

PILOT FATIGUE—A STUDY ON THE EFFECTIVENESS OF FLIGHT AND DUTY TIME REGULATIONS FOR PROFESSIONAL PILOTS IN CANADA

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In Canada, federal regulations govern the maximum time a professional pilot may fly an aircraft (flight time) and be on duty at his or her workplace (duty time). This report summarizes the findings of a study conducted in 2016-2017, which analyzed the effectiveness of flight and duty time (FDT) regulations for professional pilots in Canada. More specifically, this study was conducted to assess whether the current FDT regime adequately protects the safety of air crews and passengers onboard Canadian aircraft. This study focuses on Canadian operators conducting commercial operations under Part VII of the *Canadian Aviation Regulations* (CARs) as aerial work, air taxi, and commuter and airline operators. It analyzes whether federal laws adequately regulate pilot fatigue and whether there are any gaps within the CARs. Because the CARs regulate FDT differently depending on the category of operator, this study also considered potential safety trends with respect to pilot fatigue in various categories of carriers; the effects of standby duty; the risks associated with being awake for extended periods of time; and whether less experienced pilots are more vulnerable to pilot fatigue in comparison to more experienced pilots. Five key informants, who worked as professional pilots in Canada, were interviewed in the course of this study to substantiate certain hypotheses. Following these interviews, this report was produced. It focuses on five aspects of FDT regulations in order to understand their positive or adverse impact on pilot fatigue: (1) work schedules; (2) pilot remuneration; (3) fatigue and stress; (4) company safety culture and work environment; and (5) industry issues.

Au Canada, la réglementation fédérale régit le temps maximal pendant lequel un pilote professionnel peut piloter un aéronef (temps de vol) et être en service sur son lieu de travail (temps de service). Ce rapport résume les résultats d'une étude, menée en 2016-2017, qui a analysé l'efficacité de la réglementation en matière de temps de vol et de service (TVS) pour les pilotes professionnels au Canada. Alors que de nombreux États membres de l'Organisation de l'aviation civile internationale (OACI) ont récemment modernisé leur réglementation TVS, l'approche réglementaire adoptée par le Canada pour atténuer la fatigue des pilotes n'a pas été mise à jour depuis 1996. Pour cette raison, cette étude a notamment été menée pour déterminer si le régime actuel de TVS protège adéquatement la sécurité des équipages aériens et des passagers à bord des aéronefs canadiens. Cette étude est axée sur les exploitants canadiens menant des opérations commerciales en vertu de la Partie VII du Règlement de l'aviation canadien (RAC) en tant qu'exploitants de travaux aériens, de taxis aériens, de navetteurs et de compagnies aériennes. Elle analyse si les lois fédérales réglementent adéquatement la fatigue des pilotes et s'il existe des lacunes dans le RAC. Comme le RAC réglemente les TVS différemment selon la catégorie d'opérateur, la présente étude a également examiné les tendances potentielles en matière de sécurité en ce qui concerne la fatigue du pilote chez diverses catégories de transporteurs; les effets du devoir de disponibilité; les risques associés au fait de rester éveillé pendant de longues périodes; et si les pilotes moins expérimentés sont plus vulnérables à la fatigue des pilotes par rapport aux pilotes plus expérimentés. Cinq informateurs clés, qui ont travaillé comme pilotes professionnels au

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Canada, ont été interrogés dans le cadre de cette étude pour confirmer certaines hypothèses. Suite à ces entretiens, ce rapport a été produit. Il se concentre sur cinq aspects de la réglementation TVS afin de comprendre leur impact positif ou négatif sur la fatigue du pilote: (1) les horaires de travail; (2) la rémunération du pilote; (3) la fatigue et le stress; (4) la culture de sécurité de l'entreprise et l'environnement de travail; et (5) les problèmes de l'industrie.

En Canadá, las normas federales regulan el tiempo máximo que un piloto comercial puede volar una aeronave (tiempo de vuelo) y estar de servicio en su lugar de trabajo (tiempo de servicio). Este informe resume los resultados de un estudio realizado entre 2016 y 2017 en el que se examinó la efectividad de la regulación del tiempo de vuelo y servicio (TVS) de los pilotos profesionales en Canadá. Aunque recientemente, varios de los Estados miembros de la Organización de Aviación Civil Internacional (OACI) han modernizado sus reglamentaciones de TVS, en Canadá el enfoque reglamentario para mitigar la fatiga de los pilotos no ha sido actualizado desde 1996. Por lo tanto, este estudio fue realizado para determinar si el régimen actual de TVS protege adecuadamente la seguridad de las tripulaciones aéreas y de los pasajeros a bordo de aeronaves canadienses. Este estudio se concentra en los operadores canadienses que realizan operaciones comerciales en virtud de la Parte VII del Reglamento de Aviación canadiense (RAC), como los operadores de trabajo aéreo, los taxis aéreos, los transportistas y las aerolíneas. Examina si las leyes federales regulan adecuadamente la fatiga de los pilotos y si hay vacíos en el RAC. Dado que el RAC regula el TVS de manera diferente según la categoría del operador, este estudio también examina las posibles tendencias de seguridad con respecto a la fatiga del piloto entre las categorías de transportistas; los efectos del deber de disponibilidad; los riesgos asociados con el permanecer despierto por largos períodos; y si los pilotos menos experimentados son más vulnerables a la fatiga que los pilotos más experimentados. Cinco informantes claves, quienes trabajaron como pilotos profesionales en Canadá, fueron entrevistados para evaluar las hipótesis de este estudio. Este informe fue realizado tras terminar estas entrevistas. En él, cinco aspectos de la regulación de TVS fueron investigados para comprender su impacto positivo o negativo en la fatiga del piloto: (1) los horarios de trabajo; (2) la remuneración del piloto; (3) la fatiga y el estrés; (4) la cultura de seguridad de la empresa y el entorno laboral; y (5) los problemas en la industria.

