcoming work in this area. Transport Canada noted that it is aware of the safety issues raised by the two recommendations. The complexity of the current approach ban regulations, promulgated in 2006, is the result of multiple compromises following consultations with industry to reflect the diverse realities facing air operators. As such, Transport Canada has already carried out significant work on this issue in the past five years: • In 2015, Transport Canada developed an issue paper and presented it to the National Civil Aviation Management Executive Committee, recommending that the regulations be revised to harmonize with international standards, and to update standards for calculating approach visibility. • In November 2017, Transport Canada developed, and circulated through the Canadian Aviation Regulation Advisory Council, a Preliminary Issue and Consultation Assessment to establish a better understanding of industry concerns and to assist with regulatory development. • In January 2018, the Assessment concluded that there was a need for consultation with all stakeholders through focus groups and to support the harmonization with international standards and best practices.

	Due to the complexity of the issue, stakeholders raised specific concerns related to the workload associated with implementation; potential service impacts in the North if changes to the approach ban are not done alongside infrastructure improvements; applicability of the changes to the approach ban to helicopter operations; and the need to harmonize proposed changes to the approach ban with changes to lighting standards. Due to other competing priorities, this was the most recent work carried out by Transport Canada on this issue. Transport Canada stated that it recognizes that more work needs to be done to mitigate the risks. To this end, revisions to the approach ban regulations (Recommendation A20-01) must precede steps to ensure the new regulations are followed (Recommendation A20-02). Building on the aforementioned work and comments received from stakeholders, Transport Canada reported that it is forming, and will lead, an industry working group on this issue. The working group will have the mandate to deliver on the following: • update TP308/GPH209 - Criteria for the Development of Instrument Procedures to support new regulations with approach visibility calculations that account for runway approach lighting systems; • prepare Notice of Proposed Amendment to update approach ban regulations as well as the supporting documentation and guidance; and • review potential measures to encourage and enforce compliance with updated approach ban regulations, considering all tools in the regulatory toolbox and the experience of other jurisdictions. In order to produce the deliverables above, the work will be divided into two phases. The first phase will involve a policy review of the situation and will culminate with a policy discussion paper and a focus group(s) with industry. During the second phase, the working group will begin regulatory development, which includes the Notice of Proposed Amendment, to be completed by January 2021, and have the draft instructions and the pre-publication of the new regulations in *Canada Gazette* Part I completed by the end of 2021. Final publication in *Canada Gazette* Part II will take place approximately one year after Part I. Following the publication of the TSB's investigation report, the **Centre québécois de formation aéronautique** produced a video on approach bans in Canada.

INVESTIGATION REPORT A18A0088: Landing with partially extended landing gear, PAL Airlines Ltd. Bombardier DHC-8-315, C-FPAE, Stephenville, Newfoundland and Labrador, 15 November 2018

SAFETY ACTIONS	Following the disassembly and examination of the nose landing gear shock strut on 18 December 2018, **Safran Landing Systems, Canada Inc.** (SafranLS) issued an internal Quality Alert, instructing maintenance, repair and overhaul personnel to inspect for the possibility of components received with prior repairs, but not properly identified. On 28 February 2019, SafranLS issued Revision No. 13 of the component maintenance manual 32-20-01 for the nose landing gear assembly with an additional note to the assembly section of the manual, alerting users of the need to check the dimensions on the inner cylinder to ensure that the correct components are installed. On 25 April 2019, SafranLS published Service Letter No. SLDHC8-32-7 on its technical publication website. The service letter provided background on this occurrence and emphasized the importance of following all instructions provided in the component maintenance manual, including those related to the methods of identifying components after repair. The service letter also informed operators and technicians of the note added to the assembly section of the component maintenance manual.

	On 23 November 2018, **PAL Airlines Ltd.** amended its company-designed Dash 8 lay-over check to include emphasis on the nose landing gear shock strut minimum and maximum extension measurements. Additionally, the amendment required maintenance personnel to record the shock strut extension measurement during inspection. On 30 November 2018, PAL amended Section 3.4 of its standard operating procedures to include a formal checklist of items to be inspected when pilots conduct the exterior inspection of the Dash 8 aircraft during the pre-flight check. On 13 December 2018, immediately after being informed by the TSB that an overspeed condition had occurred in flight, PAL completed an overspeed inspection of the occurrence aircraft, and no faults were found.

INVESTIGATION REPORT A19P0002: Loss of separation, NAV CANADA Vancouver Area Control Centre, vicinity of Kelowna, British Columbia, 3 January 2019

SAFETY ACTIONS	**NAV CANADA** took the following safety actions after the occurrence: • redesigned the checklist to be completed after a Canadian Automated Air Traffic System (CAATS) software update to break down the tasks further. A step was added at the end of the procedure to ensure the person performs a mandatory "Purge All." The completed checklist is now signed, scanned, and attached to the work order for record keeping and to verify that the work is complete; • issued an Operational Directive to all specialties in the Vancouver Area Control Centre requiring that "for all audible alerts to be salient, the CAATS alert volume shall not be set lower than setting 4. Controllers shall adjust and save all their presets to volume setting 4 or above."; • issued an Operational Directive to ensure that the Kamloops and Kelowna sectors are segregated every weekday morning for a period spanning the peak traffic duration and other times as required with foresight; and • issued an Operational Directive stating that when a team supervisor leaves the operational environment, another team supervisor or a senior controller must be tasked with the ongoing oversight and monitoring of the specialty workload. After the final investigation report was published, NAV CANADA reported the following additional actions: • Implemented red indications with a white background area to make them highly visible. Scheduled for implementation in late fall 2020, but will be delayed due to COVID-19 restrictions. To further guard against the possibility of an audible alert being inaudible, controller settings will be restricted in presets so the volume cannot be reduced lower than level 4. This requirement will be documented in the future MANEQ. • Despite the resource and logistic challenges posed by COVID-19, the actions planned remain a high priority. The Kamloops sector is an integral part of the Vancouver Airspace Modernization Project (VAMP), which will address the identified safety concerns (flow of traffic, de-confliction of routes, workload management, complexity etc.), while ensuring alignment with other associated airspace changes. Although current traffic levels are low, the airspace and sectorization changes will be fully prepared for the eventual return of traffic to pre-COVID-19 levels. Further work on restructuring the Kamloops Sector airspace is currently expected for fall 2020 and updates on this element of the VAMP project will be provided as it progresses.

INVESTIGATION REPORT A19O0006: Runway incursion, Greater Toronto Airports Authority snow removal vehicles, Toronto/Lester B. Pearson International Airport, Mississauga, Ontario, 28 January 2019

SAFETY ACTIONS	The **Greater Toronto Airports Authority** (GTAA) amended its standard operating procedure for changing vehicle transponders to require that the contracted service provider installing a unit confirm with NAV CANADA that the vehicle's transponder call sign is correct and not mismatched when displayed by NAV CANADA's systems. In addition, immediately following the incident, the GTAA conducted a check of all of its other airside vehicles. They all had the correct transponder call signs. The GTAA is currently evaluating in-vehicle situational awareness tools for its vehicles operating in the manoeuvring areas. After the final investigation report was published, **NAV CANADA** reported the following safety actions: • NAV CANADA released its Manual of Air Traffic Services (MATS) Tower 2.2 on 10 October 2019. The manual contains updated missed approach phraseology to ensure that safety-critical transmissions issued to address recognized conflicts are sufficiently compelling to attract the flight crew's attention, particularly during periods of high workload. This change reflects TSB Recommendation A18-04. NAV CANADA continues to work on procedural amendments to reduce the risk of runway incursions. • Toronto Lester B. Pearson Airport Tower issued Ops Directive "Reporting Vehicle Call Sign – Radar Data Tag Discrepancies" (YYZOD-2020-385), effective 15 July 2020, to introduce procedures to track or report vehicle transponder errors to the airport operator.

