



## TSB BACKGROUNDER

### TSB fatigue-related findings, 1990–2018

The Transportation Safety Board of Canada (TSB) has identified fatigue as a causal or contributing factor or a source of risk in 91 investigations conducted up until October 2018. These investigations have included 29 occurrences in the railway industry, 28 in the marine sector, and 34 in aviation.

#### Rail investigation reports

Report	Occurrence	Date	Location	Finding
<a href="#">R17D0123</a>	Employee Fatality, CP	2017-11-08	Quebec	<b>Findings as to causes and contributing factors</b> —It is likely that the yard helper's fatigue contributed to the incorrect alignment of the 2WL/WL crossover switch.
<a href="#">R16W0242</a>	Uncontrolled movement, collision and derailment, CP	2016-11-29	Saskatchewan	<b>Finding as to risk</b> —If train crew members remain on duty after an extended period of wakefulness, there is a risk that the performance of cognitive task could be adversely affected.
<a href="#">R16E0051</a>	Main-track train collision, CN	2016-06-04	Alberta	<b>Finding as to risk</b> —If call times for train crew schedules cannot be reliably predicted, operating crew members may not be able to achieve sufficient restorative sleep, which can lead to accumulated sleep debts, increasing the risk of fatigue.
<a href="#">R16H0024</a>	Collision between train and track unit, CP	2016-03-06	Ontario	<b>Finding as to cause</b> —At the time the decision was made to depart Kinogama Siding, the foreman's level of fatigue and its negative impact on performance had been influenced by a number of interacting factors, likely including the combined effects of 2 sleep disorders (which were each considered mild), the time of day during a circadian trough, and a demanding work schedule. <b>Finding as to risk</b> —If maintenance-of-way employees who carry out safety-critical tasks are not subject to enhanced medical requirements, underlying medical conditions, including sleep disorders that affect the safety performance of employees, can go undetected, increasing the risk of accidents.

Report	Occurrence	Date	Location	Finding
<a href="#">R16C0012</a>	Non-main-track derailment, CP	2016-02-18	Alberta	<p><b>Finding as to cause</b>—The locomotive engineer’s working memory and vigilance were likely limited due to fatigue, contributing to the improper train handling.</p> <p>Findings as to risk</p> <ul style="list-style-type: none"> <li>• If operating employees do not use the rest opportunities provided, there is a risk that trains may be operated by fatigued employees, increasing the risk of accidents.</li> <li>• If operating employees do not remove themselves from work when they are not adequately rested, trains may be operated by fatigued employees, increasing the risk of fatigue-related accidents.</li> <li>• If railway industry fatigue management procedures do not provide opportunities for potentially fatigued employees to remove themselves from eligibility for duty without fear of discipline, there is an increased risk that fatigued employees will report for duty.</li> <li>• If internal company investigations into situations where human performance may have played a role do not collect and analyze data related to employee sleep history, issues contributing to employee fatigue may go undetected and unmitigated, increasing the risk of fatigue-related accidents.</li> </ul>
<a href="#">R15V0046</a>	Movement exceeds limits of authority, CP	2015-03-11	British Columbia	<p><b>Finding as to risk</b>—During periods of reduced alertness (such as low circadian rhythm), there is an increased risk of inadvertent errors, such as the misrepresentation of communications with other railway employees.</p>
<a href="#">R15V0003</a>	Main-track derailment, CP	2015-01-13	British Columbia	<p><b>Finding as to risk</b>—If fatigue management principles and best practices are not considered or permitted by company policy, and are not used by all employees involved in operating or routing trains, including personnel at the Rail Traffic Control Centre, employees can be in a fatigued state when making critical safety decisions, increasing the risk of non-optimal decisions leading to accidents.</p>
<a href="#">R14V0215</a>	Main-track derailment, CN	2014-11-15	British Columbia	<p><b>Finding as to cause</b>—The crew members were fatigued at the time of the occurrence, as they had been experiencing circadian rhythm disruptions in the days prior. This state of fatigue probably affected their ability to recognize the significance of the wheel slip alarm and the earlier than expected HBD/HWD/DED announcement.</p> <p><b>Finding as to risk</b>—If shift start times are highly variable, train crew members may not be able to obtain good-quality sleep on a regular basis, resulting in fatigue during duty shifts, and increasing the risk of accidents.</p>