Since its inception over a century ago, commercial aviation has grown into one of the most competitive industries worldwide. To satisfy the growing needs and expectations of a demanding clientele, air carriers operate around the world, nearly twenty-four hours a day, every day of the year.¹ Because of the market's strong demand, pilots often must fly day and night through several time zones, while being responsible for the lives of their passengers and fellow air crew. Although air carriers strive to achieve strong safety records, economic impediments sometimes blur the line between safe and hazardous behavior.

Aviation can indeed be a ruthless and cutthroat industry, which is fueled by passion, competitiveness and money. With trillions of dollars in overhead, the short and long-term financial health of many air carriers remains at the mercy of imponderable business risks, such as aircraft malfunctions, natural disasters, economic recessions, airspace closures, accidents and labor strikes. With air carriers generating net profit margins hovering around 1%,² the financial stakes are considerable. Even then, this profit margin may only be achieved if carriers can optimize the use of their resources, which requires, in practice, operating more flights and carrying as many passengers as possible, while minimizing the amount of resources utilized. In a perfect world, company executives must constantly balance safety and efficiency, while minimizing their aircraft's and aircrews' downtime on the ground. Whenever a multi-million-dollar aircraft is not in the sky, an airline's ability to generate a return on that asset is diminished. To mitigate this business risk, air carriers constantly seek to maximize the productivity and utilization of their air crew at the lowest cost possible,³ occasionally to the detriment of the crews' performance and wellbeing.

Pilots often fall victim to this reality when exposed to grueling work schedules that considerably contrast with ordinary "nine to five" professions. Yet pilots are no different from any other human beings; they also suffer from the adverse effects of fatigue as a result of their work schedules. Unlike in an office setting, the safety implications of making a mistake in the cockpit can be deadly. Given the nature of the civil-aviation industry, professional pilots in Canada face atypical work schedules, often working in remote areas, far away from their usual places of residence. Competitiveness within the industry also compels many pilots to work long hours to satisfy a demanding clientele. While working under these operational constraints, pilots are significantly more vulnerable to the effects of fatigue.

Based on the foregoing, it can be stated that safety is a dynamic variable⁴

¹ Temesha Evans-Davis, "Pilot Fatigue: Unresponsive Federal Aviation Regulations and Increasing Cockpit Technology Threaten to Rock the Nation's Pilots to Sleep and Compromise Consumer Safety" (1999-2000) 65:3 J Air L & Com 567 at 579.

² Paul Stephen Dempsey, "The Financial Performance of the Airline Industry Post-Deregulation" (2008-2009) 45:2 Hous L Rev 421 at 424-27; "Why airlines make such meagre profits", *The Economist* (23 February 2014), online: www.economist.com/blogs/economist-explains/2014/02/economist-explains-5 [<https://perma.cc/Y7K3-XJHP>].

³ Paul Stephen Dempsey & Laurence E Gesell, *Airline Management Strategies for the 21st Century*, 3rd ed (Chandler, AZ: Coast Aire Publications, 2012) at 605.

⁴ See ICAO, *Safety Management Manual (SMM)*, 3rd ed, ICAO Doc 9859/AN/474 (Montreal: ICAO, 2013) at 2-1 ("[w]ithin the context of aviation, safety is 'the state in which the possibility of harm

shaped by external factors, particularly economic and organizational impediments.⁵ Since safety and profitability together form an indivisible prerequisite which ensures the long-term sustainability of every commercial air operation, organizational decisions by an airline,⁶ such as pilot scheduling, can foster either improved or inferior safety levels.⁷ As these external factors can induce substantial variations in pilot performance,⁸ there has been a strong focus in aviation safety to study human behavior, including the adverse effects of pilot fatigue on safety.⁹

Due to the demanding work and rest schedules imposed upon flight crews,¹⁰ pilot fatigue is a major safety concern in air transportation.¹¹ In recent decades, the potential for a systemic pilot-fatigue phenomenon has been exacerbated by modern “cockpit automation addiction”,¹² which has enabled pilots to endure longer transcontinental flights through several time zones, often with little rest.¹³ Given that 90% of aviation accidents are caused by human error,¹⁴ pilot fatigue and inappropriate employee work and rest schedules represent a considerable safety risk in modern aviation.

The International Civil Aviation Organization (ICAO) has addressed this risk with the adoption of international safety standards and recommendations governing air-crew scheduling. Canada has implemented these international standards by enacting its own set of domestic flight and duty time (FDT) regulations to address pilot fatigue. Currently, Canadian regulations do not fully comply with ICAO’s international FDT standards. Another point of concern is that pilot fatigue was recently identified as a causal factor in a near-miss accident at night, where a major Canadian airliner almost landed on a taxiway where four other aircraft were taxiing, instead of lining up with the

to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management.”).

⁵ James Reason, “Understanding Adverse Events: Human Factors” (1995) 4:2 *Int J Qual Health Care* 80.

⁶ See generally René David-Cooper, “Landing Safety Management Systems (SMS) in Aviation: The Implementation of Annex 19 for Commercial Air Carriers in Canada” (2015) 40 *Ann Air & Space L* 445.

⁷ Michael Quinlan, *Ten Pathways to Death and Disaster: Learning from Fatal Incidents in Mines and Other High Hazard Workplaces* (Annandale, NSW: The Federation Press, 2014) at 17; Natalie N DuBose, “Flightcrew Member Duty and Rest Requirements: Does the Proposed Legislation Put to Rest the Concern Over Pilot Fatigue?” (2011) 76:2 *J Air L & Com* 253 at 256.

⁸ ICAO, *SMM*, *supra* note 4 at 2-7.

⁹ ICAO, *International Standards and Recommended Practices: Annex 6 to the Convention on International Civil Aviation: Part 1 — International Commercial Air Transport: Aeroplanes*, ch 1 [Annex 6].

¹⁰ See Eileen M Gleimer, “When Less Can Be More: Fractional Ownership of Aircraft—The Wings of the Future” (1999) 64:4 *J Air L & Com* 979 at 979.

¹¹ Quinlan, *supra* note 7 at 69 (“Extended hours of work and fatigue can both contribute to serious incidents and have long-term health effects”); Kelsey M Taylor, “Sleeping on the Job: A Critical Analysis of the FAA’s ‘Cargo Carve-out’ under F.A.R. 117 and the Simple Solution that No One is Talking About” (2014) 79:2 *J Air L & Com* 401 at 403.

