Transportation Safety Board of Canada

2016-17 Annual Report to Parliament

Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

Canada

Transportation Safety Board of Canada
Place du Centre
200 Promenade du Portage, 4th floor
Gatineau QC K1A 1K8
819-994-3741
1-800-387-3557
www.tsb.gc.ca
communications@tsb.gc.ca

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ANNUAL REPORT TO PARLIAMENT 2016-17

Place du Centre
200 Promenade du Portage, 4th floor
Gatineau, Quebec K1A 1K8

7 July 2017

The Honourable Karina Gould, P.C., M.P.
Minister of Democratic Institutions and
President of the Queen's Privy Council for Canada
House of Commons
Ottawa, Ontario 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 01 April 2016 to 31 March 2017.

Yours sincerely,

Original signed by

Kathleen Fox
Chair

CALEDONIAN

C-GJSU

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Message from the Chair

At the Transportation Safety Board of Canada (TSB), our goal is very clear: we strive to advance transportation safety. We investigate, learn, share, monitor, lead, and innovate so that Canadians can have confidence in their transportation system—a system that plays a vital role in everyone's life. It's an important mandate, and one that we take pride in delivering.

As usual, the TSB's Annual Report to Parliament features the organization's accomplishments. In support of our core mandate, we released 44 investigation reports into marine, rail, and aviation transportation occurrences. We organized our first-ever multi-modal Safety Summit, bringing together senior leaders from government and industry to examine ways to improve the flow of safety information and to capture and use data proactively. Strengthening organizational safety culture and safety management were overarching themes. We conducted a safety study and issued a final report on - *Expanding the use of locomotive voice and video recorders in Canada* that provided valuable information for the development of an action plan to implement voice and video recorders in locomotives, and served as a foundation for legislative changes recently tabled in Parliament.

We also updated the TSB's Watchlist—which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. Watchlist 2016 features two new issues. Fatigue in freight train operations has been a factor in numerous railway investigations involving human performance. Too many train crews aren't getting the rest they need. In identifying this issue, we're calling upon Transport Canada (TC) to complete its review of railway fatigue management systems and the railway industry to implement further actions to effectively mitigate the risk of fatigue. The Watchlist also highlighted TC's slow progress in addressing TSB recommendations, affecting many aspects of the transportation network. We identified 52 Board recommendations that have been outstanding for 10 years or more, with over three dozen of those outstanding for more than 20 years. A faster and more efficient regulatory process is needed for safety-related regulations, especially when TC agrees on the safety issue to be addressed.

The TSB's work has had, and will continue to have, a positive impact on safety in the coming years. Building on over a quarter-century of cutting-edge investigative work, solid reporting, and promoting safety, we are encouraged by the steady trend in declining accident rates.

However, we remain determined to continue to push for action where we feel more can be done to make the transportation system, and by extension all Canadians, safer still.

Kathleen Fox

What we do

Mission

The Transportation Safety Board of Canada (TSB)'s mission is to conduct independent safety investigations and communicate risks in the transportation system.

Mandate

The *Canadian Transportation Accident Investigation and Safety Board Act* provides the legal framework that governs TSB activities. Our mandate is to advance transportation safety in the marine, pipeline, rail, and aviation modes of transportation by

- conducting independent investigations, including public inquiries when necessary, into selected transportation occurrences in order to make findings as to their causes and contributing factors;
- identifying safety deficiencies, as evidenced by transportation occurrences;
- making recommendations designed to eliminate or reduce any such safety deficiencies; and
- reporting publicly on our investigations and their findings.

As part of its ongoing investigations, the TSB also reviews developments in transportation safety and identifies safety risks that it believes government and the transportation industry should address to reduce injury and loss.

In making its findings as to the causes and contributing factors of a transportation occurrence, it is not the Board's role to assign fault or determine civil or criminal liability. However, the Board does not refrain from fully reporting on the causes and contributing factors merely because fault or liability might be inferred from the Board's findings. No finding of the Board should be construed as assigning fault or determining civil or criminal liability. Findings of the Board are not binding on the parties to any legal, disciplinary, or other proceedings.

Independence

When an accident occurs, it's the TSB's role to find out what happened and why. Delivering these results for Canadians also means earning their trust and confidence in the work we do, which is why our organization must be objective, independent, and free from any conflict of interest. By reporting to Parliament through the President of the Queen's Privy Council, the TSB remains separate from all other government departments and agencies involved in transportation. Our independence helps ensure we can arrive at impartial conclusions and make recommendations to those best placed to take action.

Who we are

The TSB consists of about 220 employees located across the country. The Board, which is composed of up to five Members, including the Chair, approves all reports, makes findings as to causes and contributing factors, and issues recommendations to address safety deficiencies. The senior management team, responsible for strategic planning and leadership as well as day-to-day operations, is headed by the Chief Operating Officer. Our headquarters is located in Gatineau, Quebec. We have a laboratory in Ottawa and regional offices in Vancouver, Edmonton, Calgary, Winnipeg, Toronto, Montréal, Quebec City, and Halifax.

The skill sets required to carry out the mandate of the TSB vary widely. Most investigators have already had full careers in their respective fields: ship captains, engineers and naval architects; mechanical engineers with oil industry experience and pipeline experts; locomotive engineers, conductors and track specialists; pilots, cabin crew and air-traffic control operators; metallurgists, electronics technologists, and computer engineers. These are professionals who can trace the origins of microscopic defects in metals, decode any number of electronic gadgets and hardware to distill hard data, use software and simulators to recreate a variety of scenarios that may have led to an accident, or perform engine tear-downs and analyses to determine what was going on with the equipment. These are supported by a small and experienced team of human resources, administrative and communications professionals.

The Board

Kathy Fox

Chair

Joseph Hincke

Board member

Faye Ackermans

Board member

Hélène Gosselin

Board member

John Clarkson

Board member

Our values

As federal public service employees, we are guided by enduring public service values—respect for democracy, respect for people, integrity, stewardship, and excellence. We at the TSB also place a particular emphasis on our own core values, which are of the utmost importance to our success in achieving our mandate.

Respect

We are committed 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, 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.

Building a safer future for Canadians

The fiscal year 2016-17 was a busy one for the TSB. In April 2016, the TSB hosted a Safety Summit that brought together senior Canadian transportation executives from government and the transportation industry, along with some of the labour organizations. The objective of the meeting was to share best practices—notably for capturing and using safety data in a proactive, non-punitive way—and to identify ways of strengthening the organizational safety culture and safety management. The final conference report outlined practical approaches to help organizations improve safety and help mitigate risks.

In May of 2016, the TSB launched an ambitious five-year strategic plan with the goal of building a safer future for Canadians. It provides the TSB with a blueprint to evolve as a modern, world-class organization that can adapt effectively and that strives to influence changes that advance transportation safety. While the TSB continues to investigate occurrences in order to advance transportation safety, concerted efforts are also being made to improve and modernize the organization, including the way we conduct our business, to ensure that the TSB remains relevant and effective in fulfilling our mandate in the future. A major review of the TSB's investigation policies, processes and products was therefore undertaken.

Internally, and in keeping with the objective of modernization and continuous improvement, the TSB convened a number of working groups to review our operational and administrative processes. These working groups are looking at ways to reduce unnecessary administrative burden, to update investigator competency profiles, to upgrade training programs, and to better evaluate activities and share information to improve operations. These working groups and others will ensure that the TSB remains effective and relevant, and becomes more efficient in achieving our mandate.

Also this year, we released our fourth Watchlist—Watchlist 2016. The TSB Watchlist identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. The 10 issues on this list are supported by a combination of investigation reports, Board safety concerns and Board recommendations. Some issues have been on the Watchlist since 2010, others are new to this year's edition. All of them, however, require a concerted effort from the regulator and industry stakeholders.

To support Watchlist 2016, the TSB has taken a more active stance than in years past. Over the past several months, the TSB has targeted specific players in the transportation sector, engaged directly with them on Watchlist issues and discussed what they can do to mitigate risks without waiting for TC or others to intervene. With this more proactive approach the TSB is encouraging stakeholders to take the lead on safety issues.

Through these activities and others, the TSB remains fully invested in building a safer future for Canadians.

Transportation Safety Board awards

A vital and healthy organization takes the time to recognize when its employees have achieved notable results that raise the bar in their workplace. The TSB has an annual Awards and Recognition program, which consists of five awards that spotlight those individuals and teams who make a difference in the workplace and in the Public Service by contributing to the advancement of transportation safety.

Outstanding achievement award

The recipient of this year's Outstanding achievement award was Sylvie Dionne. Dr. Dionne earned the award for her work in developing a Centre of Expertise on railway tank-car design and survivability. This Centre of Expertise is key to the TSB's ability to influence the safety of the rail industry's tank car standards. It captures historical tank car designs as well as new developments in design. Essential to the Centre of Expertise is the systematic assessment methodology that was developed by Dr. Dionne and her team. This methodology allows the examination of new tank car designs, and their comparison to previous designs, in an efficient and detailed manner.

Excellence in leadership award

This year's Excellence in leadership award was presented to Art Monette. Mr. Monette was recognized for his leadership in bringing improvements to information management at the TSB–which is a critical and integral element of the organization's work. Mr. Monette organized successful information and awareness sessions for employees, modified the TSB Fundamental Principles Course, and, was directly involved in training for new investigators. He also put in place an action plan to ensure that TSB information is up to date, recorded appropriately and more easily accessible to employees. Mr. Monette encourages excellence, not only within his own team but also across the organization, and creates opportunities for his team to learn and achieve their goals.

Pictured left to right—Sylvie Donne and Kathy Fox

Pictured left to right—Jean Laporte and Art Monette

Impact award

This year, the Impact Award was shared amongst three employees for their exceptional work as part of the Marine Branch technical writers' team: Kate Wellburn, Valerie Doucette and Shauna McNally. This team has undertaken one of the most laborious and difficult tasks in the Marine Branch, namely, writing investigation reports. It is also the work that has the potential to result in the biggest safety impact. Writing a good report is an art and a science that requires a set of skills which can improve significantly the quality and timeliness of safety messages. Since the hiring of technical writers four years ago, major improvements have been made to the Marine Branch investigation reports. Ms. Wellburn, Ms. Doucette, and Ms. McNally navigate through the complexities of writing to ensure the end product is flawless. They are also valued team members who can, by their positive and respectful deportment, make a most challenging meeting a joyful event.

Pictured left to right—Kathy Fox, Valerie Doucette, Shauna McNally, and Kate Wellburn

Pictured left to right—Jean Laporte and Janie Bertrand

Pictured left to right—Jean Laporte and Earl Chapman

Client service award

This year, two recipients were honoured with the Client service award. Janie Bertrand and Earl Chapman received recognition for their contributions to the TSB and their outstanding dedication to client service. Ms. Bertrand has recently completed two significant projects aimed at updating records management at the TSB, all the while providing an excellent level of service to clients. Mr. Chapman is called upon to conduct technical analyses and to support investigators and technical leads. He also acts as an accredited representative for the analysis of systems/equipment with Canadian manufacturers. No matter how busy, he has always found time to answer questions, mentor colleagues, technical leads, and Investigators-In-Charge. In all of his endeavors, he ensured that the excellent service reputation enjoyed by our Engineering Lab is maintained.

Excellence in investigation award

This year, two teams received the Excellence in investigation award. The first recipient was the investigation team of the Jazz Aviation LP accident (A14W0177) in Edmonton, Alberta, led by Barry Holt as Investigator-in-Charge. The investigation team was composed of Derek Gagné, Frederick Burow, Jon Lee, Peter Kramar and Sylvie Dionne. Anytime the certification and design of an aerospace product comes into question, the complexity of the investigation increases significantly. The investigation team worked in collaboration with engineers at UTAS/Bombardier to design a test rig for an exemplar landing gear in which they could conduct dynamic tests in order to replicate the failure and see how the landing gear collapsed. In addition, Mr. Holt prepared a report for the International Society of Air Safety Investigators in order to communicate the challenges of managing an investigation involving the failure of a complex system.

The second team recognized for the Excellence in investigation award was the investigation team of the OC Transpo—VIA crossing accident (R13T0192) in Ottawa, Ontario. Under the leadership of Rob Johnston as Investigator-in-Charge, the investigation team was composed of Claude Lelièvre, Missy Rudin-Brown, Derek Gagné, Don Mustard, Darlene Roosenboom, Ian Henderson, Joel Morley, Joanne Ostiguy, Jon Stuart, Ken Miller, Marc Hamilton, Nathalie Lepage, Sylvie Dionne, Tony Gasbarro, Ted Parisee and Xin-Xiang Jiang. This crossing accident was a high profile, challenging and unique investigation. Under difficult circumstances, the team managed to effectively identify and communicate key safety messages. An important piece of the investigation included a review and analysis of commercial passenger bus safety. This transportation mode is not normally part of the TSB mandate. However, given the circumstances, the issue was seamlessly integrated into the rail crossing investigation and yielded three recommendations focussing on passenger bus design/operations. Important recommendations were also made with respect to grade crossing safety.

Pictured left to right—Kathy Fox, Rob Johnston, Missy Rudin-Brown, Nathalie Lepage, Joanne Ostiguy, Sylvie Dionne, Ian Henderson, Ken Miller, and Joel Morley

Pictured left to right—Barry Holt and Kathy Fox

The transportation safety landscape

Reported occurrences

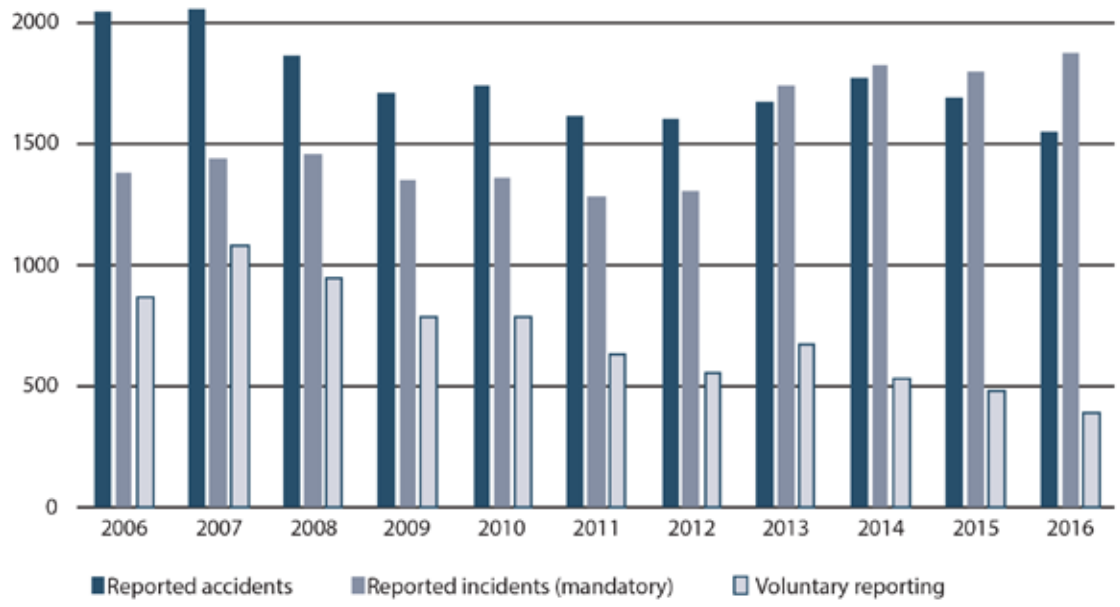
All reported occurrences were assessed under the Board's Occurrence Classification Policy to identify those with the greatest potential for advancing transportation safety. It is in these cases that a thorough, formal investigation is conducted with a final public report. However, whether we investigate or not, all information is entered into the TSB's database to keep records, analyze trends, and validate safety issues.

In Canada, transportation accidents are generally down, and Canadians can expect to benefit from a safe transportation system. In 2016, 1,568 accidents and 1,890 incidents were reported in accordance with the TSB's regulations for mandatory reporting of occurrences.[1] The number of accidents in 2016 decreased by 7.8% from the 1,700 accidents reported in 2015, and decreased by 12.45% from the 2006–2015 annual average of 1,791. The number of reported incidents increased to 1,890 in 2016 from 1,813 in 2015, and increased from the 2006–2015 average of 1,508. In 2016, the TSB also received 396 voluntary reports.[2] Fatalities totalled 118 in 2016, up 5.4% from the 2015 total of 112, but down 23.4% from the 2006–2015 average of 154.

[1] While the TSB's operations are for the 2016-17 fiscal year, occurrence statistics are for the 2016 calendar year, unless otherwise indicated. Please note that, in a live database, the occurrence data are constantly being updated. As a result, the statistics can change slightly over time. Comparisons are generally for the last five or ten years. For definitions of terms such as accident, incident, and occurrence, see Appendix B.

[2] "Voluntary reports" refer to all occurrences reported to the TSB that are not required to be reported under the *Transportation Safety Board Regulations*.

Figure 1. Reported occurrences



Investigations

In fiscal year 2016-17, the TSB launched investigations for 47 of the reported occurrences. During that period, 44 investigations were completed, compared with 48 in the previous year.[3] The number of investigations in progress at the end of the fiscal year increased to 72 from 65 at the start. The average time to complete an investigation was 569 days in fiscal year 2016-17, compared to the previous five-year average of 508 days. The increase in average time is due in part to efforts made during the year to complete some older investigations.

Table 1. Investigations at a glance 2016-17

	Marine	Pipeline	Rail	Air	Total
Investigations started	13	2	12	20	47
Investigations completed	7	0	17	20	44
Average number of days to complete investigations	438	n/a	519	656	569
Recommendations	5	0	1	14	20
Safety advisories	5	1	12	2	20
Safety information letters	11	0	19	0	30

[3] Investigations are considered complete after the final report has been issued. See Appendix A for a list of reports released by the TSB in 2016-17 by sector.