Report	Occurrence	Date	Location	Finding
<a href="#">R12V0008</a>	Collision between train and track unit, CN	2012-01-14	British Columbia	<b>Finding as to cause</b> —The foreman's diminished state of alertness and his focus on the south portion of the right-of-way likely contributed to the formulation of an erroneous mental model, resulting in him taking the south track.
<a href="#">R11D0075</a>	Main-track derailment, CN	2011-09-24	Quebec	<b>Finding as to risk</b> —Crews that work variable, unpredictable schedules are exposed to an increased risk of diminished alertness associated with the desynchronization of their circadian rhythms.
<a href="#">R11E0063</a>	Collision with tail-end of stationary unit on main-track, CN	2011-06-23	Alberta	<b>Finding as to cause</b> —The cognitive processes of the experienced and qualified train crew members were likely impeded by reduced alertness, leading to the inappropriate train control. <b>Other finding</b> —Despite the availability of the Work/Rest Rules, work scheduling practices for train crews continue to be a challenge for employers and employees in the railway industry.
<a href="#">R10T0213</a>	Main-track derailment, CN	2010-10-01	Ontario	<b>Finding as to cause</b> —The locomotive engineer was insufficiently rested to be engaged in safety-critical tasks. His fatigued state was compounded by the challenge of operating an unfamiliar train during an unplanned braking event in undulating territory with a number of curves. <b>Finding as to risk</b> —Given that it is left to employees to determine whether they are fit to work, when faced with loss of wage and/or potential company discipline, there is an increased risk that a fatigued employee will accept work, compromising safe train operation.
<a href="#">R10Q0037</a>	Main-track derailment, CN	2010-08-23	Quebec	<b>Finding as to risk</b> —Certain factors (e.g., concurrent tasks, darkness, reduced vigilance), whether alone or in combination, can reduce the inspector's ability to perform his work.
<a href="#">R10E0096</a>	Switching assignment colliding with stationary cut of cars, CN	2010-08-18	Saskatchewan	<b>Finding as to cause</b> —A reduced level of alertness contributed to the foreman's actions, including his decision to bypass the requirement for visual point protection of the movement and his actions leading to misrouting assignment 602 into track VC-64.
<a href="#">R10Q0011</a>	Main-track derailment, VIA Rail	2010-02-25	Quebec	<b>Finding as to cause</b> —The crew's planning and reaction to more complex issues was likely degraded due to fatigue.
<a href="#">R09W0259</a>	Non-main-track collision with stationary train, CP	2009-12-19	Saskatchewan	<b>Finding as to risk</b> —Operating crews that work variable and unpredictable work schedules may be at increased risk of performance impairments due to fatigue.

Report	Occurrence	Date	Location	Finding
<a href="#">R07E0129</a>	Non-main-track collision with side of train entering siding, CN	2007-10-27	Alberta	<p><b>Finding as to cause</b>—Train 417's crew was insufficiently rested to be engaged in safety-critical tasks.</p> <p><b>Finding as to risk</b>—From time to time, fatigued train crews will feel compelled to report for work without adequate rest, creating the risk of an accident.</p> <p><b>Other finding</b>—Despite previously-acquired knowledge on fatigue, the countermeasures the railway had in place were ineffective.</p>
<a href="#">R07V0213</a>	Non-main-track collision involving a Beltpack assignment and train, CN	2007-08-04	British Columbia	<p><b>Finding as to risk</b>—While both regulatory and company Work/Rest Rules address fatigue in the short term, regulatory requirements give inadequate consideration to the cumulative effects of working extended hours over the longer term because there are no specific limitations placed upon any employee who exceeds 64 hours of work in seven days.</p>
<a href="#">R06W0079</a>	Main-track derailment, CP	2006-05-22	Saskatchewan	<p><b>Finding as to risk</b>—The interpretation of the <i>Work/Rest Rules for Railway Operating Employees</i> that allows a trip, which routinely exceeds 12 hours, to be planned as two tours of duty creates a situation in which crews may routinely exceed the 12-hour maximum tour of duty and work up to 18 hours with little or no rest break. This increases the risk that crew performance will be adversely affected by fatigue.</p>
<a href="#">R05C0082</a>	Main-track derailment, CP	2005-05-27	Alberta	<p><b>Finding as to cause</b>—It is possible that fatigue played a role in the train handling errors, that is, the rapid changes in throttle and dynamic brake that were made in this instance.</p> <p><b>Finding as to risk</b>—The regulatory and industry framework for the management of risks related to fatigue may not adequately protect against the effects of fatigue that result from the work/rest cycle of train crews.</p>
<a href="#">R03W0169</a>	Main-track derailment, CP	2003-10-19	Ontario	<p><b>Findings as to risk</b></p> <ul style="list-style-type: none"> <li>• The <i>Work/Rest Rules for Rail Operating Employees</i> permit consecutive hours of wakefulness in excess of 18 hours with no scheduled rest, which increases the risk of fatigue-related errors and accidents.</li> <li>• The nature of rail operations requires crew members to work variable, unpredictable schedules, often for their entire working lives. Unpredictable schedules increase the probability that train crews will be working in a chronically fatigued state, which can lead to errors associated with fatigue.</li> </ul>
<a href="#">R99E0023</a>	Runaway, collision and derailment, CN	1999-01-31	Alberta	<p><b>Finding as to risk</b>—The rest/work cycle and sleep pattern of the crew, especially the conductor, were conducive to fatigue and a consequent risk of performance impairment.</p>