¹² See Jane Cherry, “Remembering How to Fly: How New Pilot Training Requirements May Do More Harm than Good” (2012) 77:3 *J Air L & Com* 537 at 567. In the 21st century, most airliners rely heavily on cockpit automation, with aircraft control inputs being managed almost exclusively by on-board computer and instrument systems. Nowadays, most airline pilots only fly the aircraft during take-off and landing. In practice, aircraft automation has the benefit of decreasing pilot workload during flight. Under this assumption, many regulations were developed with a view to increasing maximum FDT limits.

¹³ See Evans-Davis, *supra* note 1.

¹⁴ Reason, *supra* note 5 at 80.

actual runway.¹⁵ Since the 1990s, the Transportation Safety Board of Canada (TSB) has also cited pilot fatigue as a causal factor in 34 separate aviation occurrences.¹⁶ In 2018,

¹⁵ U.S. National Transportation Safety Board, Taxiway Overflight, Air Canada Flight 759 Airbus A320-211, C-FKCK, San Francisco, California July 7, 2017, online: National Transportation Safety Board <<https://www.ntsb.gov/investigations/AccidentReports/Pages/AIR1801.aspx>>.

¹⁶ Transportation Safety Board of Canada, *Fatigue management in rail, marine and air transportation*, 29 October 2018, online: <<http://www.bst-tsb.gc.ca/eng/surveillance-watchlist/multimodal/2018/multimodal-03.html>>. See also TSB occurrences where pilot fatigue was cited: Transportation Safety Board of Canada, “Aviation Investigation Report A12W000, Runway Overrun, 1 263 343 Alberta Inc. (DBA Enerjet) Boeing 737-700, C-GDEJ, Fort Nelson, British Columbia, 09 January 2012” (6 August 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2012/a12w0004/a12w0004.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report A08C0164, Airspeed Decay – Uncommanded Descent, Air Canada Jazz, Bombardier CRJ 705, C-FNJZ, Winnipeg, Manitoba, 180 nm SE, 01 August 2008” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2008/a08c0164/a08c0164.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report A00W0217, Collision with Terrain, Summit Air Charters Ltd., Short Brothers SC-7 Skyvan C-FSDZ, Port Radium, Northwest Territories, 08 October 2000” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2000/a00w0217/a00w0217.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report A08W0244, Controlled Flight into Terrain, Summit Air Charters Limited, Dornier 228-202 C-FYEV, Cambridge Bay, Nunavut, 13 December 2008” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2008/a08w0244/a08w0244.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report, Runway Overrun, Trans States Airlines LLC, Embraer EMB-145LR N847HK, Ottawa/MacDonald-Cartier International Airport, Ontario, 16 June 2010, Report Number A10H0004” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2010/a10h0004/a10h0004.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report, Controlled Flight into Terrain, Provincial Airlines Limited, de Havilland DHC-6-300 Twin Otter C-FWLQ, Davis Inlet, Newfoundland 2 nm NNE, 19 March 1999, Report Number A99A0036” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/1999/a99a0036/a99a0036.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report A11F0012, Pitch Excursion, Air Canada, BOEING 767-333, C-GHLQ, North Atlantic Ocean, 55° 00'N 029° 00'W, 14 January 2011” (24 April 2013), online: Transportation Safety Board of Canada, “Aviation Occurrence Report A93W0204, Engine Power Loss/Loss of Control, Arctic Wings and Rotors, Pilatus Britten-Norman BN2A-20 Islander, C-GMOP, Tuktoyaktuk, Northwest Territories 7.7 mi SE, 03 December 1993” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/1993/a93w0204/a93w0204.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report A09P0187, Wake Turbulence Encounter - Collision with Terrain, Integra Ops Ltd. (dba Canadian Air Charters), Piper PA-31-350 Chieftain, C-GNAF, Richmond, British Columbia, 9 July 2009” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2009/a09p0187/a09p0187.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report, Controlled Flight Into Terrain, Régionnaire Inc., Raytheon Beech 1900D C-FLIH, Sept-Îles, Quebec, 12 August 1999, Report Number A99Q0151” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/1999/a99q0151/a99q0151.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report, Collision With Terrain, Northern Mountain Helicopters Inc., Bell 206B (Helicopter) C-GVQK, Bear Valley, British Columbia, 30 July 1997, Report Number A97P0207” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/1997/a97p0207/a97p0207.pdf>>; Transportation Safety Board of Canada, “Aviation Investigation Report, Controlled Flight into Terrain, Cessna 182 D-EDOG, Timmins, Ontario, 3 August 2001, Report Number A01O0210” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/2001/a01o0210/a01o0210.pdf>>; Transportation Safety Board of Canada, “Aviation Occurrence Report, Controlled Flight Into Terrain, Cessna 402, N67850, Wabush, Newfoundland, 23 NM NW, 22 October 1995, Report Number 195Q0210” (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rappports-reports/aviation/1995/a95q0210/a95q0210.pdf>>; Transportation Safety Board of Canada, “Aviation Occurrence Report, Collision With Terrain, Cessna 188 AGWAGON C=GYUD, Marengo,

the TSB added pilot fatigue to its safety watchlist,¹⁷ as this phenomenon continues to endanger the health and safety of passengers and flight crews worldwide.

Based on the foregoing, one must wonder if Canada's current FDT regulations adequately address the current safety risks associated with pilot fatigue. To further explore this question, the author of this article carried out a study in 2016-2017 to analyze the effectiveness of Canadian FDT regulations.¹⁸ After analyzing the primary sources in the field of pilot fatigue,¹⁹ key-informant interviews were conducted with five professional pilots working in Canada. The premise of this study was to determine whether the current regulatory framework in Canada for pilot fatigue and air-crew scheduling is sufficiently effective to safeguard the wellbeing of air crews and the safety of passengers.