Figure 2. Investigations

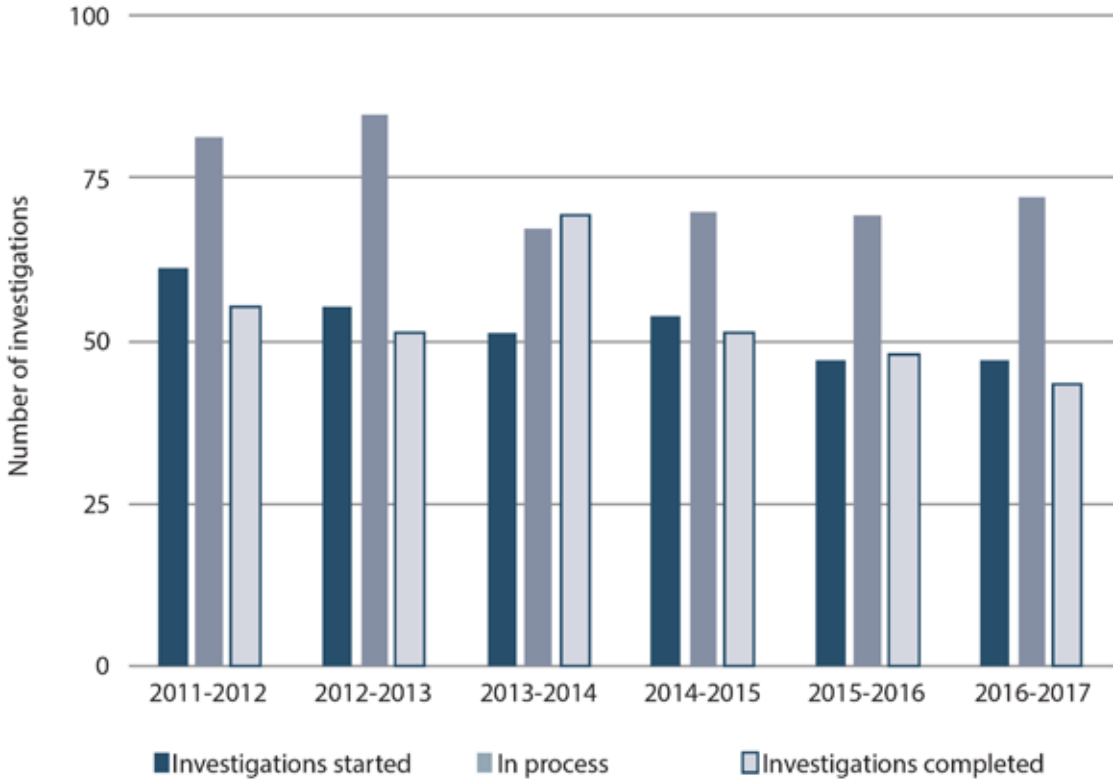
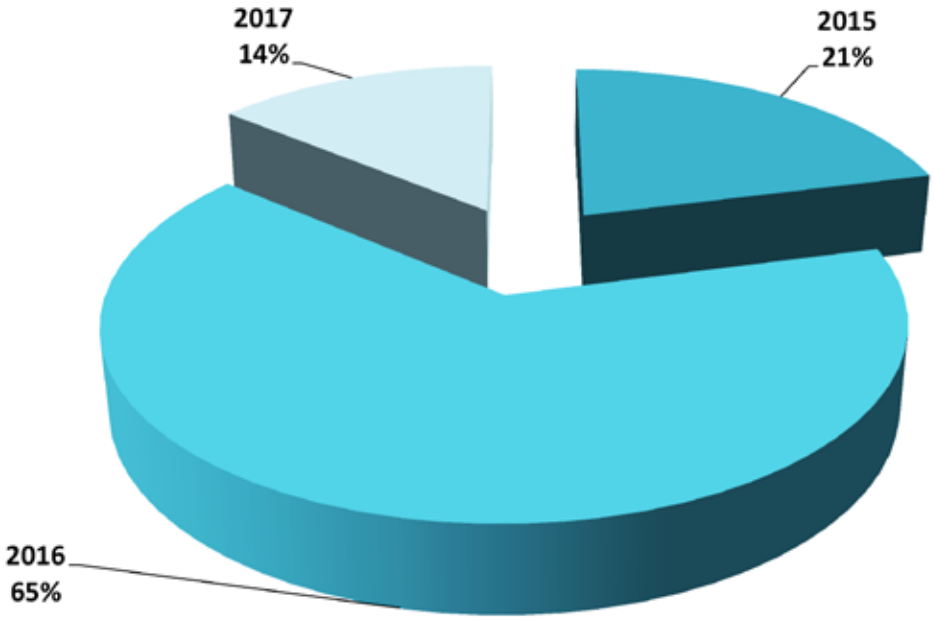


Figure 3 represents a baseline of where the TSB is in relation to its caseload. In future years this metric will be used to illustrate progress the TSB is making on managing its workload.

Figure 3. Investigations in progress by occurrence year as of 31 March 2017



Safety communications

In 2016-17, in addition to investigation reports, the TSB issued a total of 71 safety communications[4], including 20 recommendations, 20 safety advisories, 30 safety information letters, and 1 safety concern.

Information is one key TSB deliverable. Our investigations determine the causes and contributing factors that led to an occurrence. As the TSB identifies safety issues, it doesn't wait until the end of an investigation to alert industry and government change agents. Safety information is provided to stakeholders throughout the investigation, allowing them to take immediate action—a common practice for industry and government.

For example, the Marine Branch issued a Marine Safety Information letter regarding a man-overboard fatality on a fishing vessel. It noted that, in Canada, falling overboard is the second highest cause of fatality in the fishing industry. Previous TSB investigations have found that, in many cases, crew members on small fishing vessels do not practice man overboard drills. Furthermore, many small fishing vessels do not carry re-boarding devices. This information was provided to the owner of the vessel for any actions considered appropriate in the circumstances.

The Rail Branch issued a Rail Safety Advisory letter on emergency egress from hi-rail vehicles (road vehicles that can travel on a track). Such a vehicle was travelling on a track when it encountered an opposing train. About five seconds prior to impact, the hi-rail vehicle was stopped and the three occupants were able to exit and move to a safe location. However, during the emergency egress, the person occupying the rear seat discovered that the rear door locks were in the locked position. The vehicle's door locks had operated automatically, but had to be unlocked manually. This revealed a situation where emergency egress can be hindered by a vehicle safety feature. CN discussed the issue of safe egress from hi-rail vehicles with its Engineering Services personnel. Also, the Railway Association of Canada shared this information with other member railways that operate hi-rail vehicles with similar automatic door lock features.

The Air Branch was performing a routine analysis of information gathered from an incident in Manitoba involving a training aircraft. The analysis detected a component failure in one of the flight controls used in the manufacture of a number of aircraft models built by the manufacturer. The Air Branch issued a Safety Advisory to TC indicating that current inspection procedures may not be adequate in light of the risks associated with the failure of that component on the subject aircraft.

Table 2. Safety communications

Sector	Recommendations	Safety advisories	Safety information letters	Safety concerns
Marine	5	5	11	0
Pipeline	0	1	0	0
Rail	1	12	19	1
Aviation	14	2	0	0
TOTAL	20	20	30	1

[4] See Appendix B for the definition of each of the TSB's safety communications.

Board assessments of responses to recommendations

Under the *Canadian Transportation Accident Investigation and Safety Board Act*, a federal minister who is notified of a TSB recommendation must, within 90 days, advise the Board in writing of any action taken or proposed to be taken, or of the reasons for not taking action. The Board carefully considers each response, assessing the extent to which the safety deficiency is addressed, and provides its rating of the response and its reasoning soon after. The TSB continues to publish its yearly reassessments of industry and government responses to its recommendations.

Since 1990, the Board has issued a total of 586 recommendations. Many of these recommendations have led to positive change. As of 31 March 2017, over 76% of the responses to Board recommendations have achieved the Board's highest rating of **Fully Satisfactory**, indicating that change agents have taken action that will substantially reduce the safety deficiency. Another 6% were assessed as **Satisfactory Intent**, indicating that change agents have taken action or plan to take action that, when fully implemented, will substantially reduce the safety deficiency.

In 11% of cases, a rating of **Satisfactory in Part** was issued, which means change agents have taken or plan to take action that will only partially address the deficiency. Of the remaining 6.4% of responses, 4.4% received a rating of **Unsatisfactory**, as change agents have not taken, and do not plan to take, action that will address the deficiency or planned action is taking too long. In some cases, the TSB has received insufficient information to be able to assess the response, while other recommendations are too new and have not been assessed at this time.

Our goal is a safer transportation system for everyone. In last year's annual report, the stated goal was to have 80% of the responses to TSB recommendations assessed as **Fully Satisfactory** by March 2017. Considering that 20 new recommendations were issued in the 2016-17 fiscal year, we came close to hitting that mark (79%). While there has been some progress in all modes, aviation continues to lag the rest. Too many safety issues persist and that is why the TSB included TC's slow progress in addressing outstanding recommendations on the TSB Watchlist in 2016.

Table 3. Board assessments of responses to recommendations, 1990–2017

	Marine	Pipeline	Rail	Air	Total Recommendations	%
Fully Satisfactory	128	20	127	172	447	76.3
Satisfactory Intent	5	0	10	22	37	6.3
Satisfactory in Part	10	0	7	47	64	10.9
Unsatisfactory	4	0	0	22	26	4.4
Unable to Assess	0	0	0	6	6	1.0
Not Yet Assessed	5	0	1	0	6	1.0
Number of recommendations	152	20	145	269	586	100.0

Figure 4. Board assessments of responses to all recommendations, 1990–2017

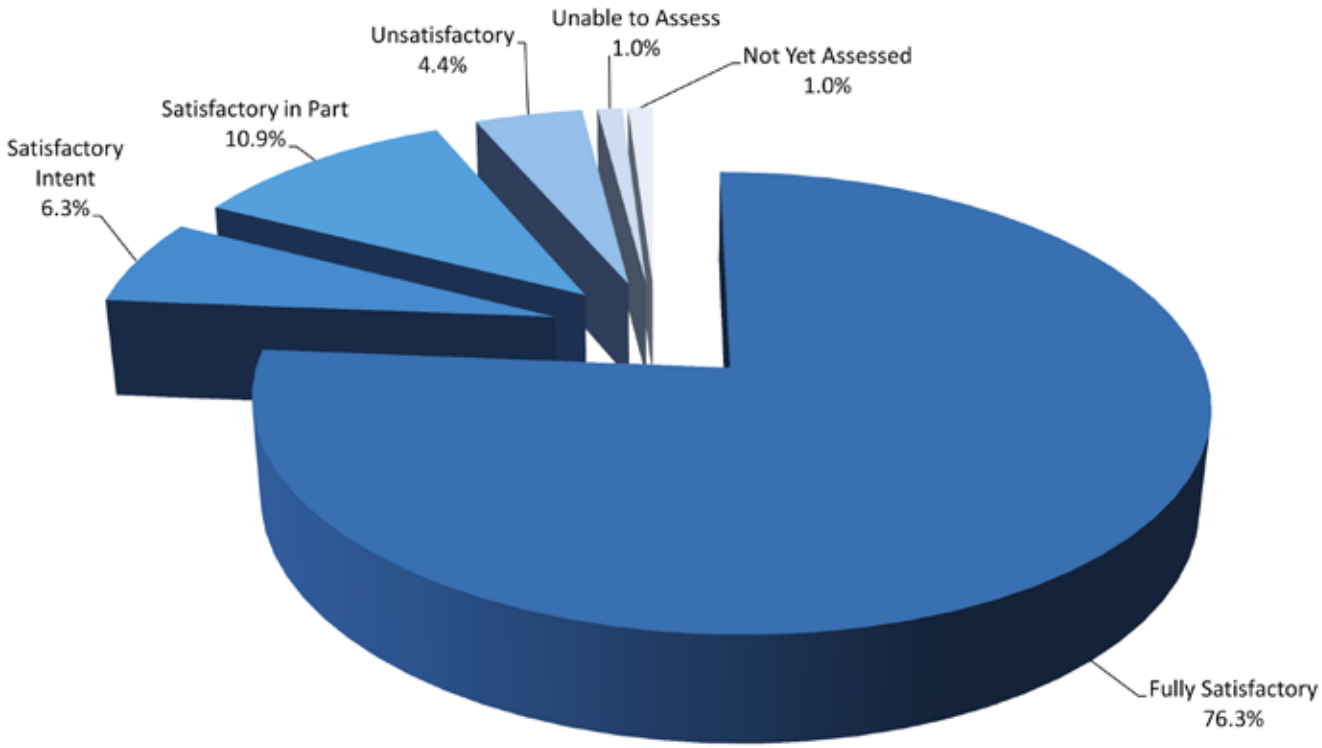
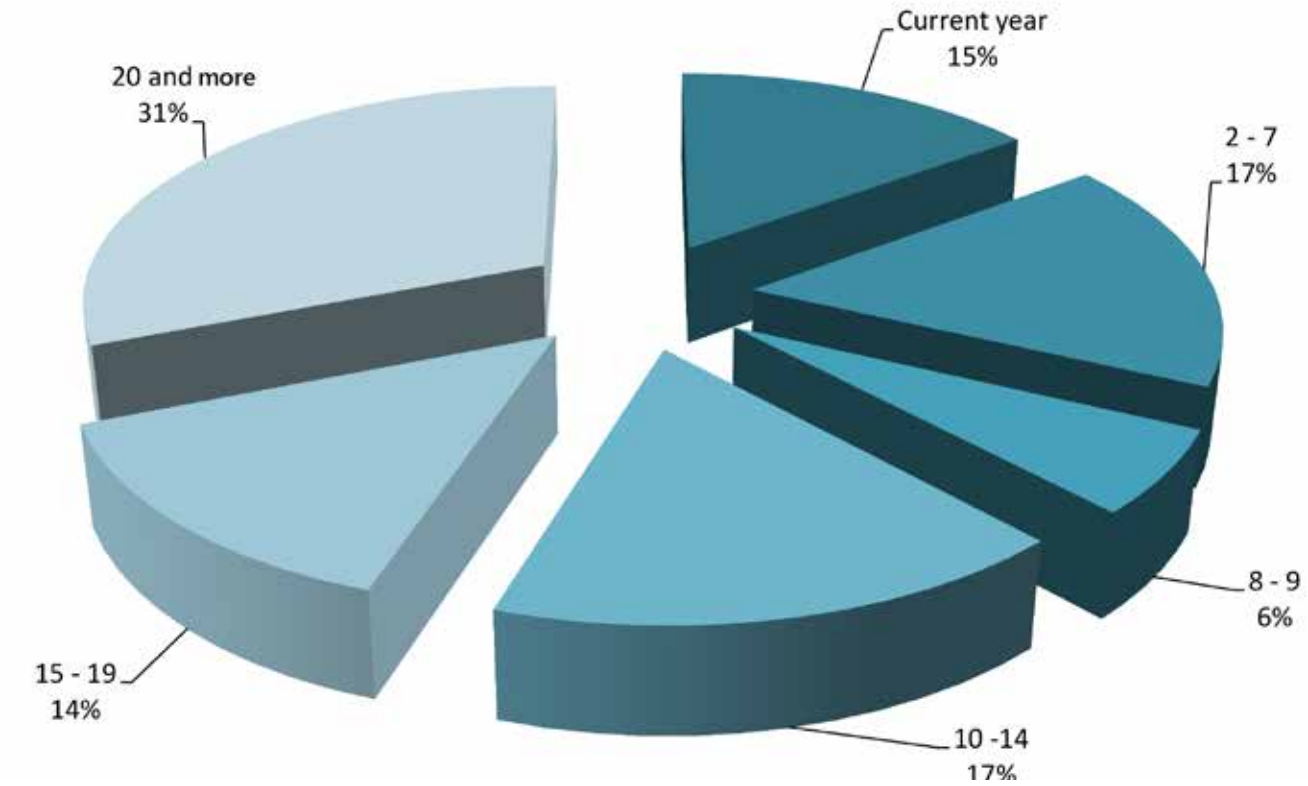


Table 4. Recommendations requiring action as of March 31, 2017[5]

Number of years recommendations have been outstanding	Marine	Pipeline	Rail	Air	Total
Current year (2016 - 2017)	5	0	1	14	20
2 - 7 (2010 - 2015)	2	0	11	10	23
8 - 9 (2008 - 2009)	1	0	0	7	8
10 - 14 (2003 - 2007)	5	0	2	17	24
15 - 19 (1998 - 2002)	2	0	2	15	19
20 and more (1997 or earlier)	7	0	1	34	42
Total	22	0	17	97	136

Figure 5. Number of years since outstanding recommendations have been issued, as of 31 March 2017



[5] The recommendations discussed in Table 4 include active and dormant recommendations as of March 31, 2017.

Communicating transportation safety

Communicating by the numbers

Mentions in the media

Among over **5,000** broadcast news clips and articles on transportation safety in 2016-17,

3,111 directly mentioned the TSB.

Media enquiries

Our media hotline received **1,098** enquiries this year, down from 1,417 in 2015-16.

Social media

An ever-expanding number of viewers and followers led to

YouTube:

we reached over

727K

lifetime views

nearly a quarter of a million more than last year

Flickr:

lifetime photo views reached

5.9M

over 400,000 new views this year

Total Twitter followers increased to

18.8K

an increase of more than 20%

Web metrics

Our web pages provide the latest information on all of our work and are the primary source for accurate information.

Total page views:	Total users:	Total sessions:
513,919	102,482	162,209

Communications products

A full range of products to inform Canadians and the industries we cover about what matters most in transportation accident investigation and safety.

58	73	8
news releases	deployment notices	media events

Statistics

The TSB Macro-Analysis team responded to 250 requests for transportation occurrence database information. This is a 6% decrease from last year, suggesting that the public and the news media are finding what they need from the annual and monthly statistical reports and data files on our website—in keeping with the Government of Canada's Open Government Policy.

Watchlist 2016

Every two years, the TSB updates its Watchlist, which identifies the key safety issues that need to be addressed to make Canada's transportation system even safer. The update also reflects progress that has been made and identifies new issues that have emerged. Watchlist 2016 is supported by hundreds of accident investigations, thousands of hours of research, and dozens of TSB recommendations. It features the addition of two new issues. The first, **Fatigue management systems for train crews**, has been a factor in numerous railway investigations, most notably regarding freight train operations.

The second, TC's **Slow progress addressing TSB recommendations**, is something that affects all aspects of the transportation network, with potentially adverse outcomes. When Watchlist 2016 was published on 31 October, there were 52 active TSB recommendations that had been outstanding for 10 years or more. Over three dozen of those had been outstanding for more than twenty years. The other eight Watchlist issues are holdovers from previous Watchlists, a clear indicator that TC and stakeholders within the transportation industry must up their game and act in concert to address critical issues.

One previous issue, railway-crossing safety, was removed from the list. In 2014, TC introduced its new *Grade Crossings Regulations* and associated standards. TC's joint efforts with railway companies, road authorities, local communities, Operation Lifesaver and other stakeholders have yielded results and the long term trend (since 2007) for crossing accidents is on the decline.