Report	Occurrence	Date	Location	Finding
<a href="#">R98V0183</a>	Main-track collision, CN	1998-10-01	British Columbia	<p><b>Findings as to cause</b></p> <ul style="list-style-type: none"> <li>• It is quite possible that both crew members of train 792 experienced a microsleep as they approached and passed the CTC signal at Mile 59.2 governing the entrance to Basque.</li> <li>• The crew fatigue issue is even more pronounced on the second subdivision of extended runs as the distance travelled and time working during one tour of duty is typically doubled.</li> <li>• The current regulatory requirements respecting mandatory time off-duty and maximum hours of service can result in train crews being in compliance with regulatory requirements but not being sufficiently rested.</li> <li>• Loss of income from missing a trip will motivate an employee to report for duty with insufficient rest.</li> </ul>
<a href="#">R97C0147</a>	Runaway and derailment, CP	1997-12-02	British Columbia	<p><b>Finding</b>—The performance of the locomotive engineer may have been affected by fatigue which would have impaired his ability to make critical operating decisions.</p>
<a href="#">R96W0171</a>	Collision with head-end of stationary train and derailment, CN	1996-07-02	Saskatchewan	<p><b>Findings</b></p> <ul style="list-style-type: none"> <li>• While fatigue is not considered to have played a direct role in the switch being left in the reverse position or the operation of train 358 in a more cautious manner, the crew's tour of duty made them vulnerable to sleep need performance degradation.</li> <li>• Mandatory rest requirements do not account for time awake before duty nor short turn-around scheduling schemes.</li> </ul> <p><b>Safety concern</b>—The Board believes that implementation of initiatives such as CANALERT, coupled with a comprehensive hours of service rule, is necessary to alleviate the problem of fatigue in the railway operating environment. The Board is concerned that, although certain elements of CANALERT have been implemented, there has not been widespread application of the CANALERT concepts.</p>
<a href="#">R96Q0050</a>	Collision with rear of stationary train, Quebec North Shore and Labrador Railway	1996-07-14	Quebec	<p><b>Finding</b>—The possibility that fatigue may have contributed to the locomotive engineer's decision not to comply with the governing signal indication cannot be ignored.</p>
<a href="#">R95V0218</a>	Collision between 2 trains, CP	1995-10-01	British Columbia	<p><b>Finding</b>—Both crew members of train 819 were impaired by fatigue as they approached the Stop Signal at Greely and operated their train past the signal and into train 996.</p>
<a href="#">R95S0021</a>	Collision with rear of stationary train, CN	1995-02-16	Ontario	<p><b>Finding</b>—It is probable that the locomotive engineer of train 272 succumbed to fatigue and experienced a sleep episode as his train was approaching Signal 44.</p>

Report	Occurrence	Date	Location	Finding
<a href="#">R94T0334</a>	Collision with rear of stationary train, CN	1994-10-28	Ontario	<b>Finding</b> —Reduced alertness from disruption of the normal sleep cycle probably was a contributing factor in the inappropriately high speed just before the collision.

## Marine investigation reports

Report	Occurrence	Date	Location	Finding
<a href="#">M17P0244</a>	Bottom contact, Tug Ocean Monarch	2017-07-09	British Columbia	<p><b>Findings as to causes and contributing factors</b></p> <ul style="list-style-type: none"> <li>The watchkeeper, who was alone on watch in the wheelhouse at night, fell asleep while the tug and tow transited the confined waters of the Inside Passage.</li> <li>When the tug made bottom contact, the mate had been on duty for at least 8 hours. The master and deckhand were below deck asleep, and so the mate had no human interaction to help him remain awake.</li> <li>It is likely that the acute fatigue, chronic sleep disruptions, circadian rhythm desynchronization, and nighttime working risk factors experienced by the mate in the days preceding the occurrence, combined with the low and monotonous workload in the wheelhouse, resulted in the mate falling asleep sometime between 0336 and 0436.</li> <li>There were no strategies in place to mitigate crew fatigue.</li> <li>Given the tug's 24 hours per day, 7 days per week operations, a crew complement of 3 made it challenging and, at times, impossible to have 2 watchkeepers at night while also ensuring the crew was sufficiently rested.</li> </ul> <p><b>Findings as to risk</b></p> <ul style="list-style-type: none"> <li>If a marine company does not have a fatigue management plan and there is no regulatory requirement for it to do so, there is a risk that crews will operate a vessel while fatigued, increasing the likelihood of an error that leads to an occurrence.</li> </ul>
<a href="#">M16P0378</a>	Grounding and sinking of articulated tug- barge <i>Nathan E. Stewart</i> and tank barge <i>DBL 55</i>	2016-10-13	British Columbia	<p><b>Finding as to cause</b>—The second mate, who was working alone on the bridge, was fatigued and fell asleep. As a result, he did not make the planned course alteration, and the articulated tug-barge struck and grounded on a reef.</p> <p><b>Finding as to risk</b>—If a 6-on, 6-off shift schedule is used without fatigue-mitigating measures, there is a risk that crew members will carry out their duties while impaired by fatigue.</p>
<a href="#">M15C0006</a>	Grounding of self-discharging bulk carrier <i>Atlantic Erie</i>	2015-01-11	Quebec	<b>Finding as to risk</b> —If mariners, including the master, exceeded the regulated hours of work and are not properly rested, there is a risk of fatigue-related accidents.