The following report outlines the study's methodology and summarizes the main safety findings that emerged from the data gathered during the key-informant interviews. This report will first provide a summary of ICAO's international FDT standards and the applicable legal framework in Canada. Based on the data gathered during the interviews, this report will then summarize the practical implications of current FDT regulations and analyze their effectiveness for professional pilots in Canada. The content of this report will also consider the factors that positively and negatively affect a pilot's flight performance, including the impact of their work schedule on flight safety in Canada.

I. ICAO's Role in the Adoption of International FDT Standards

To assess the findings of this study, one must first understand the regulatory background of FDT limitations in Canada, which are rooted in international air law. Indeed, FDT regulations in Canada stem from its international legal obligations as a

Saskatchewan 2 mi S 29 June 1994, Report Number A94C0119" (24 April 2013), online: <<http://www.tsb.gc.ca/eng/rapports-reports/aviation/1994/a94c0119/a94c0119.pdf>>

¹⁷ Transportation Safety Board of Canada, "Fatigue management in rail, marine and air transportation" (29 October 2018), online: <<http://www.bst-tsb.gc.ca/eng/surveillance-watchlist/multi-modal/2018/multimodal-03.asp>>.

¹⁸ This study was conducted by the author under the supervision of Professor Katherine Lippel (Canada Research Chair in Occupational Health and Safety Law – University of Ottawa). It was supported by the On the Move Partnership and funded by the Social Sciences and Humanities Research Council through its Partnership Grants funding opportunity (Appl ID 895-2011-1019). In 2016, a journal article was published by the author (René David-Cooper, "Protecting the Health and Safety of Pilots: A Critical Analysis of Flight and Duty Time Regulations in Canada" [2016] 41 *Ann Air & Space* 81) on the topic of FDT regulations in Canada. This article critically analyzed the current FDT regulations in Canada, and examined the domestic legal framework applicable to commercial air carriers in Canada, from both a labour and an air-safety point of view. This article identified several shortcomings within the Canadian legislation, and revealed notable differences with international aviation standards. To ensure a full understanding of the issues and technical aspects surrounding FDT regulations in Canada, this report should be read along with the above-mentioned journal article. In that article, the author concluded that the effectiveness of flight and duty time regulations was an understudied area of the law, and thus initiated this report.

¹⁹ *Ibid.*

member State of ICAO. With 192 existing member States,²⁰ ICAO is the United Nations' specialized agency responsible for ensuring "the safe and orderly growth of international civil aviation throughout the world"²¹ and promoting the "safety of flight in international air navigation".²² ICAO's Standards and Recommended Practices (SARPs) comprehensively address technical, safety, operational and regulatory aviation issues, such as air routes, air-traffic control, communications, aircraft licensing and airworthiness certification, and aircraft registration.²³ Since ICAO's inception over 70 years ago, the ICAO Council has adopted a wide variety of SARPs to improve air safety,²⁴ which have been incorporated into the nineteen Annexes to the *Chicago Convention*.²⁵

To address pilot fatigue, ICAO introduced FDT SARPs into Annex 6 to the *Chicago Convention*.²⁶ While ICAO SARPs are binding only for international air-transport operations, Annex 6 serves as authoritative guidance for States wishing to mitigate pilot fatigue in both the domestic and international sectors of their civil-aviation industries. Under Annex 6, ICAO member States must effectively regulate and manage pilot fatigue with the implementation of adequate regulations and government oversight. Since many countries have unique aviation cultures and have adopted different scientific and legal standpoints in relation to human factors,²⁷ Annex 6 does not contain any compulsory hour-specific or numerical FDT regulations.²⁸ As demonstrated in Table 1 below, many countries possess different numeric FDT limitations within their domestic laws regarding the specific number of hours a pilot may fly, or be on duty.²⁹

²⁰ International Civil Aviation Organization, "ICAO Member States List" (14 February 2019), online: <<https://www.icao.int/MemberStates/Member%20States.English.pdf>>.

²¹ *Convention on International Civil Aviation*, 7 December 1944, 15 UNTS 295, ICAO Doc 7300/9, art 44(a) (entered into force 4 April 1947) [*Chicago Convention*].

²² *Ibid*, art 44(h).

²³ Paul Stephen Dempsey & Laurence E Gesell, *Aviation and the Law*, 4th ed (Chandler, AZ: Coast Aire Publications, 2005) at 881-82.

²⁴ *Ibid* at 881.

²⁵ Paul Stephen Dempsey, *Public International Air Law* (Montreal: McGill University Institute and Centre for Research in Air & Space Law, 2008) at 75.

²⁶ See Annex 6, *supra* note 9 at para 1.1: Flight time, flight duty period, duty period limitations and rest requirements are established for the sole purpose of ensuring that the flight crew and the cabin crew members are performing at an adequate level of alertness for safe flight operations.

²⁷ See DuBose, *supra* note 7 at 272.

²⁸ Annex 6, *supra* note 9 at ATT A-3: When deciding what numerical values should be inserted, States should take into account the results of relevant scientific principles and knowledge, past experience in administering such regulations, cultural issues and the nature of operations intended to be undertaken.

²⁹ See Transport Canada, Canadian Aviation Regulation Advisory Council (CARAC) Notice of Proposed Amendment (NPA): Flight Crew Fatigue Management, CARAC Activity Reporting Notice 2014-019 (15 September 2014) at 5.