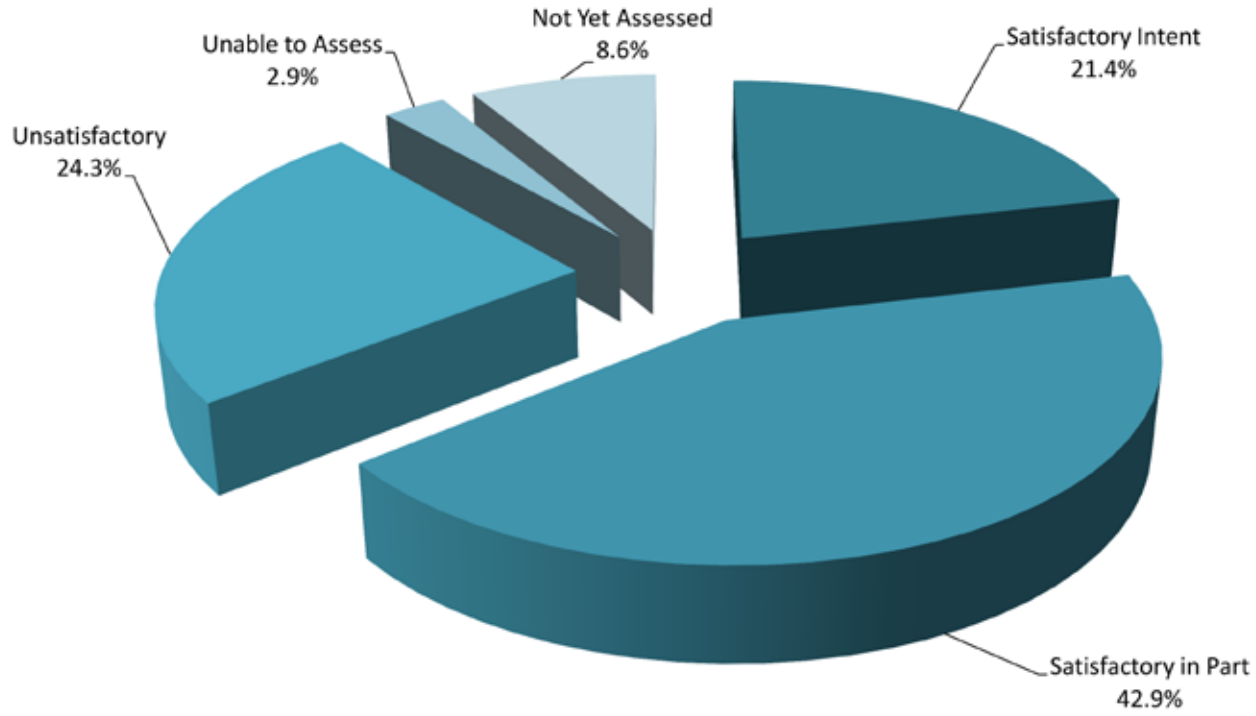
The following is a summary of the issues that persist on the Watchlist, and where more needs to be done.

Table 5. Board assessments of responses to outstanding recommendations supporting Watchlist 2016[6]

Rating	Marine	Pipeline	Rail	Air	Total
Satisfactory Intent	4	0	5	7	16
Satisfactory in Part	5	0	2	24	31
Unsatisfactory	4	0	0	13	17
Unable to Assess	0	0	0	2	2
Not Yet Assessed	5	0	1	0	6
Total	18	0	8	46	72

[6] The recommendations discussed in Table 5 are a subset of the total number of recommendations issued by the TSB as represented in Table 4 and Figure 5.

Figure 6. Ratings of assessed responses to outstanding recommendations supporting Watchlist 2016[7]



Marine

Loss of life on fishing vessels

Although fish harvesters have long known that their job carries risks, one disturbing statistic stands out: on average, over the last 10 years (2007-2016) there have been 10 fatalities per year involving fishing vessels.[8] Over the same period there were approximately 46,000 commercial fishermen employed per year. This represents a high potential risk of death in that population and is a persistent example of something that must change. The TSB is convinced work aboard commercial fishing vessels in Canada can be safer. In fact, in the four years since the TSB released its 2012 report into fishing safety in Canada[9], a dialogue has started to take place. Whether they're on the wharf or at association meetings, many fishermen are more often making safety issues top of mind. However, while industry response has been encouraging, growing awareness has not yet translated into a significant reduction in the number of serious accidents. The risk to fishermen remains high.

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[7] Figure 6 represents a subset of the recommendations enumerated in Table 5.

[8] TSB Annual Statistics—2016

[9] M09Z0001—*Safety Issues Investigation into Fishing Safety in Canada*, 28 June 2012

Rail

Transportation of flammable liquids by rail

Despite recent downward trends, the volume of flammable liquids transported by rail is expected to remain significant. Current railway operating practices, combined with the vulnerability of older tank cars used to transport crude oil and other flammable liquids, are not adequate to mitigate effectively the risks posed by the transportation of large quantities of these products. Railway companies must conduct thorough route planning and analysis, and perform risk assessments to ensure that risk control measures are effective. In addition, more robust tank cars must be used when large quantities of flammable liquids are transported by rail.

Following railway signal indications

When a train crew does not respond appropriately to a signal indication, a train collision or derailment can occur and result in significant risk to the train crew, the public, and the environment. The train crew is required to identify and communicate the signal indications among themselves, and then take required action to safely operate the train. Existing administrative defenses are inadequate, particularly in situations where the train crew misinterprets or misperceives a signal indication. What is needed to make train operations in signaled territory safer are additional physical defenses that ensure signals are consistently recognized and followed.

On-board video and voice recorders

Objective data is invaluable in helping investigators understand the sequence of events leading to an accident. Human factors, including crew performance, have been identified as an underlying safety issue in a number of railway accident investigations. Many of these investigations would have benefitted from a recording of crew communications and crew interactions that occurred immediately prior to the accident. If permitted, locomotive voice and video recorders (LVVR) could also provide railways with a means to identify and address operational and human factors issues within a proactive safety management system. Voice and video recorders should be installed on all lead locomotives operating on main track.

Fatigue management systems for train crews

Fatigue is pervasive in today's society, especially in the transportation industry. Since 1994, sleep-related fatigue has been identified as a contributing factor or as a risk in 23 TSB railway investigations, with 19 of them involving operating crew members on freight trains. Since 1995, a number of working groups have studied the issue of fatigue in the railway industry, but limited action has been implemented. To address this issue, TC must complete its review of railway fatigue management systems. In addition, TC and the railways must implement further actions to effectively mitigate the risk of fatigue for operating crew members on freight trains.

Aviation

Unstable approaches

Every year, there are millions of successful landings on Canadian runways. Unstable approaches, however, significantly increase the risk of accidents during the landing phase of flight—accidents that can result in aircraft damage, injuries, and even fatalities. The tools being used by some airlines to improve flight crew compliance include flight data monitoring, flight operations quality assurance programs, explicit standard operating procedures, and non-punitive go-around policies. However, major airlines need to expand the use of these tools, evaluate them to confirm that they are effective at reducing the number of unstable approaches continued to landing, and integrate them fully into their safety management systems. Despite recent work by industry and TC, the TSB remains concerned that, without further action, risks to the public arising from unstable approaches remain.

Runway overruns

There are millions of successful landings on Canadian runways each year. However, accidents do occur during the landing phase of flight, or if a takeoff is rejected. These accidents can result in aircraft damage, injuries, and even loss of life—and the consequences can be particularly serious when there is no adequate safety area at the end of the runway. Studies and work done by TC has not been enough to mitigate the risks and accidents involving runway overruns continue to occur. Pilots must receive timely information about runway surface conditions; TC must require appropriate runway end safety areas (RESAs); and, Canadian airports must invest in RESAs or other engineered systems and structures to safely stop aircraft that overrun. The TSB remains concerned that without these actions, risks to the public remain.

Risk of collisions on runways

There remains an ongoing risk of aircraft colliding with vehicles or other aircraft on the ground at Canadian airports, a situation industry calls an "incursion." Given the millions of take-offs and landings each year, incursions are relatively rare, but their consequences could be catastrophic. Since the TSB first placed this issue on its Watchlist in 2010, the number of these occurrences has remained at approximately one a day or more. Despite the fact that the Board has clearly identified this as an issue, not enough has been done to improve procedures and adopt enhanced collision-warning systems.

Multi-modal

Safety management and oversight

Some transportation companies are not managing their safety risks effectively, and many are not required to have formal safety management processes in place. TC oversight and intervention have not always been effective at changing companies' unsafe operating practices. All transportation companies are responsible for managing safety risks in their operations. Regulations alone cannot foresee all risks unique to a particular operation. That is why the TSB has repeatedly emphasized the advantages of safety management systems (SMS), an internationally recognized framework to allow companies to effectively manage risk and make operations safer. SMS has been on the TSB Watchlist since 2010. Since then, there has been only limited progress on expanding the application of SMS to a broader range of companies. Numerous recent investigations have found companies that have not managed their safety risks, either because they were not required to have an SMS or because their SMS was not implemented effectively. The move toward an SMS regime also has to be supported by appropriate regulatory oversight. Regulators will encounter companies with varying degrees of ability or commitment to manage risk effectively, so this oversight must be balanced: it needs to include proactive auditing of companies' safety management processes, ongoing education and training, and traditional inspections to ensure compliance with existing regulations.

Slow progress on addressing TSB recommendations

From its creation in 1990 until 31 March 2017, the TSB made 586 recommendations aimed at fixing high-risk, systemic safety deficiencies in the marine, pipeline, rail and air modes of transportation. Most of these recommendations were addressed to TC. While TSB recommendations are non-binding, the relevant minister (in most cases, the Minister of Transport) is required by law to respond to the TSB on what, if any, action will be taken to address the underlying safety deficiency. In many cases, TC has replied positively to the recommendations and agreed with the safety deficiency identified by the TSB but has not taken timely action to address it. TSB investigations have, time after time, uncovered safety deficiencies that were the subject of recommendations in previous investigations but that were simply not addressed. In many cases, TC action to address TSB recommendations is too slow. In light of this, TC must make a clear commitment to take action on the outstanding TSB recommendations with which it agrees, and, the Government of Canada must improve and accelerate the process for taking action on safety-related recommendations.

Outreach program

The TSB engaged in 114 outreach events this year, a 16% decrease from 2015-16. To influence uptake on TSB recommendations this year, the TSB implemented a more targeted approach, prioritizing outreach to stakeholders that are in a position to help resolve persistent safety deficiencies, outstanding recommendations, and Watchlist issues.

Many of the outreach activities undertaken by the TSB resulted from invitations by industry and regulators. The TSB also sought out strategic opportunities to give speeches, attend or hold meetings, provide information articles to newspapers and magazines, provide facility tours, and give presentations to a variety of stakeholders such as government regulators, foreign investigative bodies, operators, industry associations, first responders, and training institutions, as well as to the public. In addition to the roster of annual opportunities for outreach, each branch developed specific outreach action plans to prioritize audiences and then delivered focused messaging on safety issues and items of importance to achieving the TSB mandate.

In the Marine Branch, for instance, emphasis was again placed on fishing vessel safety. TSB representatives held meetings with federal and provincial regulators and with provincial occupational health and safety organizations to discuss the various challenges associated with commercial fishing safety. The discussions focused on provincial and federal responsibilities, as well as what actions are required to promote workplace safety in the fishing industry. A safety poster was also produced and distributed in fishing communities across the country.

Priorities in the Rail Branch were linked to Watchlist issues of fatigue, the transportation of flammable liquids by rail, following railway signal indications and on-board voice and video recorders. To promote the adoption of safe practices and uptake of TSB recommendations, a TSB Board member and Rail Branch officials met with a number of organizations including the Railway Association of Canada and its members, the International Railway Safety Council, and various short-line railways across the country.

Pipeline investigators participated in a number of scheduled emergency exercises in 2016. These exercises help both investigators and industry participants to understand their respective roles and responsibilities in responding to a pipeline occurrence.

In the Aviation Branch, outreach priorities focused on the Watchlist issues - risk of collisions on runways, runway overruns, and unstable approaches. TSB officials met with and provided information to TC, airport authorities across Canada, industry associations, and large and small airline operators in Canada.

Board members and Executive Committee members were also very active on outreach files. Combined they undertook 58 opportunities to promote the TSB and its issues to a wide variety of government, industry and other stakeholders. For example, TSB Board members and the Chief Operating Officer met with senior officials from NAV CANADA to discuss the air and multimodal Watchlist issues. The Chair of the TSB attended the Air Transport Association of Canada Annual Conference to discuss Watchlist aviation issues. As well, the Chair of the TSB and members of the management team hosted a visit of a delegation from the People's Republic of China, and presented a speech to the International Society of Air Safety Investigators and the Nordic Investigation Group.

In the years ahead, the TSB will look for new opportunities and new partners with an interest in transportation safety. It will build on the relationships it forms through outreach activities and leverage them to increase uptake of its recommendations.

New safety poster for commercial fishing industry

SECURITAS

The TSB operates a program called SECURITAS that enables transportation employees and the Canadian public to report, in confidence, unsafe transportation acts and conditions that they have observed.

Confidential reporting

While employees are urged to use existing internal company-specific safety reporting systems, not all transportation companies have systems in place, and even when companies do, employees may not feel comfortable using them. SECURITAS offers an additional way for people to share safety concerns in the marine, pipeline, railway, and aviation industries in absolute confidence and without fear of reprisal.

How the TSB handles reports

When the TSB receives a confidential report, a designated modal TSB Trusted Agent will analyze the information, communicate with the reporter, and determine the appropriate action to be taken. The TSB may forward information to the appropriate regulatory authority for follow-up. The TSB may also contact specific transportation organizations, companies, or agencies directly if they are the ones best placed to address the problem. The TSB may also choose to launch its own investigation or issue a formal safety communication. However, the TSB will not take any action that might reveal the reporter's identity. The identity of the person making a report to SECURITAS always remains confidential.

Activities

A total of 194 SECURITAS reports were received in 2016-17. All were carefully assessed: 34 pertained to topics outside the scope of the TSB SECURITAS mandate. In those cases, the reporters were contacted and informed and, where appropriate, suggestions were made for them to contact the appropriate organizations.

Including cases that remained open from the previous year, 142 cases were closed this year and 25 remain open for follow-up. Where information pertained to an ongoing TSB investigation, it was communicated to the appropriate investigator-in-charge. In other cases, the information provided by the reporter was communicated in confidence either to TC, to the operator mentioned in the report, or to the appropriate organization for follow-up.

Of the 25 SECURITAS cases that remained open at the end of the period, 13 pertained to Marine, eight to Rail and four to Aviation.

Table 6. SECURITAS confidential reports

Sector	Marine	Pipeline	Rail	Air	Total
Number of reports received in 2016-17	31	0	68	95	194
Outside TSB mandate	5	0	8	21	34
Cases closed	20	0	52	70	142
Cases remaining open as of 31 March 2017	13	0	8	4	25

Results

Marine sector

In 2016-17, 31 marine-related reports were received through the SECURITAS program. This represents a 33% increase compared to last year. Five reports were considered to be outside the TSB mandate and 20 cases were closed. At the end of the reporting period, 11 of the cases reported in 2016-17 remained open, along with two reports from 2015-16.

Ten of the reports dealt with regulatory matters and were resolved in collaboration with regional TC offices, and another nine were reported to TC but remain open. Two of the reports contained confidential information related to reportable occurrences or were part of an ongoing investigation. Nine reports concerned a similar safety issue, which resulted in a deployment. Twenty of the 24 safety issues validated by the Trusted Agent were closed at the end of the year. One report resulted in the production of a Marine Safety Information letter described below.

Availability of wharf specifications and operational requirements

It was reported that the aft portion of a vessel extended past the end of a wharf by approximately 60 metres. Consequently, additional mooring lines were used on the stern. Contrary to standard practice, the stern lines were arranged almost parallel to the longitudinal axis of the vessel and were pointing forward.

This unusual mooring configuration was not subject to a formal risk assessment. The effectiveness and safety of the configuration had been deemed compliant following an ad hoc, undocumented approval process carried out by the harbour master.

This situation was analyzed as part of the TSB's SECURITAS program. After collecting and analyzing the available data, the TSB found that some technical information and specifications relating to port facilities were unavailable to the various stakeholders in the marine industry who use this information to standardize practices and procedures. The absence of a formal risk assessment, documented procedures, and strict limitations specific to marine operations in the port, was also identified by the TSB as an unsafe condition. Stakeholders were notified.

Validation of safety issue—passenger ferry

It was reported through SECURITAS that a passenger ferry had a number of safety issues including concerns about: the propulsion set-up, the safe manning, the passenger accounting, and the certification of the seafarers on board. Due to the number of reports, and the fact that the reports came from several reporters, the TSB deployed two investigators to validate the nine safety issues reported. The team that deployed identified some safety issues, which were rectified immediately, while on board. The overall risk of the operation, based on the reports to SECURITAS and the results of the deployment, is still being assessed. Although the reports are still open, discussions are planned with the parent company, and have been completed with the operators.

Pipeline sector

As with the previous reporting period, there were no pipeline issues raised through the SECURITAS program in 2016-17.

Rail sector

In 2016-17, the SECURITAS program received 68 rail-related reports. This represents a 36% decrease compared to last year. Eight were outside the mandate of the TSB SECURITAS program. Some 52 cases were closed, and eight remained open at the close of the period.

A total of 23 safety communication products were issued as a direct result of these reports. The TSB Trusted Agent communicated directly with TC for 14 of those reports and directly with the operator on nine others. Another eight reports were resolved directly with the reporter. Some of the common issues reported included fatigue for train crew members, inspection and maintenance of locomotives, railway crossings, unauthorized pedestrian access, and bridge substructure conditions. The following are examples of cases that led to follow-up and/or safety action.

Degradation of railway bridge substructure conditions

SECURITAS received a report alleging that a railway bridge was in immediate need of inspection and repair, particularly with respect to the bridge substructure. After verifying the details with the reporter, the TSB issued a Rail Safety Information letter to TC. The TSB was informed that TC performed a site inspection and reviewed the bridge inspection reports from the operator. Following the inspection, TC issued a Letter of Concern to the operator relating to the bridge conditions, including the spalling concrete on the underside of the structure. The operator indicated that the immediate concerns with the railway bridge were addressed and that permanent repairs were being scheduled.

Unsafe pedestrian actions at occupied crossings

SECURITAS received a report indicating that, on a number of occasions, pedestrians had been climbing over stationary equipment that was blocking a crossing. After verifying the information with the reporter, the TSB issued a Rail Safety Information letter to TC. The TSB was informed that TC inspectors closely monitored the crossing for several months. The operator has modified operations for some trains to minimize the amount of time the crossing would be blocked during the morning peak traffic.

Aviation Sector

In 2016-17, 95 aviation-related reports were received through the SECURITAS program. This represents a 57% increase compared to last year. Twenty-one cases were outside the mandate of the TSB SECURITAS program. In total, 70 reports were closed and four remained open at the end of 2016-17. Of the submissions received, 42 referred to topics for which a current *Canadian Aviation Regulations* (CARs) is in place and for which regulatory requirements exist. These reports covered a variety of issues including: low-flying helicopters; unmanned aerial vehicles (UAV); cabin-safety-related issues, such as carry-on baggage and passenger intoxication; airport safety; and, an in-flight near miss. None of these reports required the publication of a safety communication product. The following are examples of reports TSB-Trusted Agents resolved.

UAV

Incidents regarding recreational UAV operators in and around a harbour caused concern for the reporter. The submission was forwarded to TC in confidence. TC provided information regarding the regulatory proposal and awareness campaign underway to address this issue. This information was then relayed to the reporter who was satisfied with the actions in place.

Safety concern regarding dripping water in aircraft

The reporter was on board a flight when he noticed, on takeoff, a significant stream of water dripping from the overhead baggage and ceiling area onto cabin seats. The water stopped about 10 minutes into the flight. When he advised the crew of the issue, he was told that it was a result of condensation and that it was normal. Although the explanation was plausible, the reporter felt that the response given was not appropriate given the seriousness of the situation. The reporter wanted to report this situation so that the "normal" presence of water from condensation on board this type of aircraft was investigated and risks managed by applying appropriate mitigations. The submission was relayed to TC for further investigation and follow-up with the reporter.