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<a href="#">M14C0219</a>	Bottom contact of tanker <i>Nanny</i>	2014-10-14	Nunavut	<p><b>Findings as to cause</b></p> <ul style="list-style-type: none"> <li>• At the time of the occurrence, both the master and the helmsman had been subject to significant fatigue risk factors and exhibited performance decrements consistent with fatigue.</li> <li>• Ineffective fatigue management on board the vessel contributed to the master and helmsman being fatigued while on duty.</li> </ul> <p><b>Finding as to risk</b>—If marine regulations do not require companies to develop comprehensive fatigue management plans, performance decrements may occur in those who occupy safety-critical positions, increasing the risk of incidents and accidents.</p>
<a href="#">M12L0147</a>	Grounding of bulk carrier <i>Tundra</i>	2012-11-28	Quebec	<p><b>Finding as to cause</b>—Fatigue was a likely factor in the pilot's diminished situational awareness at a critical time when a course change was required.</p> <p><b>Finding as to risk</b>—Without training in fatigue awareness, there is a risk pilots may not be able to identify symptoms or signs related to sleep disorders, which are not detectable through a regular medical exam.</p>
<a href="#">M12F0011</a>	Collision between fishing vessels <i>Viking Storm</i> and <i>Maverick</i>	2012-09-28	United States	<p><b>Finding as to cause</b>—It is highly likely that the cognitive abilities of the mate on the <i>Viking Storm</i> were reduced due to fatigue resulting from a combination of acute sleep loss, continuous wakefulness, and circadian rhythm timing.</p> <p>Findings as to risk</p> <ul style="list-style-type: none"> <li>• If fishermen equate resting with sleeping in terms of its restorative capacity, there is a risk that they may underestimate the continuous hours of sleep necessary to restore their cognitive functions.</li> <li>• Minimum safe manning requirements that do not consider the various aspects of fishing operations may result in crew members not being provided opportunities to achieve the required hours of rest.</li> <li>• Without a fatigue management plan that considers fishing operations and the need to ensure uninterrupted sleep, crew members may not be sufficiently rested to safely perform their duties.</li> </ul>
<a href="#">M12N0017</a>	Striking of wharf by Passenger vessel <i>Beaumont Hamel</i>	2012-05-30	Newfoundland and Labrador	<p><b>Finding as to risk</b>—Fatigue-management plans that do not provide sufficient opportunity for restorative sleep increase the risk of reduced crew performance on a routine basis.</p>

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<a href="#">M11W0091</a>	Striking of bridge by tug <i>F.W. Wright</i> and barge <i>Empire 40</i>	2011-06-28	British Columbia	<p><b>Findings as to cause</b></p> <ul style="list-style-type: none"> <li>The master had been awake for approximately 22 hours and was likely experiencing feelings of fatigue when he handed over the control to the mate prior to a critical stage in the passage.</li> <li>The master did not take advantage of the opportunity to rest and sleep after the mate joined the tug and fell asleep at a critical stage in the passage.</li> </ul>
<a href="#">M09W0064</a>	Collision between fishing research vessel <i>Velero IV</i> and fishing vessel <i>Silver Challenger II</i>	2009-04-08	British Columbia	<p><b>Finding as to risk</b>—Work/rest schedules that do not provide for sufficient restorative sleep are likely to lead to fatigue, performance degradation, and errors due to lack of attention, alertness, and vigilance.</p>
<a href="#">M08C0024</a>	Grounding of bulk carrier <i>Algomarine</i>	2008-05-28	Ontario	<p><b>Finding as to cause</b>—Lack of sleep contributed to the master's fatigue, which in turn likely affected his performance. Sleep disturbance could have been exacerbated by the negative side effects of quitting smoking and the use of a prescription drug.</p>
<a href="#">M07L0158</a>	Striking of passenger vessel <i>Nordik Express</i>	2007-08-16	Quebec	<p><b>Finding as to risk</b>—In the absence of a fatigue management plan, the probability of fatigue-induced errors increases, thereby increasing the risk to vessels, crew, passengers, and the environment.</p>
<a href="#">M06F0024</a>	Crew member of sail training vessel <i>Picton Castle</i> lost overboard	2006-12-08	Nova Scotia	<p><b>Finding as to cause</b>—The deckhand was likely affected by fatigue and a loss of alertness at the time of the occurrence.</p>
<a href="#">M06N0014</a>	Fire in cargo oil tank of shuttle tanker <i>Kometik</i>	2006-04-08	Newfoundland and Labrador	<p><b>Finding as to cause</b>—A crew member with a high workload of safety-sensitive duties worked while in a fatigued state, leading to insufficient oversight of the welding activities.</p> <p><b>Finding as to risk</b>—The vessel's shipboard safety manual did not identify fatigue or workload as risk factors and did not incorporate procedures to mitigate them.</p>
<a href="#">M06W0052</a>	Striking and sinking of passenger and vehicle ferry <i>Queen of the North</i>	2006-03-22	British Columbia	<p><b>Finding</b>—The change from sleeping during the night to sleeping during the day, together with the restless sleep, likely increased the risk of QM1 being fatigued.</p>
<a href="#">M05C0063</a>	Grounding of bulk carrier <i>Michipicoten</i>	2005-10-28	Ontario	<p><b>Finding as to cause</b>—The master's work/rest schedule at the time of the occurrence did not adhere to well established regulatory requirements.</p> <p><b>Finding as to risk</b>—The regulatory requirements to help ensure masters and officers have enough rest were not incorporated in the company's written procedures.</p> <p><b>Other finding</b>—The master's schedule may have predisposed him to fatigue-related performance issues.</p>