INVESTIGATION REPORT A19W0015: Loss of control and collision with terrain, Air Tindi Ltd. Beechcraft King Air 200, C-GTUC, Whatì Airport, Northwest Territories, 21 nautical miles east-southeast, 30 January 2019

SAFETY ACTIONS	**Air Tindi Ltd.** conducted its own safety investigation and identified several processes and procedures that could be improved. As a result, Air Tindi took the following actions: • met with employees to discuss the significance of the threat and error management briefing; • reviewed the minimum equipment lists (MELs) on company aircraft to eliminate any phrases or wording that may hinder their use by the flight crew; • created a new MEL template that includes a "Notes" section to be used to clarify specific terms, as well as a sample journey log entry for flight crew to use as an example; • amended the crew resource management training program and material; • amended the electronic flight bag training material to include the use of the synthetic vision feature; • standardized and labelled the power supply type for all attitude indicators in the company's King Air fleet; • installed a standby (third) attitude indicator in all aircraft that did not have one; • provided instrument suction covers in all aircraft to cover failed instruments and avoid distraction; • established life limits on all attitude indicators installed in company aircraft; • amended all aircraft simulator and flight training programs to include partial panel flying exercises; • relocated six standby attitude indicators in company aircraft that were not in the captain's primary field of view; and • established threat and error management as a specific safety goal for the company. After the final investigation report was published, Air Tindi Ltd. reported the following safety actions:

	• updated the Flight Operations Manual to ban circling procedures; • installed a Garmin G1000 suite in all King Air 200 aircraft with legacy instruments; and • amended internal process and safety management system procedures manual for risk ranking, using a Maximum Reasonable Outcome approach. Risk is assessed on the Maximum Reasonable Outcome Risk Statement using three factors (Exposure, Likelihood, Severity), with a Low, Moderate or High outcome. The outcome score determines the depth and timing of investigation. Air Tindi has also amended its process to review (weekly) all risk rankings that have a Severity of Critical or Catastrophic with an overall ranking of Low to test the Likelihood and add "what if" scenarios to ensure near misses are not under-ranked.

INVESTIGATION REPORT A19C0038: Fuel exhaustion, Keewatin Air LP Beechcraft B200, C-FRMV, Gillam, Manitoba, 24 April 2019

SAFETY ACTIONS	**Keewatin Air LP** carried out an internal investigation and issued a safety bulletin on 3 May 2019 to pilots and flight coordinators detailing the actions flight crews are to take when conducting the FUEL QUANTITY item of the AFTER START check. On 28 June 2019, Keewatin Air LP updated its Normal Checklist B-200 G1000 to reflect the changes specified in the safety bulletin. The bulletin also clarified the fuel status information that flight crews are to provide the flight coordinator after departure, and after the progressive fuel calculation. The Gillam Royal Canadian Mounted Police detachment and **Town of Gillam** officials held a post-occurrence briefing and invited TSB investigators to attend. The briefing revealed a number of concerns, one of which was the delayed activation of emergency services. As a result, Town of Gillam officials reviewed the emergency response plan and prepared the Gillam Airport Emergency Response Quick Reference document. The document details the priority in which agencies should be notified, and actions that should be taken by the on-call airport operator when notified of an aviation emergency or incident.

INVESTIGATION REPORT A19P0059: Engine power loss, forced landing into trees, Lakes District Air Service Ltd. Cessna 182E, C-FLVN, Smithers, British Columbia, 50 nautical miles north, 4 May 2019

SAFETY ACTIONS	The **Northwest Fire Centre** has changed its standard operating procedures to include saving the audio recordings of dispatch activities following an incident or accident. Recordings are normally saved for 24 hours before being overwritten. After the final investigation report was published, the **BC Wildfire Service** (BCWS) reported the following safety actions: • BCWS did not have a policy to save all of its radio logs when there was an accident, so they were automatically overwritten. BCWS has now established a procedure to save the radio logs related to any emergency. • Aircraft on contract with BCWS are required to deliver a satellite-based automated flight following signal every two minutes. BCWS is considering reducing this to one-minute intervals to provide more accurate final position reports in the event of an emergency landing or accident.

INVESTIGATION REPORT A19O0063: Ground collision and evacuation, Jazz Aviation LP DHC-8-311, C-FJXZ, and Menzies Aviation Rampstar Fuel Tanker, Toronto/Lester B. Pearson International Airport, Ontario, 10 May 2019

SAFETY ACTIONS	At the request of the **Greater Toronto Airports Authority** (GTAA), the International Air Transport Association performed an audit on Menzies Aviation and its operations at Toronto/Lester B. Pearson International Airport. Additionally, the GTAA initiated a review of the entire Airside Vehicle Operator Permit (AVOP) program, with the input of industry partners, including observations from both new and experienced AVOP drivers as well as other airside personnel. **Menzies Aviation** made a number of changes to its equipment and procedures: • added rear- and side-view cameras, which are displayed on a screen in the driver's cab, to the right of the steering wheel. It has also purchased two-way radios to be carried by drivers for company communications during vehicle operations; and • is implementing a system for transmitting fuel orders to a tablet contained in each vehicle, removing the need for a driver in a pickup truck to deliver fuel slips to the fuel tankers and hydrant trucks on the apron, thus reducing airside vehicle congestion. These tablets will also provide GPS tracking functionality, so the company can monitor the location and speeds of its vehicles in real time. After the final investigation report was published, **Rampstar** reported that it had taken the following safety actions: • requested that the cab heater manufacturer provide a new design of heater that would give more heat and more velocity. The manufacturer is finalizing the design with the hope the heater will be ready for new chassis built for 2021; and • developed a right-side camera/monitor system for its chassis. It has gone through prototyping and Rampstar will offer this as a standard feature in trucks starting in April 2021. The **GTAA** completed a comprehensive 18-month review of AVOP in the third quarter of 2020. Stemming from the review, GTAA developed an action plan that has already incorporated additional requirements for recurrent AVOP applicants in relation to varying environmental conditions that an operator is likely to experience (e.g. night-time, low visibility). In addition, all existing third-party-certified AVOP testers are planned to be recertified, and initial training requirements for AVOP applicants are to increase from 12 hours to 24 hours, inclusive of training for varying environmental conditions. These amendments are targeted for completion by the end of 2021.

INVESTIGATION REPORT A19Q0091: Loss of control on takeoff and collision with ground, Cargair Ltd. Piper PA-23-250 Aztec, C-GDUL, Trois-Rivières Airport, Quebec, 18 June 2019

SAFETY ACTIONS	In July 2019, Cargair Ltd. took the following safety actions: • sent a safety notice to affected personnel on 9 July 2019 regarding a vulnerability in using the landing gear and flaps at the same time, and a modification to the standard operating procedures (SOP); • modified the Before Landing checklist, adding "HANDLE NEUTRAL" after "GEAR… DOWN, WAIT 3 GREENS"; • specified the role and responsibilities of a pilot-in-command under supervision in the SOP; • amended the SOP pertaining to visual flight rules circuits and the execution of touch-and-go manoeuvres; and • added directives to the SOP on measures to be taken if a landing gear handle problem arises.

INVESTIGATION REPORT A19C0070: Power loss of both engines on initial climb, North Star Air Ltd. Douglas DC-3C Basler Turbo Conversions TP67, C-FKGL, Eabamet Lake, Ontario, 21 June 2019

SAFETY ACTIONS	When the final investigation report was published, the Board was not aware of any safety action having been taken following this occurrence. After the final investigation report was published, **North Star Air** reported that it had taken the following safety actions: • communicated to the Pilot group the results of the investigation; • added Line Checks, although not a Transport Canada requirement, to the training curriculum of the DC3T Pilot group. This was also extended to PC12 operations; • added a Training and Standards Pilot to the DC3T Training Program; and • added this accident to the case study topics of the North Star crew resource management course.