Approach and landing in minimal weather

The reporter was a passenger on a flight to a destination where she reports weather was known to be an issue. She had discussed the situation with one of the pilots before departure and was advised that if unable to land, they would return to the departure airport. She reports the last 30 minutes of the flight as being rough, with passengers getting sick and anxious. The reporter felt that the pilot put passengers' safety at risk when deciding to land in those conditions. She also reported that other companies had cancelled their flights to that destination due to weather. This information was relayed to TC, who in turn informed the operator. Since the reporter did not request to remain anonymous, the operator contacted her directly with the results of their investigation on the issue. The reporter was advised by both TC and the operator that the pilots were operating within the regulatory and manufacturer's limits.

Marine sector

Making safety a priority from coast to coast

Marine sector

Annual statistics

In 2016, 304 marine accidents were reported to the TSB, up from the 2015 total of 248, but down from the 2006–2015 average of 327. Over the past 10 years, 83% of marine accidents were shipping accidents, while the remainder were accidents aboard ship.

There were 261 shipping accidents in 2016, up 23% from the 2015 total of 213, but down 4% from the 2006–2015 average of 272.

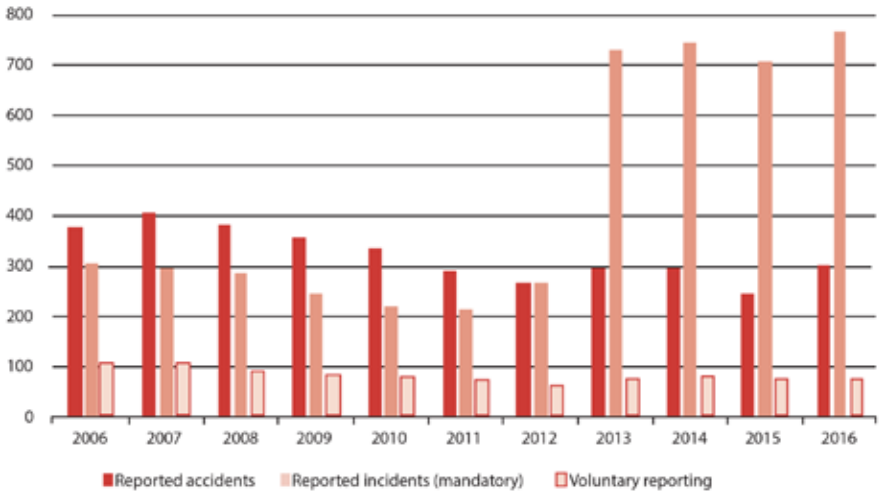
In 2016, there were 43 accidents aboard ship, up from 35 in 2015 but down from the 2006–2015 average of 56. The largest number of accidents aboard ship occurred on fishing vessels (42%) and cargo vessels (28%).

There were seven marine fatalities in 2016, down from 19 fatalities in 2015, and down from the annual average of 18 in 2006–2015. Six of these fatalities were "shipping accident fatalities" and they resulted from just two fishing vessel accidents in 2016. Also, that total (six fishing vessel fatalities) was down from the annual average of 11 fishing vessel fatalities in 2006–2015. There were no "accident aboard ship fatalities" on fishing vessels. The only "accident aboard ship fatality" occurred aboard a commercial non-fishing vessel.

In 2016, there were 768 marine incidents reported in accordance with the TSB mandatory reporting requirements, up from 708 in 2015, and up from the annual average of 404 in 2006–2015.

The increase in the number of incidents since 2013 is likely related to clarification of the threshold used to classify engine/rudder/propeller incidents in order to obtain a better understanding of related safety issues, and to new TSB regulations, effective 01 July 2014, which clarified the reporting requirements for a total failure of any machinery or technical system (and incorporated engine/rudder/propeller incidents into that category).

Figure 7. Marine occurrences

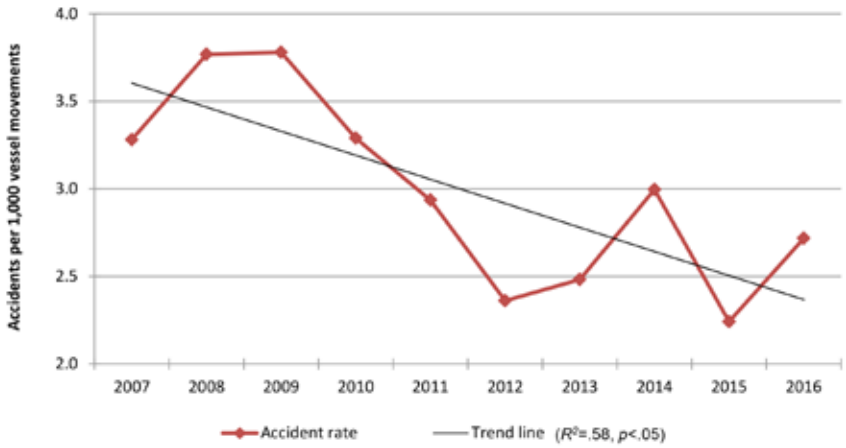


Accident rate

One indicator of marine transportation safety in Canada is shipping accident rates for Canadian-flag commercial vessels (Figure 8). According to information provided by TC, marine activity for Canadian commercial non-fishing vessels over 15 gross tons (GT) (excluding passenger vessels and cruise ships) decreased by 3% from the 2006–2015 average. The 2016 accident rate was 2.7 accidents per 1,000 movements, down from the 10-year average of 3.0. There has been a significant downward trend in the accident rate for Canadian commercial non-fishing vessels over the past 10 years. Marine activity for foreign commercial non-fishing vessels decreased 3% from the 2006–2015 average, and the accident rate decreased to 1.0 accident per 1,000 movements from the ten-year average of 1.5.

Figure 8. Canadian-flag commercial shipping accident rate

Vessel movements for 2012-2016 are estimated (Source: Transport Canada)



Investigations

In 2016-17, 13 marine investigations were started, and seven were completed. On average, investigations were completed in 438 days, below the target of 450 days.

Table 7. Marine investigations at a glance

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Investigations started	9	12	12	12	10	13
Investigations completed	7	10	13	12	15	7
Average number of days to complete investigations	504	522	458	435	406	438
Recommendations	2	0	0	0	0	5
Safety advisories	8	5	6	6	1	5
Safety information letters	6	6	7	12	11	11

Marine highlights

Fishing vessel safety continued to be top of mind in the Marine Branch. One investigation lone yielded five safety recommendations. Most of the seven marine investigation reports released in 2016-17 are related to Watchlist issues.

Fishing vessel sinking—*Caledonian* (M15P0286)

On 5 September 2015, the fishing vessel *Caledonian* capsized 20 nautical miles west of Nootka Sound, British Columbia. At the time, the vessel was trawling for hake with four crew members on board. Following the capsizing, the master and mate climbed onto the overturned hull but they abandoned it as it sank. The mate swam toward and boarded the life raft, which had become free after the ship sank. The Canadian Coast Guard subsequently rescued the mate and recovered the bodies of the master and the two other crew members.

The investigation determined that the capsizing of the *Caledonian* was caused by a combination of factors. The most significant ones were the operating practices, such as the location of stored fuel, the way fish and seawater were loaded, and the tendency of vessels to grow heavier over time. These factors caused the vessel to float lower in the water and reduced its stability, which changed its safe operating limits. The crew did not realize that the vessel had changed and grown heavier over the years or that their operating practices were putting them and the vessel at risk.

Including this occurrence, the TSB has investigated 28 fishing vessel occurrences in the past 10 years resulting in 26 fatalities in commercial fishing in Canada. This investigation uncovered persistent stability issues, similar to many other investigations. That is why the TSB is recommending that all commercial fishing vessels, large and small, have their stability assessed; and that this stability information be kept up to date and be presented in a way that is clear and useful for the crew. (*Recommendations M16-01, M16-02, and M16-03*)

Although PFDs are not mandatory, TSB investigations have shown that wearing a PFD increases the chance of surviving a marine emergency, including falling overboard.

Over time, PFDs have evolved into more comfortable, less cumbersome products. Nationally, despite these improvements, efforts

M15P0286

to inform fishermen of their benefits through product information and safety training have not yet resulted in universal acceptance of wearing PFDs. (*Recommendations M16-04 and M16-05*)

Fishing vessel sinking—*CFV 130214* (M15A0189)

On 16 June 2015, the small fishing vessel *CFV 130214* was reported overdue from a fishing trip in Placentia Bay, Newfoundland and Labrador. The Joint Rescue Coordination Centre-Halifax initiated a search of the area. The next day, search and rescue personnel recovered the three deceased crew members on Bar Haven Island. The vessel was not found and is believed to have sunk.

With only a few weeks left in the fishing season and none of his crab quota filled, the master was under increased pressure to fish. The master had modified a smaller secondary vessel, a 7.1-metre open boat, to use for crab fishing while his primary vessel was under repair, but the modifications were not assessed or tested for stability. The investigation found that the added weight from the modifications, combined with the weight of the crew members, bait, ice, and the catch on board would have significantly reduced the vessel's freeboard, making it more susceptible to taking on water, with a negative impact on the vessel's stability. Deteriorating weather and sea conditions put the heavily loaded vessel at further risk of taking on water.

To lease another vessel, the master would have had to formally ask the Department of Fisheries and Oceans (DFO) for an exemption from the Fisheries Licensing Policy for the Newfoundland and Labrador Region. It could not be determined why the master did not do so, or whether the request would have been approved. It also could not be determined whether the master fully understood that an exemption was an option or how he might have obtained one. The investigation found that there was no information about the exemption on the DFO website or in any other publication. If information about the fisheries licensing policy is not disseminated proactively to fishermen, they may not seek approval to use the safest means available to them to go fishing, thereby increasing the risk to safe fishing operations.

Recommendations and progress

The Board reassessed responses to 13 active recommendations in March 2017. Following the Board reassessments, the ratings were as follows: four **Satisfactory Intent**, five **Satisfactory in Part**, and four **Unsatisfactory**. Three of the **Unsatisfactory** reassessments were due to TC not having finalized its *Small Fishing Vessel Inspection Regulations, Fishing Vessel Safety Regulations*, and the *Navigation Safety Regulations*. The other **Unsatisfactory** is due to TC not agreeing to amend its proposed *Safety Management Regulations* to include domestic operators of passenger vessels less than 24 meters in length.

A recommendation concerning provincial responsibilities for workplace safety on fishing vessels will be reviewed as soon as all provinces have submitted their information. Eight of the 10 provinces have workplace legislation that is applicable to fishing vessels. The provinces that do not are New Brunswick and Prince Edward Island where workplace legislation continues to define workplaces in such a way that the province has no jurisdiction over fishing vessels. As part of the outreach strategy and pursuant to the launch of Watchlist 2016, the TSB visited senior officials in New Brunswick and Prince Edward Island to highlight the need for their provincial governments to take action and implement legislation to include fishermen under their provincial workplace legislation.

Five new marine safety recommendations were issued in 2016-17.

Recommendation M16-01

The Canadian fishing vessel fleet includes about 145 vessels that are greater than 150 gross tonnage, like the Caledonian, which are regulated under the Large Fishing Vessel Inspection Regulations and are required to undergo stability assessments and have stability booklets produced. However, these regulations do not address the regular monitoring of vessel lightship weight and do not include standards or guidelines to ensure that vessel-specific stability information is provided and that it is adequate for use by fishermen. The Board therefore recommends that

the Department of Transport establish standards for all new and existing large fishing vessels to ensure that the stability information is adequate and readily available to the crew.

TSB Recommendation M16-01

Board assessment of TC's response to Recommendation M16-01

Not yet assessed—Active

Recommendation M16-02

Under the *Small Fishing Vessel Inspection Regulations* (SFVIR), a portion of small fishing vessels have been required to undergo stability assessments and have stability booklets produced. However, the SFVIR do not address the regular monitoring of vessel lightship weight and do not include standards or guidelines to ensure that adequate vessel-specific stability information is provided for the use of fishermen.

In July 2016, in response to TSB Recommendation M94-33 and numerous others relating to fishing vessel stability, TC published, in the *Canada Gazette*, Part II, regulations to create new *Fishing Vessel Safety Regulations* (FVSR) and replace the SFVIR. However, these new regulations do not address the regular monitoring of vessel lightship weight or the provision of adequate stability information for small fishing vessels that had stability booklets produced under the old regulations. The Board therefore recommends that

the Department of Transport establish standards for all small fishing vessels that have had a stability assessment to ensure their stability information is adequate and readily available to the crew.

TSB Recommendation M16-02

Board assessment of TC's response to Recommendation M16-02

Not yet assessed—Active

Recommendation M16-03

In total, small fishing vessels represent approximately 99% of the entire Canadian fishing fleet of 23 878 registered vessels. For the majority of these small fishing vessels, there is no requirement to have stability assessments or for crew to be provided with adequate stability information based on a stability assessment.

When developing the FVSR, TC included a requirement for all new and existing commercial fishing vessels greater than nine metres in length to have a stability assessment. However, during public consultations, industry stakeholders considered the proposal to be impractical and an undue financial burden. As a result, TC amended the stability requirements so that only new vessels greater than nine metres in length will be required to have a stability assessment.

When the FVSR take effect in July 2017, they will leave a significant portion of the existing small fishing vessel fleet, as well as new vessels less than nine metres, at risk.

The TSB believes that it will take focused and concerted action by federal and provincial government agencies and industry members to finally and fully address the safety deficiencies that persist in Canada's fishing industry. The Board therefore recommends that

the Department of Transport require that all small fishing vessels undergo a stability assessment and establish standards to ensure that the stability information is adequate and readily available to the crew.

TSB Recommendation M16-03

Board assessment of TC's response to Recommendation M16-03

Not yet assessed—Active

Recommendations M16-04 and M16-05

Fishermen often operate in harsh physical and environmental conditions. They harvest, load, transfer, and store their catch while the vessel is in various sea conditions, and the risk of going overboard is high. If a fisherman ends up in the water, the consequences can be fatal. The **Safety Issues Investigation M09Z0001** identified falling overboard as the second highest cause of death in the fishing industry. Between 1999 and 2010, there were 41 fatalities (3.4 per year) resulting from fishermen falling overboard, which accounts for 27% of the total fatalities for that same time period. From 2011 to 2015, there were 26 fatalities (5.2 per year) resulting from fishermen falling overboard, which accounts for 53% of the total fatalities for that same time period. This represents a significant increase in the number of fatalities from fishermen falling overboard each year. In British Columbia, since 2006, the TSB has determined that in approximately 70% of all fishing-related fatalities no personal flotation device (PFD) was used.

TSB investigations have shown that wearing a PFD increases the chance of surviving a man overboard situation, and the capsizing and loss of life aboard the fishing vessel Caledonian (M15P0286) is yet another example. Both the master and the mate survived the capsizing of the vessel and were able to climb onto the overturned hull. But by the time the vessel sank, only the mate, who had been wearing a PFD while working on deck before the capsizing, was able to swim to the life raft. The master had not been wearing one, and the speed of the capsizing prevented the donning of a PFD, immersion suit, or lifejacket, resulting in the master drowning.

Despite risk-based regulations and industry initiatives to change behaviours and create awareness about the importance of wearing PFDs, as well as design improvements by PFD manufacturers to address

fishermen's concerns about comfort and constant wear, there has not been a significant change in the behaviour of fishermen and many continue to work on deck without wearing a PFD.

The TSB believes that the implementation of explicit requirements for fishermen to wear PFDs, along with appropriate education and enforcement measures, will significantly reduce the loss of life associated with going overboard. The Board therefore recommends that

WorkSafeBC require persons to wear suitable personal flotation devices at all times when on the deck of a commercial fishing vessel or when on board a commercial fishing vessel without a deck or deck structure and that WorkSafeBC ensure programs are developed to confirm compliance.

TSB Recommendation M16-04

the Department of Transport require persons to wear suitable personal flotation devices at all times when on the deck of a commercial fishing vessel or when on board a commercial fishing vessel without a deck or deck structure and that the Department of Transport ensure programs are developed to confirm compliance.

TSB Recommendation M16-05

Board assessment of TC's response to Recommendations M16-04 and M-16-05

Not yet assessed—Active

Pipeline sector

Contributing to a strong safety record on federally regulated pipelines for over a quarter century

Pipeline sector

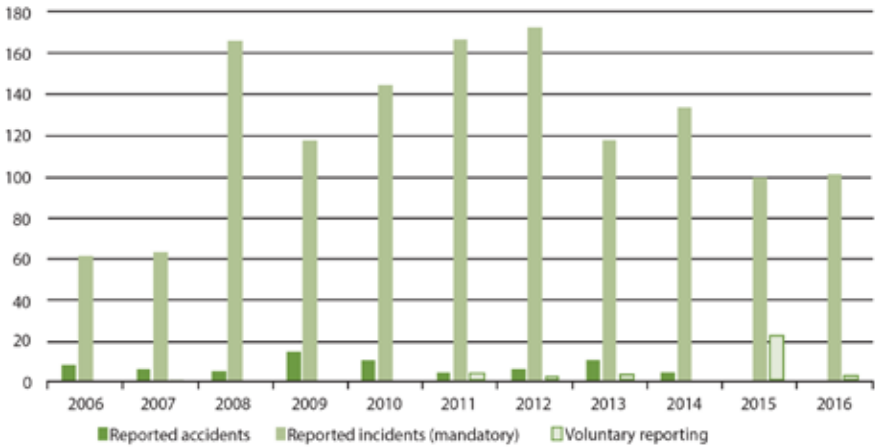
Annual statistics

No pipeline accidents were reported to the TSB in 2016, the same as in 2015, and down from the annual average of eight in the previous 10-year period (2006–2015).

There have been no fatal accidents on a federally regulated pipeline system directly resulting from the operation of a pipeline since the inception of the TSB.

In 2016, 101 pipeline incidents were reported to the TSB, similar to the 100 reported in 2015, but down from the annual average of 116 in the previous 10 years (2006–2015).

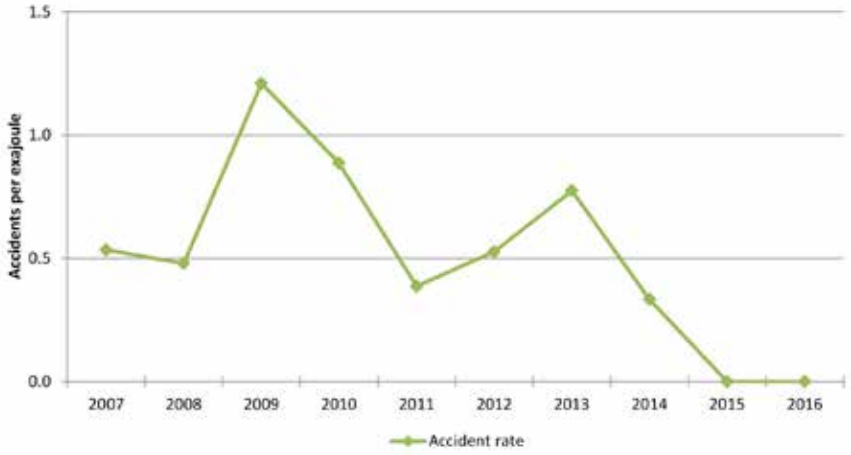
Figure 9. Pipeline occurrences



Accident rate

One indicator of pipeline transportation safety in Canada is the pipeline accident rate (Figure 10). According to data provided by the National Energy Board (NEB), pipeline activity increased by 1% from 2015. The 2016 rate was 0 pipeline accidents per exajoule,[10] the same as in 2015, and down from the annual average of 0.4 in 2011–2015.