Table 1: FDT regulations in Canada and other countries

Country	Weekly Flight Hours Limitation	Weekly Duty Hours Limitation	28 Days Duty Hours Limitation	28 days Flight Hours Limitation	365 days Flight Hours limitation
USA	n/a	60	190	100	1000
EASA	n/a	60	190	100	900
UK	n/a	55	190	100	900
CASA	30	40 - 60	n/a	100	1000
India	35	60	190	117	1000
Canada - Current	40/60	n/a	n/a	112/140	1200
Canada - Proposed	n/a	60	190	112	1000

Source: Transport Canada³⁰

Under the *Chicago Convention*, ICAO member States nonetheless have an obligation to keep their domestic regulations uniform, to the greatest possible extent, with FDT SARPs found in Annex 6.³¹ However, if a country cannot comply with ICAO's FDT SARPs, it must provide an immediate notification to ICAO³² pursuant to article 38 of the *Chicago Convention*.³³ Since ICAO Annexes are not part of the *Chicago Convention* per se,³⁴ it can be argued that SARPs constitute "soft law"³⁵ and are not subject to the international law of treaties.³⁶ For instance, they may not be binding on a State which notifies ICAO of its non-compliance with a specific Annex 6 standard.³⁷ It follows that, unless a country adopts domestic laws incorporating ICAO's SARPs, FDT regulations in Annex 6 will not impose any legal obligations on air carriers.³⁸ However, SARPs are not devoid of legal effect, as the *Chicago Convention*

³⁰ *Ibid*; Federal Aviation Administration, "Press Release – U.S. Transportation Secretary Foxx Announces Improved Aviation Safety Rating for India", (8 April 2015), online: Federal Aviation Administration <https://www.faa.gov/news/press_releases/news_story.cfm?newsId=18575>.

³¹ *Chicago Convention*, *supra* note 21, art 12; Dempsey & Gesell, *supra* note 3 at 692; Dempsey, *supra* note 25 at 72.

³² Dempsey, *supra* note 25 at 77.

³³ *Chicago Convention*, *supra* note 21, art 38.

³⁴ "Under the *Chicago Convention*, SARP's may be adopted by two thirds of the ICAO Council, which is itself comprised of only thirty-six member states. Thus, twenty-four member states less than 13% of the [191] member ICAO Assembly can promulgate a SARP": Paul Stephen Dempsey, "Compliance & Enforcement in International Law: Achieving Global Uniformity in Aviation Safety" 30 N C J Int Law Commer Regul 1 at 62.

³⁵ Dempsey, *supra* note 25 at 175; David-Cooper, *supra* note 6 at 473.

³⁶ *Vienna Convention on the Law of Treaties*, 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980).

³⁷ Dempsey & Gesell, *supra* note 3 at 691.

³⁸ See Michael Milde, *International Air Law and ICAO* (Marietta Benkö, *Essential Air and Space Law*, vol 4) (Utrecht: Eleven International Publishing, 2008) at 159; Md Tanveer Ahmad, *Adapting the Existing Regime for the Contemporary World to Achieve Global Civil Aviation Safety: A Developing Country Perspective* (LLM Thesis, McGill University Institute of Air and Space Law, 2009) at 14 [unpublished].

compels ICAO member States to adhere to the same set of uniform norms, such as ICAO SARPs, unless differences to an ICAO annex are filed.³⁹ As per Annex 6, a country's failure to comply with SARPs on FDT could, in theory, result in other States refusing the entry of air carriers registered in that delinquent country.⁴⁰ SARPs, therefore, "appear to have corresponding de facto 'hard law' attributes as well",⁴¹ as there are strong legal, political, and economic imperatives encouraging ICAO member States to comply with FDT SARPs.⁴²

II. Regulating Pilot Fatigue in the Canadian Aviation Industry

Under the *Aeronautics Act* of Canada,⁴³ the Minister of Transport holds plenary jurisdiction over its federal government department, Transport Canada,⁴⁴ in the development and oversight of civil-aviation safety regulations.⁴⁵ With its primary mission of ensuring safe air transport for the travelling public, Transport Canada is responsible for promoting and developing safety in its national civil-aviation network with adequate regulatory infrastructure and effective oversight over the commercial-aviation industry.⁴⁶ In light of this safety imperative, Transport Canada has the necessary jurisdiction to prescribe and revise "reasonable rules and regulations governing the maximum hours or periods of service airmen",⁴⁷ including FDT limitations. In relation to pilot fatigue, FDT restrictions for professional pilots have been federally regulated in Canada since the 1940s,⁴⁸ and are now firmly established in the *Canadian Aviation Regulations (CARs)*,⁴⁹ which comprehensively

³⁹ *Chicago Convention*, *supra* note 21, arts 37-38.

⁴⁰ Dempsey, *supra* note 25 at 79: When economically powerful States, such as the United States or the European Union, blacklist a nation's carriers, the economic impact can be severe. Under such circumstances, private sector insurance coverage for airlines and airports may be impossible to obtain. Moreover, the delinquent government would be responsible and arguably liable, should an aircraft collision or other aviation tragedy occur, the proximate cause of which was the failure of the government to comply with a relevant SARP. See also *Chicago Convention*, *supra* note 21. Such an interdiction could be achieved by another country blacklisting some or all Canadian carriers from its airspace or by terminating any current bilateral transport treaties between both reciprocal countries.

⁴¹ Dempsey, *supra* note 25 at 80.

⁴² Paul Stephen Dempsey & Laurence E Gesell, *Public Policy and the Regulation of Commercial Aviation* (Chandler, AZ: Coast Aire Publications, 2013) at 48; Paul Stephen Dempsey, "Compliance and Enforcement in International Law: Oil Pollution of the Marine Environment by Ocean Vessels" (1984) 6 *Nw J Intl L & Bus* 459 at 132-133.

⁴³ *Aeronautics Act*, RSC 1985, c A-2 [*Aeronautics Act*].

⁴⁴ Paul Stephen Dempsey, "The Rise and Fall of the Civil Aeronautics Board-Opening Wide The Floodgates of Entry" (1980) 11 *Transp Law J* 91 at 285 (in reference to the US Federal Aviation Administration [FAA]).

⁴⁵ *Aeronautics Act*, *supra* note 43, ss 4.2 (1).

⁴⁶ See Transport Canada, "Civil Aviation" (16 April 2015), online: <<https://www.tc.gc.ca/eng/civilaviation/menu.htm>>.

⁴⁷ Dempsey & Gesell, *supra* note 3 at 379.