Report	Occurrence	Date	Location	Finding
<a href="#">M04L0099</a>	Collision between pleasure craft <i>Mondisy</i> and container ship <i>Canada Senator</i>	2004-08-11	Quebec	<b>Finding as to cause</b> —It is likely that the unstructured watchkeeping system aboard the <i>Mondisy</i> led to a sleep debt that caused the co-worker to fall asleep while on duty at the helm.
<a href="#">M04L0092</a>	Container ship <i>Horizon</i>	2004-07-24	Quebec	<b>Finding as to cause</b> —Fatigue may have been a factor in the pilot's decreased vigilance at a critical time. <b>Finding as to risk</b> —Despite fatigue awareness training and contractual arrangements that set out adequate rest for pilots, fatigue continues to be a factor in occurrences.
<a href="#">M02L0061</a>	Bulk carrier <i>Kent</i>	2002-07-16	Quebec	<b>Finding as to risk</b> —In the 24 hours preceding the accident, the bosun only had four hours off duty, and his judgment, reaction time, and alertness would have been adversely affected by fatigue.
<a href="#">M02C0011</a>	Tug-barge unit <i>Progress/Pitts Carillon</i>	2002-04-21	Ontario	<b>Finding as to cause</b> —The adopted work-rest schedule for the crew was not conducive to acquiring proper rest, and the crew's performance was likely affected by fatigue at the time of the occurrence.
<a href="#">M97W0197</a>	Grounding of bulk carrier <i>Raven Arrow</i>	1997-09-24	British Columbia	<b>Finding as to cause</b> —The pilot did not fully appreciate the negative effects that an irregular work schedule and sleep debt can have on performance. The pilot was probably fatigued and there was no formalized education/training program in place regarding conditions conducive to fatigue and the impact of scheduling on fatigue.
<a href="#">M96C0032</a>	Dangerous Occurrence Passenger ferry <i>Wolfe Islander III</i>	1996 -05-29	Ontario	<b>Finding</b> —It is likely that master was suffering from fatigue, which may have adversely affected his judgement and performance.
M94W0066	Collision Fishing vessels <i>Narvik</i> and <i>Island Joy</i>	1994-08-21	British Columbia	<b>Finding</b> —The skipper/owner of the <i>Island Joy</i> fell asleep while alone on watch.
M94W0057	Fall overboard Bulk carrier <i>Pacific Brilliance</i>	1994-07-27	British Columbia	<b>Finding</b> —The shipyard personnel, including the victim, had been working for over 17 hours and they used an unsafe gangway to disembark from the vessel.
M94M0036	Collision Fishing vessel <i>Lady Olive Marie</i> , racing sailboat <i>Coyote</i>	1994-08-24	Nova Scotia	<b>Finding</b> —Due to fatigue, a proper lookout onboard the <i>Coyote</i> was not being maintained as required by the <i>International Regulations for Preventing Collisions at Sea</i> .

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<a href="#">M93M0008</a>	Small lobster vessel <i>Stump Jumper</i>	1993-11-30	Nova Scotia	<b>Finding</b> —The operator's performance was probably impaired by the cumulative effects of his diabetic condition and work-induced fatigue.
<a href="#">M93L0001</a>	Bulk carrier <i>Canadian Explorer</i>	1993-04-16	Quebec	<b>Findings</b> <ul style="list-style-type: none"> <li>• The pilot had had over two days of rest period since his last assignment, but was tired at the start of this assignment.</li> <li>• The pilot's behaviour pattern and sleep discipline during rest periods were not conducive to maximizing his performance.</li> <li>• The pilot had had the conduct of the vessel for some three and a half hours and was asleep at the time of bottom contact.</li> </ul>
M93CO003	Striking Bulk carrier <i>Nirja</i> and tanker <i>Hamilton Energy</i>	1993-12-11	Ontario	<b>Finding</b> —The pilot had been on duty for some 22 hours without restorative sleep and this probably adversely affected his performance. <b>Board concerns</b> <ul style="list-style-type: none"> <li>• Pilotage assignment practices permitted extended duty days, which could lead to significant performance degradation.</li> <li>• The Great Lakes Pilotage Authority and the pilots themselves apparently did not fully appreciate the negative effects of fatigue on performance and the strategies for mitigating those effects.</li> </ul>
M92W1066	Collision Bulk carrier <i>Nand Anant</i> and fishing vessel <i>Carmanah No. 1</i>	1992-08-29	British Columbia	<b>Findings</b> <ul style="list-style-type: none"> <li>• There are no regulations governing hours of work/rest on board fishing vessels.</li> <li>• Ineffective planning of the work/rest hours resulted in less vigilant, tired personnel being on watch.</li> </ul>