Figure 10. Pipeline accident rate
Exajoules are estimated (Source: National Energy Board)



[10] One exajoule = 10^{18} joules. A joule is a unit of work or energy equal to the work done by a force of 1 newton acting through a distance of 1 metre.

Investigations

In 2016-17, two pipeline investigations were started, and no investigations were completed.

Table 8. Pipeline investigations at a glance

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Investigations started	0	3	2	0	0	2
Investigations completed	1	0	2	1	2	0
Average number of days to complete investigations	404	n/a	402	665	650	n/a
Recommendations	0	0	0	0	0	0
Safety advisories	1	0	1	0	0	1
Safety information letters	0	2	0	0	1	0

Pipeline highlights

While no pipeline accidents were reported to the TSB in the fiscal year 2016-2017, investigators did follow up on some pipeline incidents resulting in safety communication between the TSB and the industry regulator, the NEB.

Overpressure occurrences on the Grande Prairie Mainline Loop

Between August 2016 and September 2016, there were three overpressure occurrences on the Grande Prairie Mainline Loop which is operated by NOVA Gas Transmission Limited. There were two other overpressure occurrences on this pipeline in July 2015. The NEB had previously imposed a pressure restriction of 6760 kPa on this pipeline in December 2014.

In each of these five occurrences, the overpressure situation had resulted from an unplanned compressor outage. Although it is recognized that unplanned outages can and do occur, pipelines should be operated in such a way that unplanned events are mitigated in a timely manner to prevent overpressure situations. The TSB sent a Pipeline Safety Advisory to the NEB stating that, given the potential consequences of overpressure occurrences on pipelines, the NEB may wish to ensure that pipeline operators are implementing appropriate mitigating measures to prevent overpressure situations on de-rated pipelines.

As a follow-up to these occurrences, the NEB confirmed that the pipeline company had conducted in-line tool inspections and excavations to verify the integrity of its pipeline. The NEB also indicated that it had recently created a System Operations Business Unit to systematically monitor and analyze trends such as repeated over-pressure events. This oversight activity will enhance the NEB's ability to better understand and address the causal factors associated with this type of occurrence.

Recommendations and progress

No pipeline safety recommendations were issued in 2016-17. With all of the TSB's pipeline recommendations rated as **Fully Satisfactory,** no responses to recommendations were reassessed.

Rail sector

Influencing changes that improve the safety of the Canadian railway system

Rail sector

Annual statistics

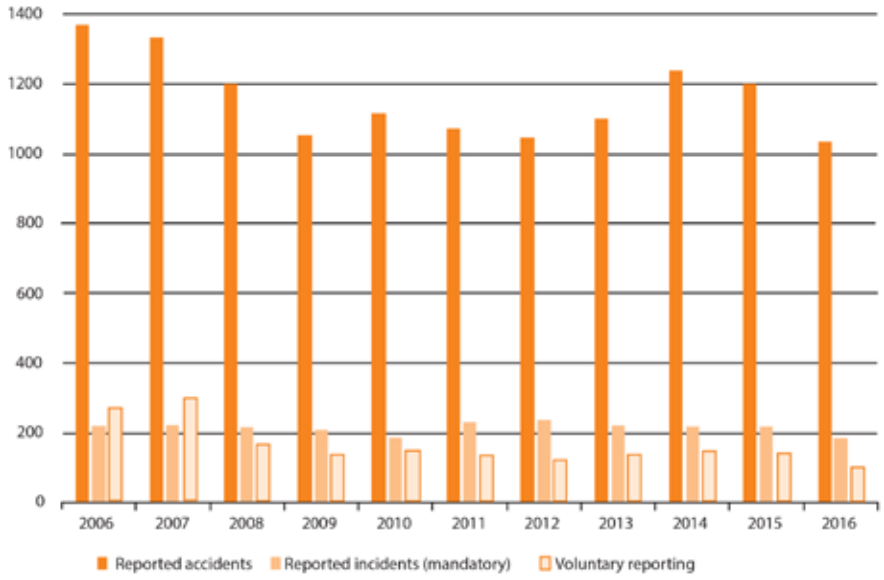
In 2016, 1,035 rail accidents were reported to the TSB, a 14% decrease from the 2015 total of 1,201, and a 12% decrease from the 2006–2015 average of 1,173.

Accidents involving dangerous goods totalled 108 in 2016, down from the 2015 total of 145 and down from the 10-year average of 151. Of these accidents, one resulted in a dangerous goods release in 2016, down from the 2015 total of six and the ten-year average of four. The single accident with a dangerous goods release resulted in a release of gasoline.

Rail fatalities totalled 66 in 2016, up from the 46 recorded in 2015 but down from the 10-year average of 78. Crossing fatalities totalled 19 in 2016, up from 15 in 2015 but down from the ten-year average of 25. There were 47 trespasser fatalities in 2016, up from 30 the previous year but comparable to the 10-year average of 46. In 2016, no rail employee was fatally injured working on or around the track structure, down from the ten-year average of two.

In 2016, there were 188 reported rail incidents, down from the 216 incidents recorded in 2015, and down from the 10-year average of 218. Movement exceeding the limit of authority (71% of reportable incidents) continues to be the main incident type since 2007, followed by dangerous goods leakers (16%).

Figure 11. Rail occurrences



Accident rate

An indicator of rail transportation safety in Canada is the main-track accident rate (Figure 12). According to data provided by TC, rail activity on main track increased by 0.6% from the previous year. The main-track accident rate in 2016 was 2.8 accidents per million main-track train miles, down from 3.0 in 2015, but up from the ten-year average of 2.5.

Figure 12. Main-track accident rate

Main-track train-miles are estimated (Source: Transport Canada)

Investigations

A total of 12 rail investigations were started in 2016-17, and 17 investigations were completed, including one Class 4 investigation. The average duration of completed Class 2 and 3 investigations was 517 days, down from the 2015-16 average of 525 days but above the previous five-year average (470 days).

Table 9. Rail investigations at a glance

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Investigations started	17	12	17	16	15	12
Investigations completed	19	16	12	16	12	17
Average number of days to complete investigations	488	409	435	494	525	519
Recommendations	0	0	6	2	5	1
Safety advisories	9	4	17	16	20	12
Safety information letters	18	14	24	5	20	19

Rail highlights

A number of rail investigations concluded in 2016-17 were related to Watchlist issues, and some others were related to track and operational issues.

Canadian Pacific (CP) Railway train exceeding its limits of authority (R15V0046)

The TSB investigation into the March 2015 occurrence near Cranbrook, British Columbia, involving a CP Railway train that exceeded its limits of authority focused on the lack of familiarity of the train crew with the territory and on misinterpreted communications. In this occurrence, the train had travelled on the main track for about five miles without authorization. There were no conflicting movements.

When communicating with the assistant trainmaster while approaching Cranbrook, the train crew misinterpreted information relating to cautionary limits at Cranbrook. These events occurred at about 0200, a time of day that is close to a known circadian low point when alertness can be compromised. During periods of reduced alertness, there is an increased risk of inadvertent errors such as the misinterpretation of communications.

Although qualified for their respective positions, the train crew, consisting of three CP management employees, was not familiar with the territory. The investigation identified that, if railway management employees who operate trains are not sufficiently familiar with the territory, the limits of operating authority may not be consistently observed, increasing the number of occurrences and risks. Following this occurrence, CP redesigned Cranbrook Yard as a siding. The cautionary limits at the yard were removed and an adjacent subdivision was combined to operate as one. In addition, CP formalized a requirement for territory familiarization for management crews.

Derailment of a Canadian National (CN) Railway crude oil unit train (R15H0013)

The TSB investigation into the February 2015 derailment of a CN crude oil unit train near Gogama, Ontario, determined that joint bars in the track had failed leading to the accident. Pre-existing fatigue cracks in the joint bars at this location had gone unnoticed in previous inspections. Once the fatigue cracks reached a critical size, the combination of cold temperatures (-31°C) and repetitive impacts from train wheels passing over the joint caused the joint bars to fail. These defects went undetected due to insufficient training and supervisory support of the assistant track supervisor.

As a result of the derailment, 29 tank cars of petroleum crude oil derailed and 19 of these breached, releasing 1.7 million litres of product. The crude oil ignited, resulting in fires that burned for five days. The lack of thermal protection on the tank cars contributed to thermal tears in those cars located in the pool fire. The cars in this train were Class 111 tank cars built to the newer CPC-1232 standard. Although this standard requires the cars to have additional protective equipment, the speed of the train had a direct impact on the severity of the tank car damage. Of note is the fact that the train had been travelling at 38 mph, which is below the 40 mph speed limit in place at the time.

Recommendations and progress

The Board reassessed responses to 15 active recommendations and one dormant recommendation of the 145 issued since 1990. The Board's reassessments were communicated to change agents for information and action.

Of the 15 active rail recommendations at the end of the fiscal year, four were assessed as **Satisfactory in Part**, 10 were assessed as having **Satisfactory Intent**, and one was still to be assessed.

One new rail safety recommendation was issued in 2016-17.

Recommendation R17-01

The severity of the outcome in any derailment is directly related to train speed and other factors. One of the ways that the rail industry manages the risk of derailment is through the reduction of train speed. Train speed is restricted based on the class and the condition of the track. When additional track maintenance is required on the track, slow orders can be implemented to further restrict train speed. This is a regular practice in the industry.

While train speed contributes to the severity of outcome in any derailment, other factors also play a role including train length, the cause of the derailment, the position of the first car(s) derailed, the position of the tank cars in the train and tank car safety design. Although managing train speed based on the condition of the track will help minimize the severity of outcome in the event of a derailment, the risk profile of each train should also be considered.

To some extent, TC has recognized the role that train speed and train risk profile plays in severity of the outcome of a derailment, and has put some measures in place to limit the speed of "key trains" under certain conditions. The TC-approved *Rules Respecting Key Trains and Key Routes* restrict "key trains" to a maximum speed of 40 mph within the core and secondary core of Census Metropolitan Areas. Although the restrictions contained in the rules were a step forward at the time issued, the current maximum speed of 40 mph was selected without being validated by any engineering analysis.

The Board is concerned that the associated train speed and residual risk may be too high for some "key trains." Therefore, the Board recommends that

the Department of Transport conduct a study on 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.

TSB Recommendation R17-01

R15H0013

Board assessment of TC's response to Recommendation R17-01

Not yet assessed—Active

Aviation sector

Pushing for change—and safer operations—for all Canadians

Aviation sector

Annual statistics

In 2016, 229 aviation accidents were reported to the TSB, a 9% decrease from the 2015 total of 251 and a 19% decrease from the 10-year average of 283. Of the total, 199 involved Canadian-registered aircraft (excluding ultra-lights), a 12% decrease from the 2015 total of 227, and a 19% decrease from the 10-year average of 244. The 199 accidents involved 203 Canadian-registered aircraft, including 170 aeroplanes (43 commercially operated), 27 helicopters, four gliders, one gyroplane, and one rotary wing unmanned aerial system (UAS).

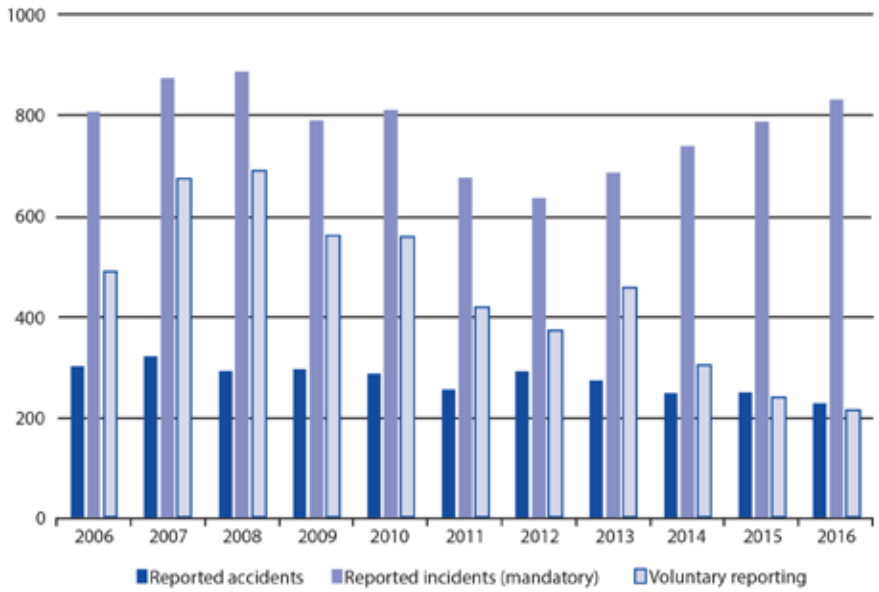
In 2016, 24 fatal accidents involved Canadian-registered aircraft other than ultra-lights, comparable to last year's total of 23, and lower than the 10-year average of 28. The number of fatalities (34) was lower than the 2015 total of 40, and lower than the 10-year average of 51.The number of serious injuries (16) was lower than the 2015 total of 29 and the 10-year average of 36.

In 2016, eight accidents involved foreign-registered aircraft in Canada, with one fatal accident resulting in seven fatalities.

In 2016, 833 incidents were reported in accordance with the TSB mandatory reporting requirements. This is a 6% increase from the 2015 total of 789, and an 8% increase from the 10-year average of 770.

The increase is consistent with a regulation change that became effective 01 July 2014, which reduced the minimum commercial aircraft weight threshold for reportable incidents to 2,250 kg from 5,700 kg.

Figure 13. Aviation occurrences

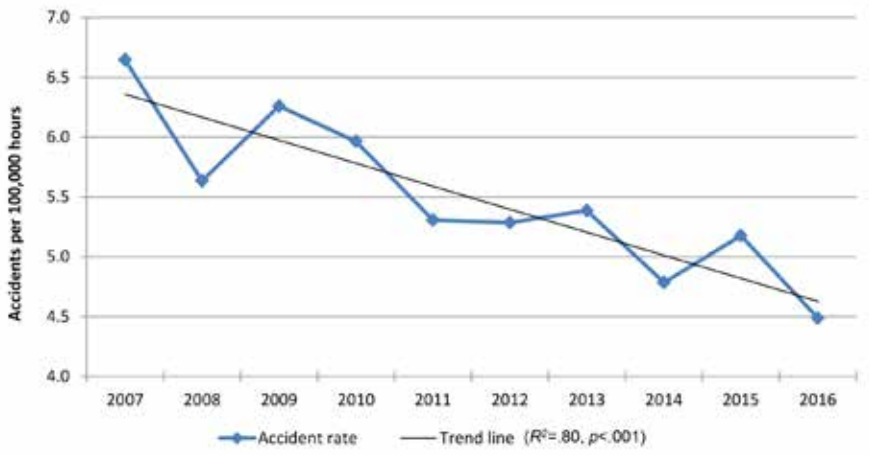


Accident rate

One indicator of aviation transportation safety in Canada is the aircraft accident rate (Figure 14). According to data provided by TC, the estimate of flying activity for 2016 is 4,301,000 hours. The accident rate in 2016 was 4.5 accidents per 100,000 flying hours—down from the 2015 rate of 5.2. There has been a significant downward trend in the accident rate for Canadian-registered aircraft over the past 10 years.

Figure 14. Canadian-registered aircraft accident rate

2012–2016 hours flown are estimated (Source: Transport Canada)



Investigations

A total of 20 new investigations were started in 2016-17, and 20 investigations were completed, of which 19 were class 3 and one was class 2. This represents an increase in the number of investigations completed compared to the previous year (19). The average duration of completed investigations was 656 days, up from the 2015-16 average of 548 days and above the previous five-year average (555 days).

Table 10. Aviation investigations at a glance

	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Investigations started	35	28	20	23	21	20
Investigations completed	28	26	42	22	19	20
Average number of days to complete investigations	447	549	639	546	548	656
Recommendations	0	2	4	0	2	14
Safety advisories	5	5	1	4	1	2
Safety information letters	0	2	0	3	1	0

Aviation highlights

Watchlist issues continued to present themselves in some of the 20 aviation investigations completed on 2016-17. Three investigations in particular highlighted persistent Watchlist issues. The first two involved circumstances where TC did not provide adequate oversight to a company that was unable to effectively manage safety. The third involved an unstable approach accident that led to the aircraft touching down short of the runway threshold.

Controlled flight into terrain (A13H0001)

In its investigation report into the fatal May 2013 collision with terrain involving an Ornge Rotor-Wing (RW) helicopter, the TSB identified organizational, regulatory and oversight deficiencies as contributing factors to the occurrence. The investigation uncovered several issues. The night visual flight rules regulations do not clearly define "visual reference to the surface", while instrument flight currency requirements do not ensure that pilots can maintain their instrument flying proficiency. At Ornge RW, training, standard operating procedures, supervision and staffing in key safety/supervisory positions did not ensure that the crew was ready to conduct the challenging flight into an area of total darkness. The training and guidance provided to TC inspectors led to inconsistent and ineffective surveillance of Ornge RW, as inspectors did not believe they had the tools needed to bring a willing but struggling operator back into compliance in a timely manner, allowing unsafe practices to persist.

As a result of risks to the aviation system found during this investigation, the Board issued 14 recommendations to address deficiencies in the areas of regulatory oversight, flight rules and pilot readiness, and aircraft equipment (see Recommendations and progress section for the list of recommendations).

Forced landing following fuel exhaustion (A13Q0098)

An investigation of the June 2013 forced landing of a Beechcraft King Air 100 determined that fuel exhaustion led to the forced landing. The TSB also identified deficiencies in the pilot's performance and the company's supervision of flights, as well as weaknesses in TC's process for approving operators' appointments of operations management personnel and in the regulatory oversight of flight operations.

A13H0001

Safety management and oversight is a persistent Watchlist issue. As this occurrence demonstrates, some transportation companies are not effectively managing their safety risks. The Board has been calling on TC to implement regulations requiring all operators in the aviation industry to have formal safety management processes, and for TC to oversee the effectiveness of these companies' safety management processes.

Impact with terrain on approach (A15O0015)

The investigation conducted into the February 2015 landing accident involving a de Havilland DHC-8 found that the continuation of an unstable approach following a loss of visual reference led to the aircraft contacting the surface short of the runway at the Sault Ste. Marie Airport.

The investigation found that a significant power reduction and subsequent decrease in airspeed, while flying below the minimum stabilization height of 500 feet, resulted in an unstable approach, that the rapidly changing weather decreased the flight crew's visibility of the runway, and that the steepened vertical profile created as a result of the power reduction went unnoticed, and uncorrected.

Although the loss of visual reference required a go-around, the flight crew continued the approach.

An examination of over 500 similar flights on Jazz DHC-8 showed that company aircraft routinely fly decelerating approaches below the minimum stabilization height of 500 feet. If approaches that require excessive deceleration below established stabilization heights are routinely flown, then there is a continued risk of an approach or landing accident.