INVESTIGATION REPORT A19Q0109: Main rotor blade failure in flight, Robinson R44 (helicopter), C-FJLH, Lac Valtrie, Quebec, 10 July 2019

SAFETY ACTIONS	On 11 February 2020, the **TSB** issued Aviation Safety Advisory A19Q0109-D1-A1, requesting that Orolia, the manufacturer of Kannad emergency locator transmitters (ELTs), and Transport Canada revise ELT periodic inspection procedures so that a failure in the switch locking system can be detected and corrected in the future. In its response on 19 March 2020, **Orolia** mentioned the following corrective actions: • added a warning in the documents containing switch operation instructions to clarify the instructions and avoid inappropriate manoeuvres that could result in breakage of the switch locking latches; • planned to add a requirement for visual inspection of the switch locking latches in the documents designed for Kannad ELT maintenance; • updated service letters called "Periodic Inspection" regarding Kannad 406 ELTs and Compact and Integra ELTs and made them available to the public on the company's website; and • identified other relevant documents to be updated within six months as a preventive measure. On 1 August 2019, **Transport Canada** updated Standard 571, Appendix G, which addresses ELT maintenance. This update introduces a requirement to visually inspect ELTs. In its response to the TSB's safety advisory letter, Transport Canada stated that Transport Canada Civil Aviation did not plan on making any further modifications to Parts V and VI of the *Canadian Aviation Regulations* with regard to ELT inspections for the following reasons: • Corrective action was taken by Orolia, as above. • The European Union Aviation Safety Agency does not plan on making arrangements, given the low rate of failure for this switch model recorded between the end of 2007 and 31 December 2019. Also, Transport Canada did not receive any service difficulty reports regarding this switch model. • Advisory Circular No. 571-025 called "Maintenance of Emergency Locator Transmitters (ELTs)" contains guidelines to check the status of ELTs and is available to the public on Transport Canada's website. Transport Canada published Civil Aviation Safety Alert (CASA) No. 2020-05 on ELT inspections on 22 April 2020, after the TSB issued its safety advisory letter. The CASA addresses visual inspection of ELTs and focuses on directing attention to switches on ELTs.

INVESTIGATION REPORT A19O0089: Loss of control and collision with terrain, Hawk Air (705833 Ontario Ltd.) de Havilland DHC-2 Mk. I (Beaver), C-FBBG, Hawk Junction Water Aerodrome, Ontario, 11 July 2019

SAFETY ACTIONS	As a result of this occurrence, **Hawk Air** has increased its emphasis on training for engine failures during critical phases of flight. Hawk Air has also made it mandatory to use both the lap strap and the shoulder harness for all operations. After the final investigation report was published, **Viking Air** reported that it was working on a campaign to promote awareness of the stall warning system for the DHC-2 Beaver. This action is being taken to ensure Beaver owners and operators remain or become aware of the availability of the system in the hope they will incorporate it into their aircraft to further improve operational safety.

INVESTIGATION REPORT A19P0112: Controlled flight into terrain, Seair Seaplanes Cessna 208 Caravan, C-GURL, Addenbroke Island, British Columbia, 26 July 2019

SAFETY ACTIONS	As a result of the accident, **Seair Seaplanes** has taken the following actions: • contracted an aviation consulting company to conduct an operational and maintenance review, which took place on 21 August 2019. The operational review consisted of interviews with operations personnel to better understand areas in which employees would like improvement and matters that cause frustration, communication issues within the company, and ideas to improve operations; • updated the Seair Caravan standard operating procedures (SOP) to include an acceptable use policy on personal electronic devices in the cockpit. This policy was also reflected in an operational memo to pilots; • updated the Seair Caravan SOP to highlight the limitations of the autopilot system. The limitation was also highlighted in an operational memo to pilots indicating that the autopilot must be disengaged when operating below 800 feet above ground level.

INVESTIGATION REPORT A19Q0128: Loss of control and collision with terrain, Beechcraft Bonanza V35B, N3804X, Senneterre, Quebec, 7 nautical miles northeast, 29 July 2019

SAFETY ACTIONS	The Trenton, Ontario, **Joint Rescue Coordination Centre** reported that Department of National Defence search and rescue stakeholders (i.e. the Directorate of Flight Safety, 1 Canadian Air Division, the Canadian Joint Operations Command, and the three Joint Rescue Coordination Centres) were made aware of the Aireon Aircraft Locating and Emergency Response Tracking (Aireon ALERT) service and the requirement to specifically request automatic dependent surveillance-broadcast (ADS-B) data. All three Joint Rescue Coordination Centre subsequently registered accounts with Aireon ALERT, and coordinators routinely include such queries when investigating overdue or missing aircraft. After the final investigation report was published, the following safety actions were reported: **Aireon** provided Aireon ALERT data for this incident at the time and explained Aireon ALERT outputs. Aireon has continued to improve the system and the number of registrations to the service has continued to grow. Following some queries observed with a review of the published report, Aireon will be looking more closely at the data to analyze any observed behaviour of the aircraft profile. **NAV CANADA** reported that Transport Canada is considering a proposal for a Canadian mandate that would specify a performance-based requirement for ADS-B equipage in transponder airspace for class A and class B. The proposal will provide data of sufficient quality

	to meet the performance criteria required for provision of Air Traffic Services surveillance services. Currently, NAV CANADA is working to support the exchange of surveillance information with external agencies to enable distribution of this data to Air Traffic Services. Upon completion of this work, NAV CANADA will analyze the data to ensure any filtered data is comprehensive and not compromised as a result of the filter or distribution in comparison to the entirety of the ADS-B feed. This will support establishing quality targets throughout the low-level structure below flight level 290 and the identification of any gaps in meeting the targets. The result of this review will support an implementation plan for class A and class B airspace, including training for Air Traffic Services, while taking into consideration the proposed Canadian mandate.

INVESTIGATION REPORT A19O0103: Wheels-down water landing, privately registered Cessna A185E (on amphibious floats), C-GBUI, Upper Raft Lake, Ontario, 4 August 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A19W0105: Controlled flight into terrain, Alkan Air Ltd. Cessna 208B Grand Caravan, C-FSKF, Mayo, Yukon, 25 nautical miles east-northeast, 6 August 2019

SAFETY ACTIONS	**Alkan Air Ltd.** has taken the following actions since the accident: • updated flight-following procedures to ensure that, when passenger manifests are changed, flight crew notify flight following; • modified its Emergency Response Plan such that, if a third party inquires about a possible missing or crashed aircraft, the company will assume it is one of its aircraft until it confirms otherwise; • updated its Emergency Response Plan to include changes to enhance communication between members of the response team and to ensure that any Alkan Air aircraft that are used for searching are dispatched with two flight crew members; • clarified with all flight crew that a NAV CANADA flight plan must be filed for all flights. The company indoctrination program has also been modified to make this clear to new hires; • now requires all Cessna 208B Grand Caravan captains (less than 2000 flight hours total time) to have a second flight crew member on the aircraft; • amended the training program for Cessna 208B Grand Caravan aircraft to include low-level route training for new captains; • now requires all candidates for captain of the Cessna 208B Grand Caravan to perform as a second crew member on this type of aircraft for one season; and • now rotates the flight crew assigned to the Mayo base of operations out more frequently.

INVESTIGATION REPORT A19O0117: Runway incursion, Air Georgian Limited Bombardier CRJ 200, C-GKEJ, Toronto/Lester B. Pearson International Airport, Ontario, 9 August 2019

SAFETY ACTIONS	**NAV CANADA** issued Operations Directive YYZ-OD-2020-488, reminding tower controllers that, as stated in the Manual of Air Traffic Services, when runway incursion monitoring and conflict alert system stage 2 alerts are activated by departing aircraft, they must cancel the take-off clearance or issue an instruction to abort takeoff. Following the occurrence, **Air Georgian Limited**, which is no longer a corporate entity, conducted a safety investigation in accordance with its safety management system. In addition, Air Georgian reported that it had amended its standard operating procedures to mandate an air

	traffic control query if one of the two crew members was unaware of the content of an air traffic control clearance or instruction.

INVESTIGATION REPORT A19Q0153: Loss of control and collision with terrain at night, Cargair Ltd. Cessna 172M, C-GSEN, Racine, Quebec, 4 September 2019

SAFETY ACTIONS	**Cargair Ltd.** put the following risk mitigation measures in place after this occurrence: • revised the list of airports authorized for dual and solo night flights; and • put restrictions on solo night flights in place for both licensed and non-licensed pilots training at Cargair.

INVESTIGATION REPORT A19C0138: In flight breakup, Blue Water Aviation de Havilland DHC-3, C-GBTU, Little Grand Rapids, Manitoba, 26 October 2019

SAFETY ACTIONS	**Viking Air Ltd.** issued Alert Service Bulletin (ASB) V3/0011 on 26 November 2019, calling for operators to perform more detailed testing on DHC-3 wing lift strut fittings and lug plates. In response to ASB V3/0011, the **TSB** issued Aviation Safety Advisory A19C0138-D1-A1, requesting that Transport Canada work with Viking Air Ltd. to amend the Supplementary Inspection and Corrosion Control Manual or issue a new airworthiness directive to include the inspection requirements outlined in Viking Air Ltd. ASB V3/0011. **Blue Water Aviation** removed the complete wing lift strut assemblies on two of the aircraft that it operates, and on four for which it provides contract maintenance. All have been replaced with new or overhauled wing lift strut assemblies. **Transport Canada** conducted a process inspection on 25 November 2019, during which it identified some discrepancies in the operator's quality assurance program. These findings were not related to this occurrence. Transport Canada also issued Airworthiness Directive CF-2020-20, which came into effect on 10 June 2020 and requires a number of corrective actions be taken. (See the A19C0138 investigation report for the complete text of the directive.)