### Aviation investigation reports

Report	Occurrence	Date	Location	Finding
<a href="#">A17Q0050</a>	Collision with wires, Exact Air	2017-04-30	Quebec	<b>Finding as to cause</b> —Sensation seeking, mental fatigue, and an altered risk perception very likely contributed to the fact that, immediately after completing the magnetometric survey work, the pilot flying descended to an altitude varying between 100 and 40 feet above ground level and maintained this altitude until the aircraft collided with the wires.
<a href="#">A16P0180</a>	Loss of control and collision with terrain, privately operated Beaver aircraft	2016-10-10	British Columbia	<b>Finding as to risk</b> —If pilots do not obtain quality sleep during the rest period prior to flying, there is a risk that they will operate an aircraft while fatigued, which could degrade pilot performance.

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<a href="#">A16O0016</a>	Runway incursion and risk of collision, Air Canada	2016-01-30	Ontario	<b>Finding as to risk</b> —If required commuting flights are not included as part of the pilot's duty day, there is an increased risk of pilots operating while fatigued due to prolonged periods of wakefulness.
<a href="#">A16A0084</a>	Collision with wires, privately operated helicopter	2016-09-04	New Brunswick	<b>Finding as to risk</b> —If pilots do not take advantage of opportunities to sleep between duty periods, there is an increased risk of degraded performance due to fatigue.
<a href="#">A15O0031</a>	In-flight breakup, privately operated Piper aircraft	2015-03-17	Ontario	<b>Finding as to cause</b> —Given the pilot's expired qualifications, lack of recent experience, and levels of chronic stress and fatigue, he was neither qualified nor fit to undertake the flight on the day of the occurrence.
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<a href="#">A15H0002</a>	Collision with terrain, Air Canada	2015-03-29	Nova Scotia	<b>Finding as to risk</b> —If Transport Canada does not consistently follow its protocol for the assessment of aeromedical risk and ongoing surveillance in applicants who suffer from obstructive sleep apnea, some of the safety benefit of medical examinations will be lost, increasing the risk that pilots will fly with a medical condition that poses a risk to safety. <b>Other finding</b> —Given that the captain rarely used continuous positive airway pressure therapy, he would have been at risk of experiencing fatigue related to chronic sleep disruption caused by obstructive sleep apnea. However, there was no indication that fatigue played a causal or contributory role in this occurrence.
<a href="#">A13H0001</a>	Controlled flight into terrain, Ornge medevac helicopter	2013-05-31	Ontario	<b>Finding as to risk</b> —If pilots engage in other work-related activities before the commencement of scheduled flight duty time, there is a risk that regulatory flight duty time limitations will be exceeded, which may degrade performance due to fatigue.
<a href="#">A13C0105</a>	Loss of control – collision with water, Transwest Air Limited Partnership	2013-08-22	Northwest Territories	<b>Finding as to cause</b> —Cumulative unmanaged stressors disrupted the pilot's processing of safety-critical information, and likely contributed to an unsafe decision to depart with a damaged, uninspected aircraft. Specifically, the pilot's fatigue, in combination with illness, anger, heavy workload, time pressure, and the tree strike, reduced the resources available to gather and systematically process safety-critical information, resulting in a decision to depart with a damaged, uninspected aircraft.

Report	Occurrence	Date	Location	Finding
<a href="#">A12W0004</a>	Runway overrun, Enerjet	2012-01-09	British Columbia	<p><b>Findings as to cause</b></p> <ul style="list-style-type: none"> <li>• The captain did not attain appreciable sleep in the 24 hours preceding the flight and was fatigued, likely resulting in attention decrements.</li> <li>• The captain continued the approach when the aircraft was not in a stabilized configuration, consistent with fatigue-induced reduction in forward planning and a focus of attention towards salvaging the flight.</li> </ul> <p><b>Findings as to risk</b></p> <ul style="list-style-type: none"> <li>• If flight crews are not given training on fatigue and fatigue countermeasures, they risk not having the tools they need to deal with fatigue.</li> <li>• If flight crew are required to assess their own level of fatigue and the effects it will have on their performance, they may not identify unacceptable levels of fatigue.</li> </ul>
Report	Occurrence	Date	Location	Finding
<a href="#">A12Q0216</a>	Low-energy rejected landing and collision with terrain, Perimeter Aviation	2012-12-22	Nunavut	<p><b>Finding as to cause</b>—Frustration, fatigue, and an increase in workload and stress during the instrument approaches resulted in crew attentional narrowing and a shift away from well-learned, highly practised procedures.</p>