Unstable approaches are one of the key safety issues on the TSB's Watchlist 2016. There is also an outstanding Board recommendation (A14-01) calling for TC to require commercial air services to monitor and reduce unstable approaches that continue to a landing.

A13Q0098

Recommendations and progress

In 2016-17, the Board assessed responses to all new recommendations made this year and reassessed responses to 26 of the recommendations issued since 1990. Movement on some of these recommendations remains slow, which prompted the TSB to add the issue **Slow progress addressing TSB recommendations** to the Watchlist.

Of the 40 recommendations, the status of one recommendation has been changed to **Fully Satisfactory**. Five were assessed as **Unable to Assess** as the responses provided by the stakeholders did not include enough information or detail to properly evaluate the changes that would result from the proposed actions, if any; 21 have been assessed as **Satisfactory Intent**; four as **Satisfactory in Part**; and nine have an **Unsatisfactory** rating.

Fourteen new aviation safety recommendations were issued in 2016-17. All of these recommendations (A16-01 to A16-14) were issued as part of the investigation (A13H0001) into the fatal collision with terrain involving an Ornge Rotor-Wing Helicopter in May 2013.

Among those 14 recommendations, seven are related to emergency locator transmitters (A16-01 to A16-07). For the full text of each recommendation, see the investigation report A13H0001.

Recommendation A16-01

Since 2005, the International Civil Aviation Organization (ICAO) standards no longer require the use of 121.5 MHz emergency locator transmitters (ELT). Instead, the ICAO standards require the use of 406 MHz ELTs. As well, since February 2009, Cospas-Sarsat, which is Canada's primary means for search and rescue alerting, detection and response, no longer monitors 121.5 MHz ELTs, and is only capable of detecting and locating 406 MHz ELTs. Despite the above, current regulations in Canada only mandate the use of 121.5 MHz ELTs. As a result, Canadian-registered aircraft and foreign aircraft operating in Canada that require installation of an ELT are permitted to operate with ELTs whose distress signals cannot be detected by the international Cospas-Sarsat system.

According to TC, more than half of all Canadian-registered aircraft that require an ELT are being operated with an ELT whose signal is not detectable by the Cospas-Sarsat system.

If the regulations are not amended to reflect the ICAO standards, it is highly likely that flight crews and passengers will be exposed to potentially life-threatening delays in search and rescue services following an occurrence. Therefore, the Board recommends that

> *the Department of Transport require all Canadian-registered aircraft and foreign aircraft operating in Canada that require installation of an emergency locator transmitter (ELT) to be equipped with a 406 MHz ELT in accordance with International Civil Aviation Organization standards.*
>
> **TSB Recommendation A16-01**

TC's response to Recommendation A16-01

TC indicated that it agrees with this recommendation and has started the regulatory process to mandate the carriage of 406 MHz ELTs for Canadian-registered aircraft and foreign aircraft operating in Canada that require the installation of an ELT. TC anticipates these regulations to be published in 2017.

Board assessment of TC's response to Recommendation A16-01

TC's regulatory changes could substantially reduce or eliminate the safety deficiency. However, at this time and until the new regulatory changes are implemented, the action is not sufficiently advanced to reduce the risks to transportation safety. The Board therefore assessed TC's response as having **Satisfactory Intent**.

Recommendation A16-02

It is highly likely that aircraft equipped with ELT systems that meet the current design standards will continue to be involved in occurrences in which potentially life-saving search and rescue services will be delayed as a result of damage to the ELT system, decreasing the survivability of an accident. Therefore, the Board recommends that

the International Civil Aviation Organization establish rigorous emergency locator transmitter (ELT) system crash survivability standards that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.

TSB Recommendation A16-02

ICAO's response to Recommendation A16-02

ICAO indicated that it is currently participating in a working group to review Cospas-Sarsat ELT requirements and to develop technical standards for both first- and second-generation Cospas-Sarsat 406 MHz ELTs. These technical standards will include antenna, cabling, and crash safety specifications, in order to update industry specifications ED-62A and DO-204A. This work is expected to be completed by December 2017.

ICAO is also coordinating closely with the International Cospas-Sarsat Programme on the development of second-generation ELT specifications to enhance the effectiveness of the ELT. These specifications are expected to be completed by 2018. Consequential amendments to Annex 10 should also be conducted after completion of these projects.

Board assessment of ICAO's response to Recommendation A16-02

The Board is encouraged by ICAO's involvement in the working group and its work with Cospas-Sarsat on the development of second-generation-ELT specifications. The Board considers that these changes, once fully implemented, will substantially reduce or eliminate the safety deficiency. The Board therefore assesses this response as having **Satisfactory Intent.**

Recommendation A16-03

It is highly likely that aircraft equipped with ELT systems that meet the current design standards will continue to be involved in occurrences in which potentially life-saving search and rescue services will be delayed as a result of damage to the ELT system, decreasing the survivability of an accident. Therefore, the Board recommends that

the Radio Technical Commission for Aeronautics (RTCA) establish rigorous emergency locator transmitter (ELT) system crash survivability specifications that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.

TSB Recommendation A16-03

Federal Aviation Administration (FAA) (on behalf of RTCA)'s response to Recommendation A16-03

In 2013, the RTCA Program Management Committee established Special Committee SC-229, "406 MHz Emergency Locator Transmitters (ELTs)", to develop a Minimum Operational Performance Standard (MOPS) for second-generation ELTs. As part of the terms of reference, the committee is developing cabling, antenna, and crash safety specifications for first- and second-generation ELTs. Special Committee SC-229 is expected to publish the revised MOPS in March 2018. The FAA will provide an updated response 60 days after the MOPS is published.

Board Assessment of FAA's response to A16-03

The Board is pleased to hear that the committee is developing cabling, antenna, and crash safety specifications for first- and second-generation ELTs, and that a specific deadline has been set for the completion of this work. Although it is a step in the right direction, the Board will only be able to determine if the new standards will reduce the likelihood of an ELT becoming inoperable after an accident once they have been implemented. The Board therefore assesses this response as having **Satisfactory Intent**.

Recommendation A16-04

It is highly likely that aircraft equipped with ELT systems that meet the current design standards will continue to be involved in occurrences in which potentially life-saving search and rescue services will be delayed as a result of damage to the ELT system, decreasing the survivability of an accident. Therefore, the Board recommends that

the European Organisation for Civil Aviation Equipment (EUROCAE) establish rigorous emergency locator transmitter (ELT) system crash survivability specifications that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.

TSB Recommendation A16-04

EUROCAE's response to Recommendation A16-04

EUROCAE Working Group WG-98 "Aircraft Emergency Locator Transmitters" is working in conjunction with RTCA Special Committee SC-229, "406 MHz Emergency Locator Transmitters (ELTs)" to update requirements for Minimum Operational Performance Specification (MOPS) ED-62A and DO-204A to help increase the technological capabilities of the ELT for the purpose of providing more timely and accurate alerts to search and rescue authorities. In particular, the WG-98 will address and improve ELT crash survivability, and antenna and cabling specifications. The EUROCAE WG-98 is expecting to complete its work by mid-2018.

Additionally, in March 2016, EUROCAE published ED-237, "Minimum Aviation System Performance Specification for Criteria to Detect In-Flight Aircraft Distress Events to Trigger Transmission of Flight Information", to support early triggering of emergency messages before crash impact.

Board assessment of EUROCAE's response to Recommendation A16-04

EUROCAE's planned actions of updating industry specifications ED-62A and DO-204A relating to antenna, cabling, and crash safety specifications as part of their joint EUROCAE WG-98/RTCA SC-229 Working Group, as well as the publication of ED-237 outlining the minimum specifications to be met for the in-flight activation of ELTs, are encouraging.

Although there is still work to be done before the changes are completed, EUROCAE is moving in the right direction to reduce the likelihood that an ELT becomes inoperative following an accident. The Board therefore assesses this response as having **Satisfactory Intent**.

Recommendation A16-05

It is highly likely that aircraft equipped with ELT systems that meet the current design standards will continue to be involved in occurrences in which potentially life-saving search and rescue services will be delayed as a result of damage to the ELT system, decreasing the survivability of an accident. Therefore, the Board recommends that

the Department of Transport establish rigorous emergency locator transmitter (ELT) system crash survivability requirements that reduce the likelihood that an ELT system will be rendered inoperative as a result of impact forces sustained during an aviation occurrence.

TSB Recommendation A16-05

TC's response to Recommendation A16-05

TC indicated that ELT technology and its development is an international effort and has recently joined the RTCA Special Committee SC-229, which is tasked to update the DO-204 standards to address the latest design, performance, installation and operational issues for ELTs. In parallel to crash survivability requirements, the SC-229 will consider the need to develop standards for pre-accident automatic ELT activation.

TC also informed the TSB that it is publishing an article in its quarterly publication, *Aviation Safety Letter* to raise awareness of ELT installations. It is also working on revising the standards in Airworthiness Manual 551.104.

Board assessment of TC's response to Recommendation A16-05

The Board is encouraged that TC has joined the joint RTCA Special Committee SC-229 and that it has short- and medium-term plans to publish an article in the *Aviation Safety Letter* and to revise the standards in the Airworthiness Manual. These actions, once formalized, could substantially reduce or eliminate incidences where an ELT is rendered inoperative following an accident. The Board therefore assesses the response as having **Satisfactory Intent**.

Recommendation A16-06

If an ELT system is compromised (i.e. damaged or submerged) before its first-burst delay period has elapsed, it is highly likely that critical life-saving search and rescue services will be delayed, potentially leading to further injury or death following an aviation accident. Therefore the Board recommends that

Cospas-Sarsat amend the 406-megahertz emergency locator transmitter (ELT) first-burst delay specifications to the lowest possible time frame to increase the likelihood that a distress signal will be transmitted and received by search-and-rescue agencies following an occurrence.

TSB Recommendation A16-06

Cospas-Sarsat's response to Recommendation A16-06

In its response, Cospas-Sarsat Council said that they have approved a change in the specification, such that first-generation ELTs, when activated automatically, would emit the first 406 MHz distress message as soon as possible and within 15 seconds after the ELT activation. This 15-second maximum will be in effect for ELT models submitted for new type approval on or after 01 January 2018. For ELTs with a type approval prior to 01 January 2018, the manufacturers will have the option of using the 50-second first-burst delay or the shortest possible time first-burst delay.

The Cospas-Sarsat Programme is also finalizing specifications for ELTs for in-flight distress tracking ["ELT(DT)s"], which will have a first-

burst transmission delay of less than five seconds. Additionally, work is on-going with regards to a next-generation ELT specification that will offer a first-burst delay as short as three seconds.

Board assessment of Cospas-Sarsat's response to Recommendation A16-06

Cospas-Sarsat's prompt action to address the risks associated with the current "first" generation 406-MHz ELT specification, which permits a 50-second first-burst delay, is encouraging. The new first-burst delay requirement of a maximum of 15 seconds will increase the likelihood that a distress signal will be transmitted and received by search and rescue agencies following an occurrence. However, Cospas-Sarsat has indicated that the manufacturing of 406-MHz ELTs with a 50-second first-burst delay will continue to be permitted if a type approval is received prior to 01 January 2018. Although these specifications will still be permitted, their use will likely diminish. Once fully implemented this, in addition to the next-generation ELT specification, should significantly reduce the safety deficiency associated with this recommendation. The Board therefore assesses the response as having **Satisfactory Intent.**

Recommendation A16-07

There are a large number of emergency locator transmitter (ELT) systems in use in Canada and other parts of the world that rely on hook-and-loop fasteners to secure an aircraft's ELT to the airframe. The problems associated with hook-and-loop fasteners are well documented, and some national regulatory bodies have already taken action to address these problems.

While hook-and-loop fasteners continue to be permitted for ELT installations, there is a significant risk that signals originating from these ELTs will not be transmitted due to damage associated with an ELT coming free from its mounting tray during a crash sequence. This lack of transmission could result in delays in life-saving search and rescue services. Therefore, the Board recommends that

the Department of Transport prohibit the use of hook-and-loop fasteners as a means of securing an emergency locator transmitter (ELT) to an airframe.

TSB Recommendation A16-07

TC's response to Recommendation A16-07

TC advises that it no longer permits the use of hook-and-loop fasteners to secure ELTs meeting the minimum performance specifications of TSO-C126a. It also advised that it has adopted the United States FAA TSO-C126b as the eligible minimum performance standard for issuance of a new CAN-TSO design approval.

Additionally, TC will no longer issue a new design approval for ELTs meeting CAN-TSO-C126a and predecessor minimum performance standards (MPS). New installations of previously approved designs continue to satisfy Canadian Aviation Regulations (CARs) 605.38, so long as the ELTs meet standards specified in Airworthiness Manual (AWM) 551.104 (i.e. CAN-TSO C91, CAN-TSO-C91a, CAN-TSO-C126 or later).

In the medium term, as part of a regulatory amendment, the installation standards are being revised and TC will be proposing the proscription of installation using hook-and-loop fasteners.

Although no Airworthiness Directives have been issued against hook-and-loop fastened ELTs, TC has engaged in awareness activities through the *Aviation Safety Letter* and *Feedback* magazine.

Board assessment of TC's response to Recommendation A16-07

The Board is encouraged that TC has adopted Federal Aviation Administration (FAA) TSO-C126b into AWM 537.103 for the issuance of new ELT CAN-TSO design approvals. As a result, new 406 MHz ELT designs will be prohibited from using hook-and-loop fasteners.

In addition, TC has indicated that a new Notice of Proposed Amendments (NPA) is being developed proposing an amendment to AWM 551.104 that would require ELTs to meet standards that include 406 MHz signals and prohibit the use of hook-and-loop fasteners.

The Board believes that, once fully implemented, these efforts, combined with TC's awareness activities related to the use of hook-and-loop fasteners, will significantly reduce the safety deficiency associated with Recommendation A16-07. The Board therefore assesses the response as having **Satisfactory Intent**.

Recommendation A16-08

Night visual flight rules (VFR) flights are routinely conducted across Canada. In heavily populated areas, it may be easy for pilots to maintain visual reference to the surface using cultural lighting. However, flights are often conducted in remote locations of Canada, where there may be little to no cultural lighting available to help pilots maintain visual reference to the surface without some type of alternative means, such as night vision goggles (NVG).

Although the CARs indicate that night VFR requires a pilot to maintain visual reference to the surface, they do not adequately define the visual references required for compliance. For example, the regulations do not define the cultural/ambient light requirements, nor do they provide for an alternate means of compliance when this cannot be achieved. Further, there is no regulatory requirement, as there is in some countries, for commercial operators to demonstrate to TC that their night VFR routes can be reasonably carried out by relying on cultural or ambient lighting, or by alternative means such as NVGs, before they receive TC approval of their night VFR routes.

Strong evidence exists to suggest that the current night VFR regulations should be re-examined and amended to clearly establish the conditions required to meet the intent of the regulation.

Without clearly defined night VFR requirements that establish unaided visual reference/lighting considerations or alternative means of maintaining visual reference to the surface (i.e. night-vision imaging systems), it is highly likely that accidents, such as this one, will continue to occur. Therefore, the Board recommends that

the Department of Transport amend the regulations to clearly define the visual references (including lighting considerations and/or alternate means) required to reduce the risks associated with night visual flight rules flight

TSB Recommendation A16-08

TC's response to Recommendation A16-08

TC intends to address this recommendation in two steps: first with safety promotion and education activities; and second by initiating a regulatory amendment project in 2017, including consultation with key stakeholders. Safety promotion and education will leverage TC's recently published Advisory Circular No. 603-001—Use of Night Vision Imaging Systems.

Board assessment of TC's response to Recommendation A16-08

TC indicated that it will take a two-fold approach to address this recommendation to reduce the risks associated with night visual flight rules flights.

The Board is encouraged to note that TC is planning to take short- and long-term actions. However, there is no indication as to the details of the proposed regulatory changes. While the actions taken are encouraging, much more work is required. The Board therefore assesses this response as having **Satisfactory Intent**.

Recommendation A16-09

Under the current regulations, instrument-rated pilots may go up to 12 months following their instrument ride before they are required to conduct any actual or simulated instrument flying. After 12 months, the regulations require pilots to have completed six hours of instrument flying, including six instrument approaches during the previous six months to maintain their instrument qualification (the 6/6/6 requirement). Many of these instrument-rated pilots do not routinely conduct instrument flight training or operations to maintain a reasonable degree of instrument flying proficiency. As a result, pilots who have had little to no instrument flying experience for 12 months may legally be called upon to carry out, and may accept, a challenging instrument flight without recent practice in the skills essential to the safe conduct of an instrument flight.

As identified in TC's instrument procedures manual, instrument flight is a skill that requires "careful training, constant practice and a methodical approach." As for any other skill, repetition is essential to prevent erosion of a pilot's instrument flying skill. As explained above, the instrument currency requirements allow for an extended period (i.e. up to 12 months) to lapse before a pilot is required to complete any type of instrument flight. In contrast, there are a number of semi-annual currency requirements in the CARs, such as takeoffs and landings, which a pilot must complete in order to remain current for operational duty.

The instrument currency requirements in the CARs do not provide adequate assurance that an instrument-rated pilot will possess an acceptable level of proficiency to ensure the safe conduct of a flight in challenging instrument meteorological conditions. As a result, pilots may conduct flights in challenging instrument meteorological or dark night conditions without the level of instrument flying proficiency required to maintain safe flight operations. Therefore, the Board recommends that

the Department of Transport establish instrument currency requirements that ensure instrument flying proficiency is maintained by instrument-rated pilots, who may operate in conditions requiring instrument proficiency.

TSB Recommendation A16-09

TC's response to Recommendation A16-09

TC intends to conduct an internal assessment on this issue and will be providing its senior management with a recommendation prior to consulting the aviation community. With input from these various sources, TC will draft a Notice of Proposed Amendments (NPA) to amend the regulation.

Board assessment of TC's response to Recommendation A16-09

The Board is pleased that TC plans to address this recommendation via a regulatory amendment. However, until the regulatory amendment is published, it is impossible to determine whether or not the safety deficiency will be adequately addressed. The Board therefore assesses the response as having **Satisfactory Intent**.

Recommendation A16-10

A large number of commercial helicopters routinely conduct flight operations at night or in instrument meteorological conditions (IMC), or both. Without the benefit of terrain awareness and warning systems (TAWS), such aircraft are at significantly greater risk for a controlled flight into terrain (CFIT) accident. The TSB has investigated a number of helicopter occurrences that took place at night or in IMC where TAWS may have proven useful in preventing an accident.

This occurrence is an example of a CFIT accident in which a serviceable aircraft was unintentionally flown into the ground. During an attempt to conduct a night visual departure in extremely dark conditions, an inadvertent descent developed, and the aircraft struck the terrain. When the flight crew recognized that an inadvertent descent had developed, they were at an altitude from which they were unable to recover.

In Canada, commercially operated aeroplanes and some privately operated aeroplanes are required by regulation to be equipped with TAWS. However, there is no such regulatory requirement for commercial helicopters, despite the fact that they often operate along similar routes as commercial fixed-wing aircraft, and sometimes carry larger numbers of passengers. As a result, the regulations do not currently provide for an equivalent level of safety between commercial fixed-wing versus commercial rotary-wing operations.