⁴⁸ Sarah Schmidt, "Pilots Question Transport Canada's Stance on New Fatigue Guidelines", online: Air Canada Component of the Canadian Union of Public Employees (CUPE) <www.accomponent.ca/en/news/pilots-question-transport-canadasstance-new-fatigue-guidelines>

⁴⁹ *Canadian Aviation Regulations*, 1996, SOR96-433 [*Canadian Aviation Regulations*], s SOR/96-433.

support every other aspect of aviation safety.⁵⁰ As such, FDT regulations establish limitations standards for FDT, and constitute “a preventive measure designed to ensure that pilots are not called upon to fly in a condition of excessive fatigue”.⁵¹

In the Canadian commercial-aviation industry,⁵² FDT restrictions apply to aerial work operators (“702 carriers”),⁵³ air taxi operators (“703 carriers”),⁵⁴ commuter operators (“704 carriers”),⁵⁵ and airlines (“705 carriers”)⁵⁶ that are registered in Canada. FDT regulations do not, however, apply to flight instructors, who are not subject to any limitations under the *CARs*. In the aviation industry, 702, 703, and 704 operators are

⁵⁰ Dempsey & Gesell, *supra* note 3 at 301.

⁵¹ *Black Sheep Aviation & Cattle Co Ltd* (2015), 2015 OHSTC 9 at para 34 (Occupational Health and Safety Tribunal Canada), online: Government of Canada <www.canada.ca/en/occupational-health-and-safety-tribunal-canada/programs/decisions/2015/ohstc-2015-009.html> [*Black Sheep Aviation*]. On 31 March 2011, a de Havilland DHC-3 Otter operated by Black Sheep Aviation & Cattle Co Ltd departed from Mayo (Yukon) to deliver mining supplies to a client and crashed 19 minutes after departure following a catastrophic in-flight breakup. The pilot, the sole occupant in the aircraft, was fatally injured. Among other findings, the investigation determined that the pilot had deliberately made erroneous entries in journey logs. He had likely done so to circumvent FDT limits and aircraft maintenance schedules. It was found that, by exceeding the maximum duty time permitted by the *CARs* during a seven-day period, the pilot’s conduct had increased the risk of fatigue. It was also found that company procedures to monitor FDT compliance were lacking. While the accident was not caused by pilot fatigue per se, the investigation revealed serious issues regarding the industry’s imperfect compliance with FDT regulations and the potential for pilot fatigue.

⁵² Dempsey & Gesell, *supra* note 3 at 223 (“Air commerce is the carriage of persons or property for compensation or hire, or the carriage of mail by aircraft, or the operation or navigation of aircraft in the conduct of furtherance of a business or vocation”; air commerce therefore excludes any State or military aircraft operations).

⁵³ *Canadian Aviation Regulations*, *supra* note 49, s 702.01(1), defines an aerial work operation as: the operation of an aeroplane or helicopter in aerial work involving: (a) the carriage on board of persons other than flight crew members; (b) the carriage of helicopter Class B, C or D external loads; (c) the towing of objects; or (d) the dispersal of products.

⁵⁴ *Ibid*, s 703.01, defines an air taxi operator as: a Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, of any of the following aircraft: (a) a single-engined aircraft; (b) a multi-engined aircraft, other than a turbo-jet-powered aeroplane, that has a MCTOW of 8 618 kg (19,000 pounds) or less and a seating configuration, excluding pilot seats, of nine or less; (b.1) a multi-engined helicopter certified for operation by one pilot and operated under VFR; and (c) any aircraft that is authorized by the Minister to be operated under this Subpart. *Ibid*, s 101.01(1), provides: “MCTOW or maximum certificated take-off weight means the weight identified as such in the type certificate of an aircraft”.

⁵⁵ *Ibid*, s 704.01, defines commuter operator as: a Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, of any of the following aircraft: (a) a multi-engined aeroplane that has a MCTOW of 8 618 kg (19,000 pounds) or less and a seating configuration, excluding pilot seats, of 10 to 19 inclusive; (b) a turbo-jet-powered aeroplane that has a maximum zero fuel weight of 22 680 kg (50,000 pounds) or less and for which a Canadian type certificate has been issued authorizing the transport of not more than 19 passengers; (b.1) a multi-engined helicopter with a seating configuration, excluding pilot seats, of 10 to 19 inclusive, unless it is certified for operation with one pilot and operated under VFR; and (c) any aircraft that is authorized by the Minister to be operated under this Subpart.

⁵⁶ *Ibid*, s 705.01, defines an airline operator as: a Canadian air operator, in an air transport service or in aerial work involving sightseeing operations, of any of the following aircraft: (a) an aeroplane, other than an aeroplane authorized to operate under Subpart 4, that has a MCTOW of more than 8 618 kg (19,000 pounds) or for which a Canadian type certificate has been issued authorizing the transport of 20 or more passengers; (b) a helicopter that has a seating configuration, excluding pilot seats, of 20 or more; or (c) any aircraft that is authorized by the Minister to be operated under this Subpart.

commonly referred to as “small operators” or “small carriers”,⁵⁷ while 705 carriers are referred to as “airlines” or “large carriers”.⁵⁸ Depending on the type of operator, federal regulations govern the maximum FDT a pilot may fly an aircraft (flight time) and be on duty at his or her workplace in a given period (duty time). These regulations are summarized in Appendices 1 and 2 of this study.

III. Research Objectives and Methodology

Based on the legal framework applicable in Canada and internationally, the following study was initiated in order to assess the effectiveness of the FDT limitations discussed above. This study focused on Canadian operators conducting commercial operations under Part VII of the *CARs* as aerial work (*CARs* Subpart 702), air taxi (*CARs* Subpart 703), commuter (*CARs* Subpart 704) and airline (*CARs* Subpart 705) operators.⁵⁹ It also considered pilot-fatigue issues associated with flight-training operations in Canada. This research aimed to determine whether federal laws adequately regulate pilot fatigue and whether there are any lacunae within the *CARs*. Because the *CARs* regulate FDT differently, depending on the category of the operator (see Appendices 1 and 2), this study also tried to determine whether there are positive or adverse safety trends with respect to fatigue currently affecting any particular category of carriers.

While the author was carrying out research on the topic of FDT regulations, it was apparent that the health and safety of professional pilots was an area of concern in Canada. Consequently, it was decided that a field study with key-informant interviews would yield valuable data on the effectiveness of FDT regulations.