Report	Occurrence	Date	Location	Finding
<a href="#">A11F0012</a>	Pitch excursion, Air Canada	2011-01-14	North Atlantic Ocean	<p><b>Findings as to cause</b></p> <ul style="list-style-type: none"> <li>• The interrupted sleep obtained by the first officer prior to the flight increased the likelihood that rest would be needed during the overnight eastbound flight.</li> <li>• The first officer slept for approximately 75 minutes which likely placed the first officer into slow-wave sleep and induced longer and more severe sleep inertia.</li> <li>• The first officer was experiencing a circadian low due to the time of day and fatigue due to interrupted sleep which increased the propensity for sleep and subsequently worsened the sleep inertia.</li> <li>• By identifying the oncoming aircraft, the captain engaged the first officer (FO) before the effects of sleep inertia had worn off.</li> <li>• Under the effects of sleep inertia, the first officer perceived the oncoming aircraft to be on a collision course and pushed forward on the control column.</li> <li>• The frequency of training and depth of the training material on fatigue risk management to which the flight crew were exposed were such that the risks associated with fatigue were not adequately understood and procedures for conducting controlled rest were not followed by the flight crew.</li> </ul> <p><b>Finding as to risk</b>—North American-based pilots flying eastbound at night towards Europe are at increased risk of fatigue-related performance decrements.</p>
<a href="#">A10H0004</a>	Runway overrun, Trans States Airlines LLC	2010-06-16	Ontario	<p><b>Finding as to risk</b>—Fatigue creates a risk of performance decrements in aircraft operations, and work-rest rules did not necessarily prevent flight crews from being fatigued.</p>
<a href="#">A09Q0003</a>	Controlled flight into trees, privately operated Piper Cherokee	2009-01-06	Quebec	<p><b>Finding as to risk</b>—The pilot undertook an extended night flight at the end of the day, with a planned return flight the same day. As a result, the pilot ran the risk of fatigue that may have led to degradation of performance.</p>
<a href="#">A08O0233</a>	Uncontrolled descent into terrain, privately operated Cessna	2008-09-01	Ontario	<p><b>Findings as to cause</b></p> <ul style="list-style-type: none"> <li>• Due to fatigue, the pilot involuntarily fell asleep resulting in the aeroplane continuing to fly in its trimmed condition until it struck the ground.</li> <li>• The two passengers, both with flying experience, were asleep and did not identify the developing situation and, therefore, could not alert the pilot.</li> </ul> <p><b>Finding as to risk</b>—Reliance on a pilot's own judgment to prevent fatigue-related accidents is an ineffective defence mechanism.</p>

Report	Occurrence	Date	Location	Finding
<a href="#">A08C0164</a>	Airspeed decay – Uncommanded descent, Air Canada Jazz	2008-08-01	Manitoba	<b>Finding as to risk</b> —Although it is unlikely that the crew were fatigued at the time of the occurrence, the captain's work schedule resulted in irregular sleep patterns that had the potential to increase the risk of fatigue and fatigue-related performance decrements.
<a href="#">A07O0305</a>	Runway incursion, R & M Aviation Inc.	2007-11-15	Ontario	<b>Finding as to risk</b> —A crew's alertness may be reduced by operational pressures and fatigue associated with a long duty day and multi-leg scheduling.
<a href="#">A07O0273</a>	Collision with trees on approach, Ukrainian Cargo Airways	2007-10-04	Ontario	<b>Finding as to risk</b> —On several occasions prior to the occurrence flight, the crew did not receive the 42-hour rest period required by Ukrainian Cargo Airways' procedures after completing trans-meridian flights, potentially increasing the risk of operating while fatigued.
<a href="#">A05W0109</a>	Inadvertent stick shaker at high altitude, Air Canada Jazz	2005-06-10	Alberta	<b>Finding as to cause</b> —The captain was not well rested before the flight. The effects of fatigue likely resulted in a degradation of his concentration and prolonged diversion of attention from monitoring of airspeed after power reduction. The airspeed was therefore allowed to fall below the targeted value.
<a href="#">A04W0032</a>	Landing beside the runway, Bradley Air Services Ltd. (First Air)	2004-02-25	Alberta	<b>Finding as to risk</b> —Neither the <i>Canadian Aviation Regulations</i> nor the <i>First Air Operations Manual</i> provides sufficient defences concerning the scheduling of crew duty periods so that extended periods of wakefulness, lack of restorative sleep and rapid changes in crew shift times do not unduly affect crew performance.
<a href="#">A04H0004</a>	Reduced power at take-off and collision with terrain MK Airlines Limited	2004-10-14	Nova Scotia	<b>Findings as to cause</b> <ul style="list-style-type: none"> <li>• Crew fatigue likely increased the probability of error during calculation of the take off performance data, and degraded the flight crew's ability to detect this error.</li> <li>• Crew fatigue, combined with the dark take-off environment, likely contributed to a loss of situational awareness during the take-off roll. Consequently, the crew did not recognize the inadequate take-off performance until the aircraft was beyond the point where the take-off could be safely conducted or safely abandoned.</li> </ul>
<a href="#">A04H0001</a>	Loss of control, Georgian Express Ltd.	2004-01-17	Ontario	<b>Finding as to cause</b> —On this flight, the pilot's lack of appreciation for the known hazards associated with the overweight condition of the aircraft, ice contamination, and the weather conditions was inconsistent with his previous practices. His decision to take off was likely adversely affected by some combination of stress and fatigue.
<a href="#">A01O0210</a>	Controlled flight into terrain, privately operated Cessna	2001-08-03	Ontario	<b>Finding as to cause</b> —It is likely that fatigue affected the pilot's performance, and may have contributed to the accident.
<a href="#">A00W0217</a>	Collision with terrain, Summit Air Charters Ltd.	2000-10-08	Northwest Territories	<b>Finding as to risk</b> —Given the pilot's flying time during the 30 days before the accident, the pilot's performance might have been affected by fatigue.