Until there is a requirement for Canadian-registered commercial helicopters to be equipped with TAWS, the crew members and passengers who travel on those aircraft at night or in IMC will continue to be at increased risk for injury or death due to CFIT. Therefore, the Board recommends that

> *the Department of Transport require terrain awareness and warning systems for commercial helicopters that operate at night or in instrument meteorological conditions.*
>
> **TSB Recommendation A16-10**

TC's response to Recommendation A16-10

TC agrees in principle with this recommendation and will engage the helicopter community in 2017 by requesting data on TAWS. The data collected will be analyzed to determine a way forward.

Board assessment of TC's response to Recommendation A16-10

In its response, TC indicated that it will engage the helicopter community in 2017 to seek their input on this issue. As there is no indication as to what actions will be taken once the data collected has been analyzed, it is unclear how and if the ensuing actions will address the intent of this recommendation. The Board therefore assesses the response as **Unable to Assess**.

Recommendation A16-11

The current pilot proficiency check (PPC) standards, and associated PPC schedules, for CARs Subparts 702, 703, 704, and 705 operators make little distinction between the respective PPCs conducted on captains versus first officers. With the exception of small variances, both aeroplane and helicopter pilots are required to meet the same performance standards, as per their respective subpart, regardless of whether they will be assigned to captain or first officer duties following the PPC. There is no requirement for captains to demonstrate a higher degree of proficiency, commensurate with their increased responsibilities. Additionally, there is currently no way for an approved check pilot (ACP) to restrict a pilot to second-in-command (SIC) duties based on the ACP's assessment that the pilot is not ready to act in a pilot-in-command (PIC) capacity, potentially as captain of a multi-engine, multi-crew aircraft, responsible for the safe completion of demanding night or instrument flight rules (IFR) flights, or both.

In addition, the PPC standards do not take into account the unique challenges associated with the potential for acting as captain of a multi-engine, multi-crew aircraft in demanding IFR or night flight conditions, or both. Therefore, despite the considerable difference in responsibilities between a captain and first officer, both pilots are tested to the same standard. Once a pilot passes a PPC on a particular aircraft type, that PPC is transportable if the pilot moves to a different company that operates that same aircraft type.

Currently, the risk associated with employing a pilot as a captain is managed through internal company policies and insurance or contractor requirements. However, in many cases, companies rely on the regulations to determine the minimum requirements for employment in a PIC position.

The current PPC standards do not ensure that captains possess an adequate level of proficiency to safely carry out the operational duties of a PIC. As a result, there is a risk that Subparts 702, 703, 704, and 705 pilots will continue to be assigned to PIC duties without having first demonstrated an adequate degree of proficiency in a captain capacity. Therefore, the Board recommends that

the Department of Transport establish pilot proficiency check standards that distinguish between, and assess the competencies required to perform, the differing operational duties and responsibilities of pilot-in-command versus second-in-command.

TSB Recommendation A16-11

TC's response to Recommendation A16-11

TC advised that independent of this recommendation, a thorough review of the ACP Manual was done and had identified a general weakness in guidance regarding the difference between a pilot-in-command PPC and a second-in-command PPC. Several enhancements to the 10th edition of the manual are due to be published in the first quarter of 2017 and will include distinctions between a PIC PPC and an SIC PPC and additional guidance on the evaluation of non-technical skills.

Board assessment of TC's response to Recommendation A16-11

TC's response indicates that it will be publishing a revision to the ACP Manual before spring 2017. That revision will include additional guidance on the evaluation of non-technical skills. In addition, the Manual is also being revised to distinguish between a PIC PPC and an SIC PPC. In particular, the revisions will establish a requirement to be evaluated based on a respective duty position, and the pass/fail threshold will be higher for a PIC than it is for an SIC. When fully implemented, these proposed amendments will address the safety deficiency associated with this recommendation. The Board therefore assesses the response as having **Satisfactory Intent**.

Recommendation A16-12 and A16-13

Transportation companies have a responsibility to manage safety risks in their operations. Compliance with regulations can only provide a baseline level of safety for all operators in a given sector. Since regulatory requirements cannot address all risks associated with a specific operation, companies need to be able to identify and address the hazards specific to their operation.

In the traditional oversight model, companies are not required to have formalized systems in place to continuously manage safety at a systems level. Oversight is accomplished using an inspect-and-fix approach. In this approach, the regulator's role is focused on finding instances of regulatory non-compliance, which the operator must correct.

On the other hand, when implemented properly, safety management systems (SMS) provide a framework for companies to manage risk effectively and make operations safer. Regulatory requirements for companies to implement SMS are the first step in ensuring that all operators are capable of meeting their safety responsibility. It is for this reason that the TSB has echoed calls from the International Civil Aviation Organization (ICAO) and the worldwide civil aviation industry emphasizing the advantages of SMS.

Even with SMS requirements, companies will vary in degrees of ability or commitment to effectively manage risk. Less frequent surveillance, focused on an operator's

safety management processes, will be sufficient for some companies. However, the regulator must be able to vary the type, frequency, and focus of its surveillance activities to provide effective oversight to companies that are unwilling or unable to meet regulatory requirements or effectively manage risk. Further, the regulator must be able to take appropriate enforcement action in such cases.

The investigations into this accident and other recent occurrences emphasize the need for operators to be able to manage safety effectively. More than 10 years after introducing the first SMS regulations for airline operators and the companies that perform maintenance on their aircraft, SMS implementation has stalled. While many companies have recognized the benefits of SMS and voluntarily begun implementing it within their organizations, approximately 90% of all Canadian aviation certificate holders are still not required by regulation to have an SMS. As a result, TC does not have assurance that these operators are able to manage safety effectively. Therefore, the Board recommends that

the Department of Transport require all commercial aviation operators in Canada to implement a formal safety management system.

TSB Recommendation A16-12

the Department of Transport conduct regular SMS assessments to evaluate the capability of operators to effectively manage safety.

TSB Recommendation A16-13

TC's response to Recommendation A16-12

TC intends to address this recommendation by continuing to promote voluntary adoption of an SMS by those commercial air operators not mandated by the current regulatory requirements and will publish guidance material aimed at smaller sized-operations. It will also review the policy, regulations and program related to SMS in civil aviation by asking for input from the department's employees, as well as industry, international authorities and other specialists in this area.

Board assessment of TC's response to Recommendation A16-12

In its response, TC indicated that it would continue promoting the voluntary adoption of an SMS and that it has published guidance material for smaller operations. Additionally, TC plans on reviewing Civil Aviation's policy, regulations and program related to SMS.

There is, however, no clear indication at this time as to the actions that will be taken by TC once this review is done, and if it will include a rule change. The Board therefore assesses the response as **Unable to assess**.

TC's response to Recommendation A16-13

TC states that the suite of surveillance tools that it uses is effective in verifying compliance with the CARs, including SMS requirements. With the systems-based approach to its surveillance activities, TC's civil aviation safety inspectors use the systems as an entry point and sample end products to ensure that the system is working effectively and is in compliance with the CARs.

While TC states it continually evaluates its tools to ensure they continue to be effective, and makes updates as required, the department is confident in its approach of using a combination of surveillance tools to verify regulatory compliance.

Board assessment of TC's response to Recommendation A16-13

TC indicated that it adopted a systems-based approach to all its surveillance activities and that it is using a suite of surveillance tools to verify compliance with the CARs, including SMS requirements, and that it is confident in its systems-based approach to verifying regulatory compliance. The Board recognizes that TC has undertaken a number of change initiatives aimed at improving its oversight program, and that some progress has been made.

In a briefing to the Board, TC also reiterated its commitment to verifying regulatory compliance at appropriate intervals and effectively carrying out enforcement, as required. The Board is encouraged by the concrete enforcement actions recently taken by TC on issues that were identified through its surveillance activities. However, TC's

response does not fully address the underlying safety deficiency that led to this recommendation. Achieving minimum regulatory compliance does not necessarily guarantee that all commercial aviation operators are capable of effectively managing safety within their organization. TC must also confirm that operators have a mature, effective SMS and are managing safety risks effectively.

The Board takes note that TC has recently undertaken a Program Evaluation and Update Project aimed at taking stock of the various transformation and improvement initiatives implemented to date. Once completed, this evaluation project will assist TC in refining the various elements of its surveillance program, including regular SMS assessments of the capability of operators to manage safety effectively. Although the numerous actions taken by TC may address the risk associated with this safety deficiency, more work remains to be done. The Board therefore assesses the response as being **Satisfactory in Part**.

Recommendation A16-14

Recent investigations have highlighted the fact that, when faced with an operator that is unable or unwilling to address identified safety deficiencies, TC has difficulty adapting its approach to ensure that deficiencies are effectively identified and that they are addressed in a timely manner.

TC's risk-based approach to surveillance planning results in operators that are viewed as higher risk being scheduled for more frequent surveillance. In some occurrences, it was noted that unsafe conditions remained unidentified when the surveillance remained focused on processes and, in other cases, unsafe conditions were allowed to persist for an extended period while TC relied on a corrective action plan (CAP) process, in which operators were ill-equipped to participate.

Therefore, to ensure that companies use their safety management system (SMS) effectively, and to ensure that companies continue operating in compliance with regulations, the Board recommends that

the Department of Transport enhance its oversight policies, procedures and training to ensure the frequency and focus of surveillance, as well as post-surveillance oversight activities, including enforcement, are commensurate with the capability of the operator to effectively manage risk.

TSB Recommendation A16-14

TC's response to Recommendation A16-14

TC states that it is in agreement that it must continually enhance its oversight policies, procedures and training and, independent of this investigation, had committed to conduct an evaluation of its surveillance program as part of its National Oversight Plan for 2016/2017. TC also launched a Civil Aviation Surveillance Program Evaluation and Update Project to analyse opportunities for improvement identified via inspector feedback, analyse lessons-learned, and leverage business intelligence to update the surveillance program. The goal of the project is to ensure the surveillance program effectively verifies regulatory compliance at appropriate intervals and is effective in carrying out enforcement action, as required. While the project is scheduled to be completed in December 2017, the department will not hesitate to implement enhancements sooner, if warranted.

Board assessment of TC's response to Recommendation A16-14

In its response, TC indicated that it launched a Civil Aviation Surveillance Program Evaluation and Update Program that is scheduled to be completed in December 2017. The Board is encouraged that TC has committed to evaluating its surveillance program and has already implemented some concrete actions, such as the establishment of a National Oversight Office, the implementation of an Oversight Advisory Board, the creation of a dedicated team working on surveillance policies and procedures, strengthened oversight planning, risk-based decision making, timely enforcement actions, and taking temporary measures that will permit an increase in the number of inspections on higher-risk areas while the program evaluation and update is being done.

The Board also acknowledges TC's efforts as it strives to find the right balance between planned and reactive oversight activities, as well as in the use of the various types of oversight tools available. Although TC has implemented numerous improvements, it is too early to assess whether or not TC's actions will adequately address the safety deficiency associated with this recommendation. The Board therefore assesses the recommendation as having **Satisfactory Intent.**

Appendix A—Reports released in 2016-17

This Appendix provides an overview of investigation reports released and, where applicable, an overview of safety actions taken.

For a more comprehensive list of safety actions taken, please see the final investigation reports.

Marine

Marine investigation report M15A0009

Date	21 January 2015
Location	Burnside, Newfoundland and Labrador
Vessel	*Grace Sparkes*
Type	Roll-on roll-off passenger ferry
Event	Bottom contact
Safety action taken	The operator, the **Newfoundland Department of Transportation and Works**, took a number of corrective actions which included providing chart correction procedures to all vessels; adding lifesaving equipment signage; repairing the public address system; and providing instruction to clarify procedures for obtaining accurate passenger counts.

Marine investigation report M15C0028

Date	03 April 2015
Location	Beauharnois, Quebec
Vessel	*CWB Marquis*
Type	Bulk carrier
Event	Grounding
Safety action taken	**Algoma Central Corporation**, the vessel's management company, advised the St. Lawrence Seaway Management Commission (SLSMC) that its vessels would secure at available lock approach walls rather than anchoring in the presence of ice. Further, the corporation amended its safety management system with respect to anchoring in the presence of ice. For its part, the **SLSMC** added the Canadian Coast Guard manual Ice Navigation in Canadian Waters to its winter process toolkit.

Marine investigation report M15C0045

Date	28 April 2015
Location	Rimouski, Quebec
Vessel	*Frederike C-2*
Type	Fishing vessel
Event	Fire and sinking
Safety action taken	**TC Marine Safety** inspectors in Rimouski added compliance deadlines to Notices of Deficiency issued in relation to the familiarization and training manual. Failure to comply with notices by the deadline will result in administrative monetary penalties.

Marine investigation report M15C0094

Date	13 June 2015
Location	Toronto, Ontario
Vessel	*Northern Spirit I*
Type	Passenger vessel
Event	Passenger overboard and subsequent loss of life
Safety action taken	The vessel's lifesaving equipment plan was re-approved by **TC Marine Safety and Security** on 26 September 2015, changing the designation of the craft carried by the *Northern Spirit I* on the plan from a rescue boat to an emergency boat. Following that, the company changed the designation of the boat carried by the *Northern Spirit I* on the muster list from lifeboat to emergency boat.

Marine investigation report M15A0189

Date	16 June 2015
Location	Placentia Bay, Newfoundland and Labrador
Vessel	*CFV 130214*
Type	Fishing vessel
Event	Loss of vessel at sea with three fatalities
Safety action taken	Although no safety action was taken by the operator as a result of this investigation, the TSB continues to highlight fishing vessel safety in its Watchlist and to proactively conduct meetings and information sessions with fishermen and representatives from industry associations.

Marine investigation report M15P0286

Date	05 September 2015
Location	20 nm west of Nootka Sound, British Columbia
Vessel	*Caledonian*
Type	Fishing vessel
Event	Capsizing and loss of life
Safety action taken	The **authorized representative** has purchased and installed one additional emergency position indicating radio beacon (EPIRB) and one additional life raft for each of its vessels, thereby going beyond the regulatory requirements. As a result of the occurrence and upon request from its trawl masters, the **Canadian Fishing Company** has initiated a policy to ensure that all of its trawl vessels are equipped with two life rafts and two EPIRBs.

Marine investigation report M15A0348

Date	30 November 2015
Location	Clark's Harbour, Nova Scotia
Vessel	*Cock-a-Wit Lady*
Type	Fishing vessel
Event	Person overboard and subsequent loss of life
Safety action taken	Although no safety action was taken by the operator as a result of this investigation, the TSB continues to highlight fishing vessel safety in its Watchlist and to proactively conduct meetings and information sessions with fishermen and representatives from industry associations.

Pipeline

There were no Pipeline Investigation reports released in 2016-17.

Rail

Rail investigation report R14W0256

Date	07 October 2014
Location	Mile 74.58, Margo Subdivision, Clair, Saskatchewan
Company	Canadian National Railway
Event	Main-track derailment
Safety action taken	**CN** improved procedures for flaring tank cars and enhanced its documentation requirements for emergency response activities. The **Saskatchewan Ministry of the Environment** enhanced its procedures for ensuring that incident commanders are appropriately trained and site monitoring activities are established when responding to emergencies involving dangerous goods.

Rail investigation report R14C0114

Date	06 November 2014
Location	Mile 23.40, Crowsnest Subdivision, Pearce, Alberta
Company	Canadian Pacific Railway
Event	Main-track derailment
Safety action taken	Although no safety action was taken by the operator as a result of this investigation, the TSB continues to assemble information on broken rail derailments involving pre-existing rail defects and on the initiatives taken by the railway industry relating to ultrasonic rail testing.

Rail investigation report R14V0215

Date	15 November 2014
Location	Mile 48.41, Skeena Subdivision, Kwinitsa, British Columbia
Company	Canadian National Railway
Event	Main-track derailment
Safety action taken	**CN** reformatted its wayside inspection systems to include axle counts as part of the post-scan announcement.

Rail investigation report R15V0003

Date	13 January 2015
Location	Mile 76.7, Mountain Subdivision, Stoney Creek, British Columbia
Company	Canadian Pacific Railway
Event	Main-track train derailment
Safety action taken	**CP** made changes to its rail equipment scanner system to provide TrAM violation alerts when a train marshalling restriction is identified after a train passes the scanner. The railway company also made changes to the roles and responsibilities of the rail traffic controller with respect to TrAM. CP's General Operating Instructions were also updated.

Rail investigation report R15H0005

Date	13 January 2015
Location	Mile 42.0, Nipigon Subdivision, Dublin, Ontario
Company	Canadian Pacific Railway
Event	Main-track derailment
Safety action taken	Although no safety action was taken by the operator as a result of this investigation, the TSB continues to assemble information on derailments involving wheel failures and on the initiatives taken by the railway industry relating to wheel impact load detectors.

Rail investigation report R15H0013

Date	14 February 2015
Location	Mile 111.7, Ruel Subdivision, Gladwick, Ontario
Company	Canadian National Railway
Event	Main-track train derailment
Safety action taken	Multiple safety actions were undertaken by **CN** following the TSB investigation. The Board recommended that the **Department of Transport** conduct a study on 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.

Rail investigation report R15V0046

Date	11 March 2015
Location	Mile 103, Cranbrook Subdivision, Cranbrook, British Columbia
Company	Canadian Pacific Railway
Event	Movement exceeds limits of authority
Safety action taken	**CP** re-designated the Cranbrook Yard as a siding. The cautionary limits at the yard were removed, and an adjacent subdivision was combined to operate as one. In addition, CP formalized a requirement for territory familiarization for management crews.

Rail investigation report R15M0034

Date	17 April 2015
Location	Mile 212.8, Napadogan Subdivision, Saint-Basile, New Brunswick
Company	Canadian National Railway
Event	Main-track derailment
Safety action taken	**CN** reduced the combined wear limit for 136-pound rail and initiated gauge restraint measurement to enhance its assessment of lateral strength of the track structure.

Rail investigation report R16H0002

Date	25 May 2015
Location	N/A
Event	Rail Safety Issues Investigation: Expanding the use of locomotive voice and video recorders in Canada (LVVR)
Safety action taken	There are a number of outstanding differences of opinion on the appropriate use of LVVR. Expanded use will be achieved only by ensuring that the implementation approach appropriately balances the rights and obligations of all parties. If these differing perspectives can be reconciled, implementation of this technology, including expanded use, could result in considerable safety benefits to the railway industry. With the completion of the LVVR Safety Study, the final report will be circulated to key stakeholders in the four transportation modes: Marine, Pipeline, Rail, and Aviation. The **TSB** will also initiate discussions with TC regarding next steps for the implementation of LVVR and the expanded use of on-board recorders in all modes.

Rail investigation report R15D0073

Date	10 August 2015
Location	Mile 6.3, Adirondack Subdivision, Farnham, Quebec
Company	Central Maine & Québec Railway
Event	Derailment
Safety action taken	The **TSB** issued a Rail Safety Information letter to **TC** regarding the incorrect data recorded by the locomotive event recorder (LER). TC replied that railway companies are responsible for carrying out yearly inspections and accuracy testing of LERs and the event recorder's memory module. TC indicated that its regional office verified the data extracted from the LER of the occurrence locomotive and reported that it has been fixed and is working properly.