INVESTIGATION REPORT A19O0178: Loss of control and collision with terrain, privately registered Piper PA-32-260, N50DK, Kingston Airport, Ontario, 3.5 nautical miles north, 27 November 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A19P0176: Loss of control and collision with terrain, privately registered Piper Aerostar PA-60-602P, C-FQYW, Gabriola Island, British Columbia, 10 December 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A19P0187: Collision with terrain, Cessna 172H, C-GECG, Tofino/Long Beach Airport, British Columbia, 31 nautical miles northwest, 21 December 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20Q0023: Collision with power lines, privately registered Cessna 150M, C-GYEV, Les Cèdres, Quebec, 17 February 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20W0035: Loss of control and collision with terrain, RS Ultra Kangook MF powered paraglider (basic ultralight), C-ILQJ, Gibbons, Alberta, 4.5 nautical miles northwest, 13 May 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20P0060: Collision with power line, missing aircraft, International Flight Centre Inc. Cessna 172M, CF-CCV, Abbotsford Airport, British Columbia, 9.7 nautical miles north-northwest, 6 June 2020

SAFETY ACTIONS	**BC Hydro** has prioritized the schedule for the commissioning of the daytime strobe lights, which should be completed in 2021. Once this work has been completed, the Notice to Airmen will be rescinded.

INVESTIGATION REPORT A20O0053: Mid-air collision, privately registered Champion 7GCB, C-FPTR, and privately registered Cessna 172M, C-GEDC, Arnprior/South Renfrew Municipal Aerodrome, Ontario, 12 nautical miles east-northeast, 14 June 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20W0046: Loss of control and collision with terrain, privately registered Murphy Aircraft Mfg. Ltd. SR3500 (Moose), C-GATR, Rolly View, Alberta, 2 nautical miles northeast, 3 July 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20A0027: Loss of control and collision with terrain, privately registered Robinson R44 Raven II (helicopter), C-FPBL, Thorburn Lake, Newfoundland and Labrador, 20 July 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20P0071: Loss of control during rejected takeoff, privately registered Cessna 140, C-GOFK, Stave Lake abandoned aerodrome, British Columbia, 27 July 2020

SAFETY ACTIONS	The **TSB** issued Aviation Safety Advisory A20P0071-D4-A1 on 9 November 2020 regarding the Cessna 120 and 140 aircraft lap belt centre mounting bracket failure. The TSB issued the safety advisory letter upon finding that one arm of the lap belt centre mounting bracket on the aircraft in this occurrence was broken. Although the Y-belt forming the shoulder harness remained attached to the lap belt, the failure of the centre bracket allowed the pilot who was flying to become largely unrestrained during the accident. This occurrence demonstrated that without the steel alloy lap belt centre mounting bracket in Cessna 120 and 140 aircraft, failure of the aluminum centre bracket during accidents may continue, thus increasing the risk of potentially fatal injuries. As such, the TSB noted in its safety advisory letter that Transport Canada should consider taking safety action to address the problem with the bracket in all affected Cessna 120 and 140 aircraft. In its January 2021 response, **Transport Canada** reported that the National Aircraft Certification group of Transport Canada Civil Aviation (TCCA NAC) had reviewed the TSB's safety advisory letter. A search of the Transport Canada aircraft registry database found that 190 Cessna 140 and 67 Cessna 120 aircraft are currently registered in Canada. Of these, 131 (69%) and 47 (70%) of the aircraft, respectively, were manufactured before the change from aluminum to steel alloys became effective. The following actions have taken place since the release of the safety advisory letter: • TCCA NAC engaged the Federal Aviation Administration (FAA) as the state of design. The FAA published an Airworthiness Concern Sheet on December 14, 2020, as part of its evaluation to determine whether additional action is needed. • Transport Canada published Civil Aviation Security Alert (CASA) 2021-02 in February 2021, recommending that owners, operators and maintainers of Cessna 120 and 140 aeroplanes follow the recommendations of the airworthiness bulletin. CASA 2021-02 noted that damage or failure of the seat belt mounting bracket on Cessna 120 and 140 aeroplanes is a Reportable Service Difficulty. It also noted that owners, operators and maintainers that are required to report under the *Canadian Aviation Rules* must submit a Service Difficulty Report to Transport Canada. • TCCA NAC, using the data it gathered from the FAA, will evaluate the need for mandatory corrective action in consultation with the FAA.

INVESTIGATION REPORT A20P0080: Collision with terrain, Aberdeen Helicopters Ltd. Airbus Helicopters AS 350 B2 (helicopter), C-FAHC, Stewart, British Columbia, 45 nautical miles north-northwest, 17 August 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT A20W0072: Collision with power line, privately registered Harmon Rocket II, C-FZXS, Hugget/Goodwood Field Aerodrome, Alberta, 26 September 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Marine transportation sector

INVESTIGATION REPORT M17C0179: Bottom contact and subsequent flooding, passenger vessel *Island Queen III*, Kingston, Ontario, 8 August 2017

SAFETY ACTIONS	The **TSB** received a SECURITAS report before the occurrence about safety issues similar to those in this occurrence relating to passenger management, evacuation procedures and emergency preparedness on a passenger vessel operated by another company in the Kingston area. On 8 and 9 October 2017, TSB investigators visited four other vessels operated by four different companies in the same geographical area to better understand and verify these common safety issues. Investigators identified 19 safety issues relating to passenger management, emergency preparedness and lifesaving equipment on one or more of the vessels. The TSB described these safety issues in Marine Safety Advisory Letter No. 02/18 ("Safety Issues on Passenger Vessels Navigating in the Thousand Islands Area"), which it sent on 9 April 2018 to the four companies the investigators had visited. The purpose of the letter was to provide this information to the companies so that appropriate measures could be taken in advance of the 2018 cruise season. The TSB requested that it be informed of any action taken; however, none of the companies responded. The TSB also sent the letter to Transport Canada, which responded that its inspectors would conduct unannounced monitoring inspections of passenger vessels during the 2018 cruise season. **Kingston & The Islands Boat Lines Ltd.** took the following safety actions: • changed how the pre-departure safety briefing is delivered to passengers on board the *Island Queen III*. Complementing the pre-recorded audio safety briefing, a crew member positioned on each deck demonstrates the proper procedure for donning lifejackets. This change was implemented before the 2018 season; • reviewed its safety management system (SMS) and revised it to reflect current operating practices; • now holds an annual marine staff meeting, with the first meeting taking place in May 2019. The meeting focused on numerous operating procedures concerning the operation of the company's vessel fleet, as well as a review of the revised SMS; • began tracking the training each officer received; • developed a detailed evacuation procedure for the *Island Queen III*. The procedure describes the evacuation process, from the launching of life rafts by the crew to the boarding of the life rafts by all passengers; • installed a closed-circuit television camera in the wheelhouse of the *Island Queen III* to monitor and supervise marine staff operating the vessel to ensure their actions are consistent with company policy and procedures and with industry best practices. A notice has also been posted in the wheelhouse indicating that a two-person wheelhouse policy must be followed in all confined areas. **Transport Canada** began conducting unannounced monitoring inspections of passenger vessels in the Thousand Islands area in the spring of 2018. While conducting these inspections, Marine Safety inspectors checked for safety issues identified in the TSB's safety advisory letter, including the need for unobstructed emergency exits, functionality and availability of firefighting and lifesaving equipment, and effective safety briefings. These inspections resulted in a number of vessel operators being issued deficiency notices requiring them to address the identified issues by a specific date. In the fall of 2018, Transport Canada introduced the Passenger Vessel Checklist, which Marine Safety inspectors must complete during monitoring and periodic inspections conducted on Canadian passenger vessels. The checklist focuses on the safety issues identified in the safety advisory letter.