Report	Occurrence	Date	Location	Finding
<a href="#">A99W0043</a>	Wing strike on landing, Delta Air Lines	1999-03-10	Alberta	<b>Finding as to risk</b> —The captain and the second officer were subjected to a long work day because, in addition to the duty day required to operate the flights, they had commuted to their base of operation by air early on the morning of the flight. Long work days may contribute to fatigue.
<a href="#">A99Q0151</a>	Controlled flight into terrain, Régionnair Inc.	1999-08-12	Quebec	<b>Findings as to risk</b> <ul style="list-style-type: none"> <li>• Both crew members had surpassed their maximum monthly and quarterly flight times and maximum daily flight duty times. They were thus at increased risk of fatigue, which leads to judgement and performance errors.</li> <li>• The first officer likely suffered from chronic fatigue, having worked an average of 14 hours a day for the last 30 days, with only 1 day of rest.</li> </ul>
<a href="#">A97Q0183</a>	Wire strike on take-off, privately operated Piper Aztec	1997-08-22	Quebec	<b>Finding as to cause</b> —The pilot was fatigued, because he did not take enough rest in preparation for the flight.
<a href="#">A97P0207</a>	Collision with terrain, Northern Mountain Helicopters Inc.	1997-07-30	British Columbia	<b>Findings as to risk</b> <ul style="list-style-type: none"> <li>• The pilot's work/rest schedule increased the probability of him making fatigue-related errors in both aircraft handling and judgement.</li> <li>• According to the company records, the pilot had, on several occasions, exceeded the legislated flight- and duty-time limitations of the CARs.</li> </ul>
<a href="#">A95W0093</a>	Weather-related event, Continental Helicopters	1995-06-13	Yukon Territory	<b>Finding as to cause</b> —The pilot's flying activities in the period prior to the accident were conducive to fatigue.
<a href="#">A95Q0210</a>	Controlled flight into terrain, privately operated Cessna	1995-10-22	Newfoundland and Labrador	<b>Finding as to risk</b> —The pilot had been on duty for a long period, which possibly affected his performance.
A95P0007	Collision with water, privately operated Piper	1995-01-12	British Columbia	<b>Finding as to cause</b> —The pilot reportedly had little sleep in the previous 24 hours and may have been fatigued.
<a href="#">A94C0119</a>	Collision with terrain, privately operated Cessna	1994-06-29	Saskatchewan	<b>Finding as to cause</b> —The pilot's flying and non-flying duties resulted in long hours of work. As a result, he may have been suffering from fatigue.
<a href="#">A94C0088</a>	Controlled flight into obstacle and terrain, Keewatin Air Limited	1994-06-01	Manitoba	<b>Finding as to cause</b> —Pilot fatigue and personal stress likely adversely affected the performance of the pilot flying.

Report	Occurrence	Date	Location	Finding
<a href="#">A93W0204</a>	Marine power loss/loss of control, Arctic Wings and Rotors	1993-12-03	Northwest Territories	<b>Finding as to risk</b> —While it cannot be determined that fatigue contributed to this accident, the pilot's recent work schedule was conducive to fatigue.
A91H0004	Collision with terrain, Government of Quebec	1991-06-19	Quebec	<b>Findings as to risk</b> <ul style="list-style-type: none"> <li>• The crew had been subjected to fatigue-inducing elements during the three days prior to the accident.</li> <li>• The Service aérien du Québec does not consider stand-by time held at the airport by water bomber crews as duty time.</li> </ul>