A proposal for the key-informant interviews was approved in 2016 by the Office of Research Ethics and Integrity at the University of Ottawa. One of the key aspects of this study was that participants would remain completely anonymous, given the sensitive nature of this topic. The participants took part in audio-recorded interviews lasting between 45 and 90 minutes. These interviews were later transcribed, anonymized and summarized in the report’s analysis.

IV. Key-Informant Profiles

Five participants were interviewed in 2016 and 2017. These individuals were

⁵⁷ Transport Canada, *Safety Management Systems for Small Aviation Operations: A Practical Guide to Implementation*, TC-1001017, TP 14135E (09/2004) (Ottawa: Transport Canada, 2004) at 1, online: Government of Canada <publications.gc.ca/collections/Collection/T52-4-7-2004E.pdf>.

⁵⁸ *Ibid.*

⁵⁹ The commercial-aviation industry in Canada is regulated under Part VII of the *CARs*, with five operator categories assigned based on the type of aircraft flown, the number of passengers carried and the nature of the operations conducted: aerial work operators (*CARs* subpart 702), air taxi operators (*CARs* subpart 703), commuter operators (*CARs* subpart 704) and airlines (*CARs* subpart 705).

recruited based on their experience in the Canadian civil-aviation industry.⁶⁰ The profile of each participant is summarized in Appendix 3. The participants were anonymized in order to maintain confidentiality over their personal views regarding their work experiences, pilot fatigue and FDT regulations.

V. Results of the Study

Based on the interviews conducted with the five key informants, a report of the facts and findings was produced. This report focuses on the issues raised during these discussions. The study focused on five aspects of FDT regulations to understand their positive or adverse impact on pilot fatigue: (1) work schedules; (2) pilot remuneration; (3) fatigue and stress; (4) company safety culture and work environment; and (5) industry issues. These five aspects are addressed and briefly analyzed in this section of the report.

A. Work Schedules

The atypical nature of pilot work schedules was a common issue noted by all informants, regardless of the type of operator. In all cases, pilots noted that their work schedule is not a typical “nine to five” work schedule, as they are scheduled to fly at all hours of the day and, in some instances, across several time zones during their shift. As discussed in this section, the study determined that certain work schedules are more likely to affect a pilot’s ability to maintain a structured lifestyle and regular sleep schedule.

1. TYPE OF FLIGHT OPERATION

The study revealed that the work schedule for pilots could vary depending on the type of flight operations conducted. In smaller operations, namely 703 operators (air taxis), the study revealed that pilots are more likely to be exposed to atypical work schedules in unorthodox working environments, such as flying to and from remote locations in northern parts of Canada. These pilots are also required to fly longer hours, often to maximize the operator’s revenue. Indeed, smaller operators often rely on a smaller roster of employed pilots. Hence, any flight cancellation or a pilot’s refusal to fly (e.g. due to pilot fatigue) can amount to a loss of revenue for both the operator and the pilot. Several informants noted that this reality added a pressure to fly, regardless of the potential for pilot fatigue.

Three of the five informants admitted working from time to time beyond the maximum duty time (generally 14 hours per day) established by the *CARs*, often because of operational pressures and unplanned circumstances (e.g. weather or

⁶⁰ In civil aviation, the experience of a pilot is often valued based on a person’s flight experience and number of flying hours.

mechanical issues). In most cases, informants noted that smaller operators often demand more from their pilots as far as the number of tasks required and the number of hours worked are concerned.

For instance, Informant #1 often flew between 8 and 14 hours a day when he worked for a 703 operator.⁶¹ Once he started flying for a 705 operator (airline), he was never required to be on duty for more than 85 hours a month. In his view, this significant variation highlights the different realities that pilots must face with smaller operators in comparison to larger airlines. He viewed this as a paradox, because less experienced pilots often start flying for 703 operators upon graduating from flight school and are exposed to more demanding work schedules, while more experienced pilots are hired by larger airlines that require them to be on duty, on average, for approximately 20 hours a week.

When he worked for an air taxi operation, Informant #2 conducted seasonal contracts for a hunting & fishing outfitter in a remote location in northern Canada. Because of the shorter operational window to conduct this type of “bush flying” operation, Informant #2 was required to work on 10-day work rotations with only one day off in between each rotation. He was expected to fly up to 12 hours a day and be on duty for an average of 15 hours a day, even though the maximum duty time allowed under the *CARs* is currently 14 hours per day. Informant #2 estimated that he would be working on average between 60 and 65 hours (on duty) every week and, during peak periods, up to 100 hours (on duty) every week. While airline informants reported working approximately 85 hours a month (on duty), Informant #2 reported working over three times that amount with an average of 250 hours on duty each month.

Informant #2 admitted that his employer imposed a very demanding work schedule, with a turnaround time of about six minutes between each flight, leaving him with little time to rest and eat during the day, which affected his energy levels. Because he lived on the airbase in the owner’s hunting and fishing lodge, Informant #2 was also required to do odd tasks, such as setting up and maintaining hunting camps, clearing small wooded areas, doing general maintenance around the various lodges owned by the outfitter and washing the airplanes. He noted that these additional tasks had an impact on his fatigue levels.

When he worked for a 703-704 operator, Informant #3 stated that he would fly on an average between 45 and 55 hours a week and be on duty between 60-70 hours a week. He enjoyed a more relaxed work schedule once he started working for a 705 operation, where his duty time was capped at 85 hours per month. Such a reasonable work schedule was common among informants with experience working for larger operations, such as 704 and 705 operations. These informants are usually on schedule for an average of 75 hours a month, and up to a maximum of 85 hours a month with the possibility, but not the requirement, to do some overtime.

⁶¹ While Informant #1 had been assigned to longer working shifts when he worked for a 703 operator, he had an irregular work schedule, and was often on-call for charter and medical evacuation flights. Therefore, there were weeks when he did not fly at all, and others where he would work several days in a row.

One exception was Informant #4, who flew on average 6.5 hours a day and was on duty for about eight hours each day. His employer expected him to fly between 40 and 50 flight hours each month, thereby providing him with a relatively reasonable work schedule. This particular informant noted that his longest day working for this employer was around eight hours of flight time and 10 hours of duty time. He associated this work schedule with the safe working culture promoted by his employer. Informant #5, for his part, held another full-time job outside the aviation industry in addition to working as a flight instructor. Depending on the week, he could be flying a dozen flight hours as a flight instructor in addition to his full-time office job (37.5 hours), resulting in about 50 hours of duty time (counting both jobs).