	From September 2018 to December 2018, Transport Canada conducted its concentrated inspection campaign with a focus on maintenance and safety procedures. This campaign, which took place in all regions, targeted all vessel types, including passenger vessels. Approximately 30 passenger vessels were inspected, several of which operated out of Kingston. Transport Canada is reviewing the results of both the campaign and the use of the checklist to identify passenger vessel safety issues that require improvement and the necessary corrective actions.

INVESTIGATION REPORT M18P0014: Engine room fire, container vessel *MOL Prestige*, 146 nautical miles south-southwest of Haida Gwaii, British Columbia, 31 January 2018

SAFETY ACTIONS	**Bernhard Schulte Shipmanagement (China) Company Ltd.** (BSM China) took the following safety actions: • conducted an investigation and initiated a training program on risk perception and awareness for ship staff, based on the various issues identified in BSM China's investigation report; • issued a bulletin to be posted in officer and crew recreation rooms fleetwide warning crew members not to leave fuel systems open and susceptible to leaks and overflows during repairs and not to transfer distillate fuels into heated heavy fuel oil tanks; • highlighted the staircase in the *MOL Prestige*'s engine room with photo-luminescent tape so that it can easily be seen in a blackout. The local fire plan was posted on four decks in the engine room. Two additional rapid-action firefighter outfits and six additional fire hoses were added to the fire control station. A stenciled sign was added to the engine control room entrance indicating that crew are not to assemble in the engine control room in the event of an engine room fire; • initiated pre-joining briefings, shipboard training and dissemination of case studies to all vessels. The risk assessment process for operating in an emission control area, including entering and exiting the area, was enhanced to include these hazards; • revised procedures for the timely implementation of the planned maintenance system in its entirety, including inspection, maintenance and triggering of jobs, and is amending the system to include a spare parts list. It has improved the monitoring of all hand-over reports received at the office and ensured these notes make a reference to the defect list; • took steps to ensure leaks of low-sulphur mixed gas oil from the main engine are controlled; • incorporated the maintenance and an inspection schedule for the heating coils and valves for the fuel tanks in the planned maintenance system and the new reporting system (Loss Prevention Safety and Quality–Portal Access Link). The company has also added monthly checks for tank level indicators in the engine room to the planned maintenance system; and • had the carbon dioxide fixed fire suppression system serviced on 15 March 2018, in compliance with International Maritime Organization requirements.

INVESTIGATION REPORT M18A0076: Capsizing and loss of life, unnamed fishing vessel, Medway Harbour, Nova Scotia, 5 May 2018

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT M18C0240: Crew member seriously injured, passenger vessel *Amadea*, Québec, Quebec, 9 September 2018

SAFETY ACTIONS	**Bernhard Schulte Cruise Services GmbH & Co. KG** ordered a complete inspection of lifeboat No. 4's davit and winch by a shore technician. This inspection took place on 22 October 2018, while the *Amadea* was dry docked in Hamburg, Germany. No defect was noted during this inspection. The company also investigated this occurrence. The investigation concluded that the incident occurred due to human error, that the ordinary seaman was injured because he was not wearing the proper personal protective equipment required for the job, and that the ordinary seaman had not been trained in lifeboat recovery. Bernhard Schulte Cruise Services has since updated the *Amadea*'s training manual. For lifeboat recovery, crew members must now wear protective headgear (a helmet), gloves and safety shoes while performing any activity involving lifeboat winches, davits and lashings. The company also implemented a detailed written procedure for lifeboat stowage that requires four crew members to be involved.

INVESTIGATION REPORT M18A0454: Downflooding and sinking, fishing vessel *Atlantic Sapphire*, Georges Bank, Nova Scotia, 13 December 2018

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT M19P0020: Striking of berth and shore gantry crane, container vessel *Ever Summit*, Vanterm, Port of Vancouver, Vancouver, British Columbia, 28 January 2019

SAFETY ACTIONS	The **Pacific Pilotage Authority** (PPA) took the following actions: • reviewed the incident to identify findings and make recommendations, and promulgated these to British Columbia Coast Pilots Ltd. • requested in April 2019 that all terminals provide general arrangement plans and berthing and fender information for their berths. The PPA has since received the requested information for most terminal berths and sent it to industry and the pilots via the PPA website. Berthing and fender information for Vanterm 5 and 6 was provided to the PPA in May 2020, while upgrades to the terminal were underway. **British Columbia Coast Pilots Ltd.** took the following actions: • developed a standard operating procedure for tug communications to be used between pilots and tugs for berthing and unberthing operations. Among other things, the procedure requires pilots to determine a backup very high frequency channel, discuss the planned manoeuvre with the tug masters, and include the tug's position with reference to the vessel with every command; • issued an email to pilots with safety-related information about the occurrence; • issued, in discussion with the PPA, a letter to the Port of Vancouver stating that a third tug would be required for berthing all vessels that are 280 m or more in length overall at Vanterm until properly engineered fendering with the appropriate fender factor for high freeboard vessels is provided; • met with Global Container Terminals (GCT) Canada to discuss safety, crane spacing, berthing spacing and fendering; • created standard operating procedures for major container terminals on the west coast of British Columbia; and

	• conducted a post-incident fitness-for-duty and simulation assessment with the pilot involved in the occurrence. **GCT Canada** reviewed its practice of storing shore gantry cranes during berthing and unberthing operations and concluded that the best option was to disperse the cranes along the berth, boom up and unmanned during these operations. The **Port of Vancouver** amended its Port Information Guide in June 2020 to reflect crane positioning requirements at Port of Vancouver container terminals for arriving and departing vessels.

INVESTIGATION REPORT M19P0029: Grounding, search and rescue vessel (*Spirit of Sooke*), Christie Point, Sooke Harbour, British Columbia, 7 February 2019

SAFETY ACTIONS	Operations at **Royal Canadian Marine Search and Rescue** (RCMSAR) Station 37 ceased immediately following the occurrence. RCMSAR subsequently implemented a return-to-operations plan for Station 37 that included refresher training sessions for coxswains, with regular self-checks and discussions with leaders throughout the process. The training featured an evaluation of skills in vessel-simulator scenarios, a review of leadership/decision making, presentations on situational awareness and positive control, and two on-the-water training sessions with a focus on navigational communications, emergency procedures and electronic navigation. All of the coxswains at Station 37 have completed the refresher training. In August 2019, the **TSB** sent Marine Safety Information Letter 01/20 to RCMSAR to clarify the confusion around whether the TSB's mandatory marine occurrence reporting requirements applied to RCMSAR and Canadian Coast Guard Auxiliary vessels. Although Transport Canada treats community-owned vessels as pleasure craft, the TSB's mandatory reporting requirements still apply, and marine occurrences involving these vessels must be reported to the TSB. As well, Transport Canada requires these vessels to be registered as commercial vessels. Transport Canada has confirmed that it was not its intent, when treating these vessels as pleasure craft, to imply that they are exempt from the TSB's reporting requirements. RCMSAR responded to the letter and indicated that it had reviewed its procedures and had begun to ensure that all reportable marine occurrences are reported to the TSB. RCMSAR also implemented a plan to ensure all its vessels are registered with Transport Canada as commercial vessels by the end of 2020.

INVESTIGATION REPORT M19P0078: Striking of shore crane, container vessel *Oakland Express*, Fraser Surrey Docks, British Columbia, 5 April 2019

SAFETY ACTIONS	**Fraser Surrey Docks** took the following safety actions: • revised the procedure for crane positioning prior to berthing and unberthing vessels; • initiated a requirement for the superintendents to be present at the berth and equipped with very high frequency radiotelephones to communicate with pilots for all vessel movements; • reviewed the incident with the Fraser River pilots and commenced bi-annual meetings to discuss areas of improvements and future plans; and • revised the procedure for when a crane is passing a vessel's mast or superstructure while transiting along the berth.

INVESTIGATION REPORT M19A0090: Capsizing and loss of life, unregistered fishing vessel, Mackenna Point, Nova Scotia, 8 April 2019

SAFETY ACTIONS	**Nova Scotia Community College**, the **Nova Scotia Fisheries Sector Council** and a **safety consultant** developed a voluntary training course to address gaps in training for small aquaculture vessel operators. The training focuses on vessel maintenance and operations, and creates awareness about regulatory requirements and the benefits of conducting drills and safety procedures. Participants review vessel stability and safe working practices for loading and handling the traps and cages used in the aquaculture industry. **Transport Canada** conducted outreach with local First Nations aquaculture operations. The **vessel's authorized representative** (the manager of the Paqtnkek Mi'kmaw Nation's oyster project) arranged to have the vessel's stability assessed.