Rail investigation report R15V0183

Date	06 September 2015
Location	Mile 62.0, Mountain Subdivision, Beavermouth, British Columbia
Company	Canadian Pacific Railway
Event	Main-track train collision
Safety action taken	**TC** issued a Notice and Order to ensure that trackside slow order flags are installed in a timely manner. For its part, **CP** enhanced its processes to ensure that slow order flags are installed as required by regulations.

Rail investigation report R15T0245

Date	25 October 2015
Location	Mile 304, GO Transit Kingston Subdivision, Whitby, Ontario
Company	VIA Rail Canada Inc.
Event	Risk of collision
Safety action taken	Both **CN** and **VIA Rail** conducted their own internal investigations of the occurrence. In addition, CN reviewed the incident with each rail traffic controller (RTC) as part of a course titled Looking out for Each Other. In response to a TSB Rail Safety Advisory, **TC's Ontario Regional Office** issued a letter of concern to CN regarding a violation of CROR Rule 137, which states that "[i]nstructions from a foreman must be in writing except when the instructions permit unrestricted operation through the entire limits." **CN** responded and issued a system notice stating that in the application of Rule 137, a movement is considered restricted when instructions from a foreman include the use of a specific track(s), and therefore must be in writing.

Rail investigation report R15D0103

Date	29 October 2015
Location	Mile 2.24, Outremont spur, Montréal, Quebec
Company	Canadian Pacific Railway
Event	Runaway and derailment of cars on non-main track
Safety action taken	Following the occurrence, **CP** took a number of additional measures to eliminate trespassing at this location, including increased monitoring, improved signage and follow-up investigations for all known trespassing incidents.

Rail investigation report R15H0092

Date	01 November 2015
Location	Mile 72.08, Webbwood Subdivision, Spanish, Ontario
Company	Huron Central Railway (HCR)
Event	Main-track derailment
Safety action taken	**HCR** issued slow orders for any identified track defects on the Webbwood Subdivision and the defects were repaired. The slow orders were removed only after repairs were completed and inspected by a supervisor.

Rail investigation report R15D0118

Date	11 December 2015
Location	Mile 6.30, CNR Montreal Subdivision, Montréal, Quebec
Company	VIA Rail Canada Inc.
Event	Main-track derailment
Safety action taken	**VIA Rail** issued a bulletin with special instructions requiring a radio broadcast to state the signal indication displayed. For its part, **CN** implemented several mitigating measures to ensure that employees are in full compliance with Planned Protection.

Rail investigation report R16W0004

Date	09 January 2016
Location	Mile 13.45, Redditt Subdivision, Webster, Ontario
Company	Canadian National Railway
Event	Main-track train derailment
Safety action taken	Although no safety action was taken by the operator as a result of this investigation, the TSB continues to assemble information on derailments involving wheel failures and on the initiatives taken by the railway industry relating to wheel impact load detectors.

Rail investigation report R16W0059

Date	01 March 2016
Location	Mile 91.10, CN Quappelle Subdivision, Regina, Saskatchewan
Company	Cando Rail Services
Event	Uncontrolled movement of railway equipment
Safety action taken	**Cando Rail Services** took a number of measures to increase the safety of its operations. This included issuing a system-wide bulletin requiring that all equipment have the minimum number of hand brakes applied, even if attended by an employee. **TC** issued two administrative monetary penalties to Cando Rail Services (Cando) for violating the Railway Safety Act and the Canadian Rail Operating Rules (CROR).TC also conducted follow-up inspections of Cando's operations in Regina, Saskatchewan, in April, July, and September 2016, with no non-compliances observed.

Air

Aviation investigation report A13H0001

Date	31 May 2013
Location	Moosonee, Ontario
Aircraft	Sikorsky S-76A (helicopter), C-GIMY
Event	Controlled flight into terrain
Safety action taken	Since the occurrence, **TC** has undertaken a number of different actions. Although TC has indicated that none of these actions were taken as a direct result of this occurrence, it is important to understand the evolution of TC oversight since the accident. In 2014, TC launched Staff Instruction (SI) SUR-001 Issue 05 as an e-learning course for all inspectors, as well as a two-day classroom course on the surveillance procedures described in the SI; and established a multi-modal technical training (MITT) office to create a more efficient, innovative and streamlined technical training. In 2015, TC issued Internal Process Bulletin (IPB) 2015-03 on certificate action policy to ensure more timely and effective risk-based decision making in response to surveillance findings. TC also developed a sampling plan builder tool; and, published guidance material on root cause analysis and effective corrective action plans (CAP) among other actions. For a full list of safety actions taken, please see the full text of the report. **Ornge Rotor-Wing** (7506406 Canada Inc.) took a series of actions, including: temporarily suspending black-hole operations and setting out restrictions and prohibitions on various other procedures and operations; reviewing company standard operating procedures (SOPs), amending the Company Operations Manual (COM); amending the emergency locator transmitter (ELT) maintenance procedures; and, enhancing crew pairing procedures among other actions. For a full list of safety actions taken, please see the full text of the report.

Aviation investigation report A13Q0098

Date	10 June 2013
Location	Montréal/St-Hubert Airport, Québec, 8 nm E
Aircraft	Beechcraft King Air 100, C-GJSU
Event	Forced landing following fuel exhaustion
Safety action taken	No safety action was reported to the TSB further to this investigation.

Aviation investigation report A14F0065

Date	10 May 2014
Location	Montego Bay, Jamaica
Aircraft	Airbus A319, C-FZUG
Event	Unstable approach and hard landing
Safety action taken	**Air Canada Rouge** conducted an internal safety management system (SMS) investigation, as well as an assessment of its flight operations in which it identified and took steps to mitigate the risks associated with portions of its flight operations, specifically unstable approaches. These steps include: incorporating more simulator training for unstable approaches leading to a go-around; modifying the recurrent training syllabus to include more manual flying; amending the standard operating procedures (SOPs) to refine the company's stable approach policy; and improving the annual recurrent training program to include new and/or improved modules on dealing with distractions on the flight deck, on leadership and professional standards, and on dealing with situations where the other flight crew member does not comply with the SOPs.

Aviation investigation report A14Q0068

Date	29 May 2014
Location	Montréal International (Mirabel) Airport, Québec
Aircraft	BD-500-1A10 (C Series CS100), C-FBCS
Event	Uncontained turbine rotor failure
Safety action taken	**Bombardier** grounded the C Series test aircraft fleet until the cause of the occurrence could be clearly established. For its part, **Pratt & Whitney** proposed a plan to return to flight which included an enhanced seal, a revised cool-down procedure, and other measures to monitor engine temperatures and prevent hot shutdowns. Further, production engines will feature an enhanced oil supply tube and a cooling airflow configuration that will physically separate the turbine rotor airflow from the bearing compartment to eliminate the possibility of recurrence. In addition, Pratt & Whitney has incorporated several design enhancements to the PW1500G turbofan's No. 4 bearing compartment lubrication supply, mid-turbine frame (MTF) cavity, and low-pressure turbine (LPT) cooling air systems to mitigate the potential for oil-system-related thermal distress to the LPT rotor system.

Aviation investigation report A14P0132

Date	14 August 2014
Location	Chantslar Lake, British Columbia
Aircraft	Air Tractor AT-802A Fire Boss Amphibian, C-GXNX
Event	Stall at takeoff and collision with water
Safety action taken	**Conair Group Inc.** put forward a risk mitigation plan; hired a safety manager, and a company check pilot for the Fire Boss fleet, as well as a manager of standards to work on the standard operating procedures (SOPs), flight training and field operations. Conair also added an annual inspection to the company supplemental maintenance document to inspect the cable run; installed a physical defense to prevent any foreign objects from becoming lodged under the control stick; designed additional storage space in the cockpit; and instructed pilots to keep areas around control cables and tubes clear and free at all times. Ionode Onboard Loads Monitoring systems (Latitudes Technology), which record pre-set parameters to enhance operational oversight, were installed on the Fire Boss fleet. The data collected across the fleet is compared and then sent to designated management personnel. Ground school material and operational procedures were reviewed and significant changes were made: new checklists and standard operating procedures (SOPs) were implemented and amended in order to ensure safe operations during the aerial firefighting season, with emphasis placed on reduced loads; and the hazard identification and risk assessment efforts were enhanced to ensure all hazards associated with the Fire Boss operation are identified, assessed and mitigated.

Aviation investigation report A14O0165

Date	05 September 2014
Location	London, Ontario, 53 nm W
Aircraft	Embraer EMB-145LR, N16954
Event	Loss of control
Safety action taken	**ExpressJet Airlines** improved dispatcher use of flight-following software, and developed policy and procedures related to adverse weather phenomena. ExpressJet Airlines also developed a training module for all flight crew members to promote severe weather avoidance and weather radar utilization techniques to identify developing storm activity.

Aviation investigation report A14O0218

Date	03 October 2014
Location	Toronto/Billy Bishop Toronto City Airport, Ontario
Aircraft	DHC-8-400, C-FSRN
Event	Risk of runway excursion on landing
Safety action taken	**Sky Regional Airlines** conducted an internal SMS investigation. It identified and took steps to mitigate the risks associated with portions of its flight operations. The following corrective actions have been taken: the captain received additional and remedial training; the aircraft operating manual was amended regarding the operating parameters for the landing gear; the training syllabus, as well as the initial and the recurrent training programs, were updated to address landing procedures; and the entire Q400 fleet was equipped with an enhanced digital quick-access recorder that now permits accurate flight data analysis (FDA) of landings.

Aviation investigation report A14Q0155

Date	07 October 2014
Location	Montréal/Pierre Elliott Trudeau International Airport, Montréal, Québec
Aircraft	Airbus A330-343, C-GFAF
Event	Runway excursion
Safety action taken	**Aéroports de Montréal** (ADM), in consultation with **NAV CANADA**, reviewed their operating agreement and ADM amended its directives and procedures to provide more specific instructions to staff with respect to the types of accidents and incidents required to be reported to the TSB. **Air Canada** developed threat-based briefings for all of its departure and arrival procedures. It also examined existing policies and developed and offered new guidance to pilots regarding approach visibility requirements. Additionally, a safety awareness article with regard to lateral excursions, published in the Airbus Safety first magazine, was sent to all Air Canada pilots.

Aviation investigation report A14W0177

Date	06 November 2014
Location	Edmonton International Airport, Edmonton, Alberta
Aircraft	DHC-8-402, C-GGBF
Event	Right main landing gear collapse
Safety action taken	**Jazz Aviation** no longer uses retreaded tires on the main landing gear of their DHC-8-402 fleet. Further, the operator made changes to its DHC-8-402 operating procedures to reduce stress on the main landing gear tires when maneuvering on the ground. Other operators using this aircraft have adopted similar procedures to reduce main landing gear tire stress. **TC** issued an Airworthiness Directive mandating the implementation of Bombardier's Service Bulletin, SB 84-32-140. **Bombardier Inc.** issued a Flight Operations Service Letter, DH8-400-SL-32-046. The Airworthiness Directive and the Flight Operations Service Letter have resulted in a revision to the Aircraft Flight Manual (AFM), which has been approved by the Design Approval Delegate (DAD) at Bombardier. This revision will be forwarded to TC for their approval.

Aviation investigation report A15C0005

Date	21 January 2015
Location	Key Lake, Saskatchewan, 11 nm SE
Aircraft	Eurocopter AS350 B2 (helicopter)
Event	Collision with terrain
Safety action taken	The **Airspan Helicopters Ltd.** suspended AS350 helicopter stringing operations until it received the manufacturer's Service Bulletin. They reviewed and amended their standard operating procedures, including amendments to pre-flight checks, stringing operations, and feeder cable pulling procedures. The operator also hired third-party consultants to audit the company's safety management system. **TC** confirmed that the wording in the flight manual was not clear and that it will be modified by Airbus.

Aviation investigation report A15O0015

Date	24 February 2015
Location	Sault Ste. Marie, Ontario
Aircraft	de Havilland DHC-8-102, C-GTAI
Event	Impact with terrain on approach
Safety action taken	**Jazz Aviation LP** (Jazz) amended its DASH 8 Aircraft Operating Manual, introducing significant changes to the "Stabilized Approach Factors" subsection; distributed Flight Safety Briefs, All Pilot Memos, and Focus on Safety magazine articles on stable approach issues and procedural non-compliance; and added simulator scenarios to the training syllabus to reflect the speeds and weights of the occurrence flight. The company also provided the occurrence flight crew with additional training.

Aviation investigation report A15O0031

Date	17 March 2015
Location	French River Provincial Park, Ontario
Aircraft	Piper PA-32RT-300T, C-GDWA
Event	In-flight breakup
Safety action taken	No safety action was reported to the TSB further to this investigation.

Aviation investigation report A15W0069

Date	22 May 2015
Location	Cold Lake, Alberta, 25 nm NW
Aircraft	Air Tractor AT-802A Fire Boss Amphibian, C-FDHV
Event	Loss of control and collision with terrain
Safety action taken	**Conair Group Inc.** removed all of the Fire Boss groups from duty on 23 May 2015 and supported any crew member who wished to be removed from duty for a longer period. The company commissioned a fire behaviour study and contracted a study into the accident. Conair crews were briefed on the results of the investigation, with emphasis on awareness of environmental conditions and the dangers around forest fires. A session addressing these issues was added to the training program. An operational review of Conair was performed by a consultant. This review included a document review, an employee survey, and a series of interviews with Conair personnel. The company has installed 5-point harnesses in its AT-802A fleet.

Aviation investigation report A15W0087

Date	21 June 2015
Location	Fort McMurray, Alberta, 21 nm NE
Aircraft	Cessna 172P, C-GJSE and Cessna A185E, C-FAXO
Event	Mid-air collision between W.M.K. Holdings Ltd. (dba McMurray Aviation), Cessna 172P, C-GJSE and Cessna A185E, C-FAXO
Safety action taken	**NAV CANADA** published the amendment of the Canada Flight Supplement, containing the addition of the flight training practice area depiction in the Fort McMurray visual flight rules terminal procedures chart. Additionally, the 17th edition of the Lake Athabasca Visual Flight Rules Navigation Chart included the addition of a flight-training symbol for the area northeast of Fort McMurray.

Aviation investigation report A15P0147

Date	07 July 2015
Location	Osoyoos, British Columbia
Aircraft	Beechcraft A36, C-GPDK
Event	Engine power loss and forced landing
Safety action taken	No safety action was reported to the TSB further to this investigation.

Aviation investigation report A15A0045

Date	30 July 2015
Location	Rigolet, Newfoundland and Labrador, 5 nm WSW
Aircraft	Airbus Helicopters AS 350 BA (Helicopter), C-GBPS
Event	Collision with wires
Safety action taken	**Canadian Helicopters Limited** (CHL) has adopted the policy of conducting an overhead inspection flight prior to landing at any Bell Aliant site, as well as new local operating procedures for each site. CHL also developed wire strike avoidance training, which has been added to the annual recurrent training program. **Bell Aliant** collaborated with CHL to conduct reviews of all Labrador tower sites to identify and mitigate hazards. As well, an independent organization was hired to conduct risk assessments at all Bell Canada sites accessed by aircraft, and to audit all aviation service providers used by Bell Canada. As a result, the helipad at Moliak was moved outside of the circumference of the outer guy wire anchor points. Bell Alliant also established an Aviation Project Team, which is focused on: developing an aviation standards document; a passenger training program, and a flight hazard assessment form; auditing the 153 helicopter landing-sites across the country and developing site obstruction placards for each site; completing helicopter landing site drawings; and completing vendor audits and reducing the number of operators being hired by Bell Canada Enterprises.

Aviation investigation report A15C0130

Date	08 September 2015
Location	Foleyet, Ontario, 17 nm S
Aircraft	Robinson R44, C-GZFX
Event	Collision with terrain
Safety action taken	**Apex Helicopters Inc.** reviewed and emphasized, with all newly hired pilots and ground crew, the importance of timely reporting of aircraft late for arrival.

Aviation investigation report A15C0134

Date	15 September 2015
Location	Thompson, Manitoba, 1 nm SW
Aircraft	Piper PA-31-350, C-FXLO
Event	Incorrect fuel type and forced landing
Safety action taken	**Keystone Air Service Ltd.**'s operations manager published a memo to all of the company's pilots, reiterating the importance of crew supervision of aircraft fueling and the expectation of compliance with the Keystone Company Operations Manual. **TC** conducted a post-accident program validation inspection. The inspection revealed safety concerns that resulted in the suspension of Keystone's air operator certificate. Subsequently, TC conducted an in-depth review of Keystone's aviation safety record. On 29 December 2015, the Minister of Transport cancelled Keystone's air operator certificate, citing public interest and the company's aviation safety record.

Aviation investigation report A15C0146

Date	22 October 2015
Location	Paynton, Saskatchewan, 7 nm N
Aircraft	Hughes 369D (helicopter), C-FOHE
Event	Engine failure and collision with terrain
Safety action taken	**Oceanview Helicopters Ltd.** voluntarily suspended, and has not yet resumed, external platform worker operations. **SaskPower** implemented a Helicopter Safety Program. **Forbes Bros. Ltd.** reviewed its helicopter operations standards; adopted the Helicopter Association of Canada Pre-Flight Risk Assessment best practice as a requirement for all Forbes Bros. Ltd. helicopter vendors; and engaged third-party aviation safety experts to assist in evaluating its helicopter practices.

Aviation investigation report A15F0165

Date	30 December 2015
Location	Anchorage, Alaska, 85 nm ENE
Aircraft	Boeing 777-333ER, C-FRAM
Event	Severe turbulence encounter
Safety action taken	**Air Canada** commenced a program to replace V-clamps on the B777 fleet in accordance with Boeing Service Bulletin 777-21-0145R01. Air Canada also published a Standard Operating Procedure (SOP) Bulletin and a Flight Operations Bulletin on turbulence. Additionally, a new section on clear air turbulence has been approved and will be incorporated into the April 2017 amendment of the Air Canada Flight Operations Manual.

Appendix B – Glossary

Accident

In general, a transportation occurrence that involves serious personal injury or death, or significant damage to property, in particular to the extent that safe operations are affected (for a more precise definition, see the Transportation Safety Board Regulations)

Incident

In general, a transportation occurrence whose consequences are less serious than those of an accident, or that could potentially have resulted in an accident (for a more precise definition, see the TSB Regulations)

Occurrence

A transportation accident or incident and any situation or condition that the Board has reasonable grounds to believe could, if left unattended, induce an accident or incident

Safety advisory

A less formal means for communicating lesser safety deficiencies to officials within and outside the government

Safety concern

A formal way to draw attention to an identified unsafe condition for which there is insufficient evidence to validate a systemic safety deficiency, but where the risks posed by this unsafe condition warrant highlighting

Recommendation

A formal way to draw attention to systemic safety issues, normally warranting ministerial attention

Safety information letter

A letter that communicates safety-related information, often concerning local safety hazards, to government and corporate officials