INVESTIGATION REPORT M19P0246: Girding and sinking, tug *Sheena M* and barge *Seaspan 566*, Williamsons Landing, British Columbia, 1 October 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT M19C0387: Bottom contact, bulk carrier *Kaministiqua*, Kahnawake, Quebec, 27 November 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT M20A0003: Fire, fishing vessel *Newfoundland Lynx*, 90 nautical miles northeast of St. Anthony, Newfoundland and Labrador, 29 January 2020

SAFETY ACTIONS	The operator of the *Newfoundland Lynx*, **Ocean Choice International**, removed the sauna, which was where the fire was located, from the vessel. The space was converted into a storage area and equipped with a smoke and heat detector. Ocean Choice International also ordered additional firefighting equipment be placed on board.

INVESTIGATION REPORT M20P0092: Dragging anchor and subsequent collision, bulk carriers *Golden Cecilie* and *Green K-Max 1*, Plumper Sound, Southern Gulf Islands, British Columbia, 30 March 2020

SAFETY ACTIONS	The *Golden Cecilie*'s operator, **SeaTeam Management Pte Ltd.**, took the following safety actions: • amended the anchoring and anchor watch checklist on 1 May 2020 to indicate that the master should be informed immediately if the barometric pressure drops by 3 mb during watch or if the wind speed exceeds 21 knots (force 5 on the Beaufort scale). In such circumstances, the engines are to be placed on standby and the deck watch is to monitor the anchor position; • amended the checklist to specifically indicate the engine notice period as per the master's instruction;

	• sent a notice to the vessels informing vessel crews that they should be documenting the engine notice period, the state of readiness and the position of the second anchor in the bridge log book; • circulated a "Safety Flash" bulletin to all vessel crew members stressing the importance of proper anchor watches and compliance with the safety management system; and • arranged bridge resource management refresher training for bridge watch officers.

INVESTIGATION REPORT M20P0110: Striking, roll-on/roll-off passenger ferry *Spirit of Vancouver Island*, Tsawwassen, British Columbia, 18 April 2020

SAFETY ACTIONS	**BC Ferries** completed a site investigation report and took the following safety actions:
	• held a two-hour review session with the bridge team that included the following:
	  ○ a review of the incident;
	  ○ a review of the site investigation report, including root causes and recommendations;
	  ○ a re-creation of the incident in the simulator and a review of the stages of the incident and lessons learned; and
	  ○ a discussion of the findings as well as personal and institutional lessons learned from the incident;
	• updated the anchor documentation and training manual to clarify the anchor release method; all crews have been practising proper stowage of the anchors on board Spirit-class vessels;
	• updated the vessel-specific manual to include the major factors of a command decision point in accordance with the fleet operations manual; bridge teams have performed drills that address vessel speed and the elements of a command decision point involving all bridge team members; and
	• posted instructions on the remote release of the anchors.

INVESTIGATION REPORT M20A0258: Sinking and loss of life, unnamed fishing vessel, 3 nautical miles west-northwest of Sally's Cove, Newfoundland and Labrador, 28 July 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

Pipeline transportation sector

INVESTIGATION REPORT P20H0017: Release of crude oil incident, Enbridge Pipelines Inc., Herschel pump station, near Herschel, Saskatchewan, 30 April 2020

SAFETY ACTIONS	**Enbridge Pipelines Inc.** evaluated the need for drag reducing agent (DRA) injection systems and isolated the systems that are no longer required. Enbridge also initiated a review of its storm water management procedures and documentation to identify areas for improvements. In addition, Enbridge took the following safety actions: • developed procedures for flushing intermittently operated DRA injection systems to prevent blockages and freezing; • revised the design standard for DRA injection systems to ensure the check valve is located downstream of the flexible braided hose; and

	• revised the preventative maintenance procedures for DRA injection systems and their components.

Rail transportation sector

INVESTIGATION REPORT R17W0267: Employee fatality, Canadian National Railway Company, remote control locomotive system, extra yard assignment Y1XS-01, Melville, Saskatchewan, 22 December 2017

SAFETY ACTIONS	**Canadian National Railway Company** (CN) issued several local notices and special instructions identifying locations where the kicking of cars uphill was forbidden. With regard to protecting the point of movement by remote control locomotive system crews, CN added additional information in its General Operating Instructions, including that the remote control operator must be able to see and monitor the movement at all times, and that the primary focus should be controlling the movement. CN also reviewed the way switching was being performed at Melville Yard. As a result, CN identified areas where track reconfiguration and changes to the track gradient would significantly reduce the likelihood of a rollback and uncontrolled movement. Switching was moved to the west end of the yard, where the above modifications have been made. The **Board** issued Recommendation R20-01 as part of this investigation: that Transport Canada work with the railway industry and its labour representatives to identify the underlying causes of uncontrolled movements that occur while switching without air, and develop and implement strategies and/or regulatory requirements to reduce their frequency. In response to the recommendation, **Transport Canada** stated that it was preparing a Ministerial Order, expected to be issued in September 2020, requiring industry to create a new rule that provides additional requirements when conducting switching operations. The rule would require that, once switching is complete, the equipment must be left properly secured. Furthermore, Transport Canada indicated that it continues to revise the *Railway Employee Qualification Standards Regulations* to strengthen oversight requirements and address gaps related to training and experience of employees to ensure they can safely conduct their duties. Transport Canada also stated that it would launch stakeholder consultations on key aspects of the regulations. Publication of the regulatory proposal in *Canada Gazette*, Part I, is planned for spring 2021. In its assessment of this response, the Board confirmed that the first step, to issue the Ministerial Order (MO 20-09), was completed on 29 September 2020. The Ministerial Order directs the railway industry to revise the *Canadian Rail Operating Rules* to address three key risks during switching operations as follows: requirements for location of switching operations; requirements when performing switching operations; and requirements for switching with remote control locomotives. Although Transport Canada's past regulatory focus for reducing unplanned/uncontrolled movements has been largely directed at the securement of equipment, it is encouraging that the Ministerial Order may improve the likelihood of solutions being put in place for increasing the lines of defence against hazards inherent with switching operations. The effectiveness of Transport Canada's response cannot be fully ascertained, however, until the consultations with the railway industry and its labour representatives have occurred, the underlying causes of uncontrolled movements that occur while switching without air are better understood, and strategies have been developed and implemented to reduce their frequency. Until that time, the Board has assessed the response to Recommendation R20-01 to be Satisfactory in Part. With regard to stakeholder consultations on key aspects of the *Railway Employee Qualification Standards Regulations*, these had been planned for fall 2020 but had yet to be initiated when the Board assessed Transport Canada's response to the recommendation in December 2020.

	The Board is encouraged that Transport Canada acknowledges the existence of gaps in the training and qualification for employees in safety-critical positions and that it is actively working in a number of areas to address these gaps, including amendments to the regulatory framework. The Board also issued a safety concern focusing on the potential adverse outcomes when inexperienced remote control locomotive system operators are paired together when working in yards. The Board is concerned that, given the ongoing employee turnover in the railway industry and without additional mitigation, inexperienced operators will continue to be paired, with a commensurate risk of ongoing adverse outcomes. The Board is of the view that the measures Transport Canada has committed to taking related to the *Railway Employee Qualification Standards Regulations* should address the safety concern.

INVESTIGATION REPORT R18E0007: Uncontrolled movement of rolling stock, Canadian National Railway Company, freight train L76951-10, Mile 0.5, Luscar Industrial Spur, Leyland, Alberta, 10 January 2018

SAFETY ACTIONS	**Canadian National Railway Company** (CN) implemented new air brake testing procedures for cold weather operations at Luscar to verify that car brakes apply. CN also initiated the use of five cold-wheel detectors on the network, each located in an area of significant grade. These detectors allow CN to identify cars on which the individual brake systems are not applying sufficient retarding force so that such cars can be marked as being in bad order and addressed accordingly. CN also implemented a requirement that car owners ensure that leased cars come to CN with freight car air brake control valves that are less than 10 years old. Newly leased coal cars on CN lines must have passed a single-car air brake test within the preceding five years. All car control valves greater than 10 years old must be replaced. CN also systematically replaced freight car air brake control valves that were 10 years or older on CN-owned rail cars. For winter operations on the Luscar Industrial Spur, loaded coal train operations must cease when the temperature reaches −25 °C or lower. When the temperature is between −22 °C and −25 °C, loaded coal train operations are conducted during the day only. The **TSB** issued Rail Safety Advisory 04/18, "Potential brake valve failures on cars that have been in long-term storage," to advise Transport Canada that, given the potential consequences of a loss of braking function due to brake valve failure, it may wish to alert railways and car owners of the need to examine the brake valve functionality of cars that have been in long-term storage, particularly if the cars are to be used in cold weather service. In response to the TSB's safety advisory letter, **Transport Canada** indicated that it had issued a Rail Safety Bulletin in 2019, "Potential brake valve failures on cars in long-term storage," to advise railway companies and car owners to examine the complete valve functionality of cars placed in long-term storage, where the potential for rubber setting of valve seals is possible, before placing the cars in service, especially if cars are to be used in cold weather service. **New York Air Brake** issued a general letter recommending that any DB-10 service brake portion of the air brake control valve experiencing one or more of the described symptoms should be removed from service as soon as practical and refurbished. Furthermore, in response to a 2019 request by the Association of American Railroads, New York Air Brake analyzed freight control valves collected from the field and data collected from the clean oil test and stencil portions. Based on the findings of independent analyses, New York Air Brake formally submitted a letter of recommendation for a time-based maintenance overhaul period of 12 years for freight control valves. Effective 1 July 2020, the **Association of American Railroads** introduced a change to its Field Manual and Office Manual of Interchange Rules enabling the removal of control valves older

	than 13 years. This rule change establishes renewal requirements for brake valves regarding age and cold weather.

INVESTIGATION REPORT R18H0039: Uncontrolled movement of rolling stock, Canadian Pacific Railway, remote control locomotive system, yard assignment T16-13, Mile 195.5, Belleville Subdivision, Toronto Yard, Toronto, Ontario, 14 April 2018

SAFETY ACTIONS	**Canadian Pacific Railway** (CP) issued Operating Bulletin SO-026-18, requiring there to be five cars with air for every 3000 tons when pulling cars from the east or west end of Toronto Yard. CP also issued Operating Bulletin SO-038-18, requiring the employee who is protecting the point of the movement outside an active zone to be in control of the remote control locomotive system (RCLS) box. When changing direction, control must be passed to the other employee prior to starting the movement in the opposite direction. Furthermore, CP integrated its existing RCLS training and qualification program into the knowledge management program that is part of its safety management system. As a result of the incident and pursuant to the *Railway Safety Act*, a **Transport Canada** inspector issued a Notice Acknowledging Immediate Action Taken to CP. The notice stated that CP had addressed the threat of uncontrolled movements in the Toronto Yard. Transport Canada also verified that operating crews and supervisors had read and understood the instructions in Operating Bulletin SO-026-18.

INVESTIGATION REPORT R18W0237: Main-track train derailment, Hudson Bay Railway, freight train 995-15, Mile 99.59, Wekusko Subdivision, Ponton, Manitoba, 15 September 2018

SAFETY ACTIONS	**Transport Canada** inspectors conducted a site profile and comprehensive inspection of Hudson Bay Railway (HBR). During this inspection, Transport Canada noted that, after the accident, HBR updated its security plan and emergency response plan to include measures to address derailments, and planned to purchase and upgrade its communication equipment. Because this accident involved a fatality and serious injury to employees on board, Transport Canada conducted a parallel investigation on behalf of Employment and Social Development Canada, in accordance with a memorandum of understanding between them. **HBR** inspected all the culverts on all its subdivisions and reinstated its beaver control program, including introducing additional new equipment, personnel, inspection protocols and training for all track foremen. In addition, HBR hired a specialist in bridges, structures and culverts for all planned inspections. This specialist will attend all third-party engineering inspections. HBR modified its communications policy with respect to operating in dark territory to require crews to check in with the rail traffic controller every hour. If the crew does not do so within 30 minutes, the controller will immediately notify an HBR supervisor. HBR also updated its safety management system to include updated reporting templates and procedures, as well as company targets and initiatives. Designated reporting stations were set up in appropriate booking-in locations, with paperwork and procedural outlines. The new safety management system also included quarterly and annual safety reporting and trend analysis. HBR also implemented a new hazard prevention program. As part of this program, HBR completed a task analysis with its health and safety committee. In collaboration with the University College of the North and Manitoba Education and Training, HBR developed a four-week pre-employment training program for new track employees that includes training specific to rail and track safety. In addition, HBR implemented an on-boarding program, and put a process in place to educate employees on company safety procedures. HBR also implemented a process to coordinate

	additional rail-specific training and track certification expiry dates. It updated the process for health and safety meetings.

INVESTIGATION REPORT R18D0096: Movement exceeds limits of authority, VIA Rail Canada Inc., passenger train P02921-31, Mile 99.1, Drummondville Subdivision, Drummondville, Quebec, 31 October 2018

SAFETY ACTIONS	**Transport Canada** conducted an inspection and issued a letter of non-compliance to VIA Rail Canada Inc. (VIA) for violations of the *Canadian Rail Operating Rules* (CROR). **VIA** relayed the risks related to radio communications with locomotive engineers about non-urgent subjects and their possible distraction to all employees and briefed all Eastern Region locomotive engineers about CROR rules 578, 34 and 110 and VIA's Cab Red Zone (CRZ) instructions. VIA also re-issued to its Quebec employees instructions related to the use of the headlight when approaching a crossing and clarified how to perform the required inspection under CROR Rule 110 (Inspection of Passing Trains), reiterating that inspecting trains while both trains are moving is not efficient and that employees should be looking at what is coming ahead of them. Furthermore, VIA management discussed this occurrence during health and safety summits held at various locations throughout the country in order to raise awareness among locomotive engineers and met with senior union leadership to review the events of this occurrence and discuss how to improve the operating environment. In addition, the crew members involved in this occurrence provided safety talks and a summary of the incident to other locomotive engineers of their terminal in order to raise awareness about the application of the CRZ, headlight usage and the application of CROR rules 578, 34 and 110. Before resuming normal duty, both crew members attended a two-week recertification session and took additional training on cab awareness. Extra training on CRZ was provided to confirm their application of the instructions. Management at the **Canadian National Railway Company** Montréal rail traffic control centre reviewed this occurrence with other rail traffic controllers and emphasized the importance of following procedures when a CROR Rule 439 alarm occurs (a Rule 439 alarm occurs whenever rolling stock passes a signal indicating Stop). In addition, the rail traffic control screen was modified to include a visual cue (red square) at a location where a CROR Rule 439 alarm occurs. That visual cue helps controllers identify the location of a CROR Rule 439 alarm and determine whether it is related to a train.

INVESTIGATION REPORT R18M0037: Employee fatality, Canadian National Railway Company, assignment L57211-04, Mile 1.03, Pelletier Subdivision, Edmundston Yard, Edmundston, New Brunswick, 4 December 2018

SAFETY ACTIONS	The **TSB** issued Rail Safety Advisory 02/19, "Securement of cars that are considered 'attended' during yard switching operations," to alert Transport Canada that, given the risks associated with cars rolling unintentionally, it may wish to review, clarify and update the definition of "unattended" as it pertains to Rule 112 of the *Canadian Rail Operating Rules* (CROR) to ensure this rule is appropriately (and consistently) applied during yard switching operations. In its safety advisory letter, the TSB indicates that this rule implies that an employee in "proximity" would be able to take effective action to stop an unintentional movement of equipment. However, as in this occurrence, employees are normally engaged in other work activities and may not always be able to take effective action to stop the equipment, should it move unintentionally. Furthermore, if equipment does roll unintentionally, the crew members would have to climb onto the moving equipment to take action, placing them in a hazardous situation. **Transport Canada** investigated this occurrence under the *Canada Labour Code*, Part II, to understand the circumstances surrounding the occurrence in order to prevent a similar

	occurrence, to determine whether there were violations of the Code, and to determine what compliance activities, if any, should be taken. After its investigation, Transport Canada issued a letter of non-compliance to the Canadian National Railway Company (CN) for non-compliance with CROR Rule 112 (c) (Securing Unattended Equipment – Yard Tracks) and with CROR Rule 108 (Precautions While Switching). In response to the TSB's safety advisory letter, Transport Canada indicated that it considered the cars to be unattended and noted the letter of non-compliance that had been issued to CN. In addition, Transport Canada stated its intention to further engage with industry to ensure accurate understanding of unattended equipment and determine whether additional guidance is required. **CN** issued bulletins for the Napadogan and Pelletier subdivisions regarding cars left unattended in Edmundston Yard. The bulletins prohibit leaving less than 10 cars on the lead track at the west end of Edmundston Yard. In response to the TSB's safety advisory letter, CN indicated that CROR Rule 112 was sufficiently clear and explained that special instructions were already in place with regard to sections (i) and (iv) of Rule 112. The company also clarified that it had already issued a special instruction that at least one hand brake must be applied and a brake effectiveness test carried out for equipment considered attended on main track, subdivision track or siding, or in any high-risk location. In its response to the TSB's safety advisory letter, the **Canadian Pacific Railway** (CP) indicated that the definition of "unattended" in CROR Rule 112 was clear. It explained that, as part of the company's process, CP had investigated the four uncontrolled movements of cars in CP yards in 2018 to determine their underlying cause. CP determined that these occurrences had been caused by unsecured equipment and that the rolling stock had not been considered "attended" according to CP rules. CP explained that, to conform to the requirements of CROR Rule 112, it trains its employees to understand the difference between "unattended" and "attended" when they perform switching activities. CP instructions indicate that, when crews are uncertain whether they are in close enough proximity to take effective action, equipment involved in yard switching operations must be considered "unattended" and must be secured. CP indicated that it had met individually with the employees involved in these four occurrences to re-educate them on CP's rules and procedures.

INVESTIGATION REPORT R19W0017: Main-track train derailment, Canadian National Railway Company, freight train G86742-21, Mile 11.35, Warman Subdivision, Saskatoon, Saskatchewan, 22 January 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT R19H0021: Rolling stock collision with object and employee injury, VIA Rail Canada Inc., train No. 62/52, Mile 240.44, Kingston Subdivision, Brighton, Ontario, 2 February 2019

SAFETY ACTIONS	The **TSB** issued Rail Safety Advisory 03/19, "VIA trains coming into contact with track materials placed between the rails in preparation for track work," indicating that, given the potential consequences when trains come into contact with track materials, Canadian National Railway Company (CN), in conjunction with VIA Rail Canada Inc. (VIA), might wish to conduct a risk assessment to identify and implement appropriate measures to ensure that VIA trains can travel safely through locations where track materials are placed between the rails in preparation for track work. In response to the safety advisory letter, **CN** issued instructions requiring that tie plates or other track materials not be left between the rails before any work block is undertaken on all passenger train corridors. CN also committed to conducting a risk assessment in conjunction

	with VIA should CN consider resuming the practice of leaving tie plates or other track materials between the rails on a passenger train corridor. VIA stated that it would support any future risk assessment CN may undertake that has an impact on locations where CN and VIA jointly operate.

INVESTIGATION REPORT R19C0038: Non-main-track train collision and derailment, Canadian Pacific Railway, freight train 118-09 and locomotive control system yard assignment CR01-09, Mile 172.0, Brooks Subdivision, Calgary, Alberta, 9 March 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT R19M0018: Main-track train derailment, VIA Rail Canada Inc., train 14, Mile 15.27, Canadian National Railway Company Newcastle Subdivision, Coal Branch, New Brunswick, 4 April 2019

SAFETY ACTIONS	The **TSB** issued Rail Safety Advisory 06/19, "Ensuring effective and consistent rail condition monitoring practices at railway crossings," suggesting that, given the challenges with detecting rail defects at railway crossings, Transport Canada may wish to review how rail condition monitoring is performed at railway crossings and provide guidance (as necessary) to ensure these inspections are conducted in an effective and consistent manner. **Transport Canada** responded that the railway company is responsible for conducting a valid search for internal defects, reducing the class of track as necessary and removing the rail from service. The **Board** issued a safety concern as part of this investigation: The lifespan of a road crossing varies and is affected by multiple variables, such as traffic, weather conditions and winter road maintenance practices. Railways generally have programs in place to regularly inspect the condition of crossing components in order to determine whether rehabilitation is warranted. During rehabilitation, the crossing structure is usually removed, which exposes the rail and provides an opportunity to examine and assess the condition of the rail and the rail web. A thorough fitness-for-service assessment of the rail should include an inspection for possible deterioration due to corrosion. Since there is no reference to this type of inspection in the *Rules Respecting Track Safety*, it may not be systematically performed in the field. Therefore, the Board is concerned that track inspection provisions at crossings do not include a requirement to assess for corrosion of the rail web; consequently, there may be rail web corrosion at other crossings, which could result in in-service rail failures.

INVESTIGATION REPORT R19C0088: Main-track train derailment, Canadian Pacific Railway, freight train 118-01, Mile 126.4, Maple Creek Subdivision, Irvine, Alberta, 2 August 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT R19C0094: Main-track train derailment and dangerous goods release, Canadian Pacific Railway, freight train 469-01, Mile 17.88, Aldersyde Subdivision, Barons, Alberta, 2 September 2019

SAFETY ACTIONS	**Canadian Pacific Railway** conducted rail flaw detection testing on the newly repaired rail at the derailment site in order to identify and protect against any defective rail. Additional rail flaw detection tests were conducted on more than 81 miles of the Aldersyde Subdivision, which

	resulted in 26 rails being replaced within seven days of testing to address a variety of defects, including 11 defective field welds, seven bolt hole cracks, five transverse defects or detailed fractures, two vertical split heads, and one head and web separation.

INVESTIGATION REPORT R19H0123: Main-track train collision with standing cut of cars foul of the main track, VIA Rail Canada Inc., passenger train 48, Mile 186.68, Canadian National Railway Company Kingston Subdivision, Ernestown, Ontario, 5 September 2019

SAFETY ACTIONS	**Transport Canada** conducted an inspection and issued a letter of non-compliance to Canadian National Railway Company for non-compliance with Rule 115 of the *Canadian Rail Operating Rules*.

INVESTIGATION REPORT R19E0150: Main-track train derailment, Canadian National Railway Company, freight train G86341-28, Mile 80.45, Vegreville Subdivision, Chipman, Alberta, 29 September 2019

SAFETY ACTIONS	**Canadian National Railway Company** (CN) inspected the Vegreville Subdivision with a heavy track geometry inspection car and found no defects. On 11 September 2020, CN installed a wheel impact load detector on its Prairie North Line, at Mile 18.2 of the Blackfoot Subdivision.

INVESTIGATION REPORT R19D0117: Main-track train derailment, Central Maine & Quebec Railway, freight train 630, Mile 103.73, Sherbrooke Subdivision, Bolton-Ouest, Quebec, 16 November 2019

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT R19W0329: Main-track train derailment, VIA Rail Canada Inc., passenger train 692, Mile 22, Canadian National Railway Company Gladstone Subdivision, Beaver, Manitoba, 31 December 2019

SAFETY ACTIONS	**Canadian National Railway Company** expanded its Engineering Track Standards to require additional inspections and preventative maintenance measures whenever work is being conducted in the vicinity of a joint. The joint bars must be inspected for cracks, the bolts tightened and the low joints tamped or shimmed. Also, any joint bar found to be cracked or broken, outside of the middle bolt holes in Class 3 track and above, must be replaced. When replacing a cracked bar, the matching bar should be closely inspected for cracks and replaced if needed.

INVESTIGATION REPORT R20V0005: Main-track train derailment, Canadian National Railway Company, freight train U79351-06, Mile 69.97, Bulkley Subdivision, near Kitwanga, British Columbia, 7 January 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT R20D0013: Crossing collision, Réseau de transport métropolitain, commuter train EXO 182, Mile 9.91, Canadian Pacific Railway Parc Subdivision, Montréal, Quebec, Ahuntsic-Cartierville borough, 18 February 2020

SAFETY ACTIONS	The TSB is unaware of any safety action having been taken as a result of this occurrence.

INVESTIGATION REPORT R20W0031: Main-track train derailment, Canadian National Railway Company, train X35041-18, Mile 108.25, Fort Frances Subdivision, Emo, Ontario, 18 February 2020

SAFETY ACTIONS	**Canadian National Railway Company** (CN) clarified inspection expectations in its Engineering Track Standards. CN now requires zone and production gangs doing work on one rail to inspect both rails to ensure they comply with track standards and that no hazards exist.