2. STANDBY DUTY

For pilots on standby duty, commonly referred to as being “on-call”, pilots noted that this type of assignment was particularly tiring because pilots had to be ready to come into work and fly at any time of the day. Some pilots would start their standby duty later in the day (e.g. late afternoon or early evening), even though they had been awake since the morning for various reasons (e.g. family, commitments outside of work, natural sleep cycle, etc.). In some instances, on-call pilots would end up being awake for over twenty-four hours by the time they were completing their final flight of the day (when they were called into work). The study therefore determined that standby duty can have deleterious effects on the fatigue of pilots, if regulations do not take into account pilots’ time since awakening of pilots.⁶²

3. NIGHT FLIGHTS

Pilots in our study reported that they are more likely to be fatigued at night. First, flying at night conflicts with the human body’s natural sleep cycle, and, secondly, night flying can be more challenging at times for various reasons (e.g. the lack of visual references, which makes navigation more important but also more challenging).

The author of this study had an interesting discussion on the topic of night flying with Informant #1. Before working for a large airline, Informant #1 had previously been employed by an air taxi operation conducting medical evacuation flights (commonly known as “medevacs”) carrying patients, mostly in remote and northern communities. He was called in at all hours and had the added pressure of knowing that, if he refused a medevac flight (e.g. because of fatigue), his decision could prevent a patient from receiving the necessary medical treatment, as medevac flights are often the last resort for patients in critical condition. He found night flights to be more fatiguing because they would go against his circadian cycle. For instance, he would sometimes carry out his final landing of the day with the sun rising. On several occasions, he mentioned having been awake for over 24 hours because he had been

⁶² The *Canadian Aviation Regulations* currently do not take into account a pilot’s time since awakening. Proposed amendments to the *CARs* with respect to FDT will not regulate time since awakening either.

called in for a night medevac flight. While he found medevac flights to be “exciting”, these assignments were particularly stressful and fatiguing at times.

In all cases, pilots admitted being more fatigued when conducting flights during night hours because they felt it was unnatural for them to be awake at that time and therefore difficult for them to perform at one hundred percent of their capabilities, throughout the flight. Informant #3 recounted several instances when he had been scheduled to fly at night, then check in at a hotel for about five hours to sleep and then wake up early the following morning to conduct the company’s first morning flight. He stated that it was difficult to get proper sleep within that short window of time, causing him to “live in a constant nap life”, as he could not always get the full sleep he needed to recover from fatigue. It was noted by some informants during the study that additional rest periods should be provided to pilots conducting night operations and that Transport Canada should add specific regulations for night operations (e.g. take into account the time since awakening).

4. DEADHEADING

As noted by some informants, an interesting feature with the *CARs* is how duty time is only triggered once a pilot reports to his or her place of employment or reports for standby duties as a reserve pilot, and finishes when the aircraft engines are shut down.⁶³ On the other hand, ICAO states that time spent deadheading should be counted towards duty time.⁶⁴ However, this is a recommended practice only and, therefore, non-binding. The ICAO SARPs state that the time spent by a pilot travelling from his or her home to the point of reporting for duty (i.e. commuting) does not count towards duty time,⁶⁵ even though ICAO recognizes that not counting it can have an adverse effect on pilot fatigue.⁶⁶ The *CARs* also imply that duty time does not include the time spent travelling as a flying passenger to and from another base of operations (i.e. an airport) to conduct flight operations⁶⁷ otherwise referred to in the industry as “repositioning”⁶⁸ or “deadheading”. At the time when this report was written, the *CARs*

⁶³ *Canadian Aviation Regulations, supra* note 49, ss 101.01(1).

⁶⁴ Annex 6, *supra* note 9 at ATT A-2 and ATT A-8: All time spent positioning counts as duty, and positioning followed by operating without an intervening rest period also counts as flight duty. In the wording of the SARPs, the term “should” indicates that the practice is only a recommended one and is therefore non-binding on ICAO Member States.

⁶⁵ *Ibid* at ATT A-2.3.2: A flight duty period does not include the period of travelling time from home to the point of reporting for duty. It is the responsibility of the flight or cabin crew member to report for duty in an adequately rested condition.

⁶⁶ *Ibid*, s 4.8.1 states that: Travelling time spent by a flight or cabin crew member in transit between the place of rest and the place of reporting for duty is not counted as duty, even though it is a factor contributing to fatigue. Excessive travelling time undertaken immediately before commencing a flight duty period could therefore detract from a flight or cabin crew member’s ability to counter fatigue arising whilst on duty, and should therefore be taken into account when deciding where pre-flight rest should be taken.

⁶⁷ Indeed, no laws or interpretative guidance regarding FDT regulations specify whether or not time spent deadheading must be counted when monitoring FDT compliance.

⁶⁸ Annex 6, *supra* note 9 at ATT A-4. ICAO defines “positioning” and “deadheading”, which are synonymous terms, as the “transferring of a non-operating crew member from place to place as a passenger at the behest of the operator”. See also ATT-A-4.2.5.

did not expressly identify whether deadheading time should be calculated in the total duty time and it remained unclear how air carriers classify deadheading time.

The study's findings with respect to deadheading highlight a regulatory void where pilots may be required to commute considerable hours without that time being included in their duty time or even remunerated. Interpreting current duty time regulations, it seems apparent that a pilot who flies in the jump seat of another flight to report to another sub-base of operations⁶⁹ where he or she is scheduled to fly will only start calculating his or her duty time once he or she reports to that other base of operations. Of course, many companies will manage this potentially unsafe interpretation of the *CARs* with adequate policies to manage pilot fatigue and thus cover over this gap in regulations. However, Informant #2 noted that smaller cash-strapped operators may be tempted to utilize their pilots up to the very limits permitted under the law, even if doing so may not be entirely safe. In this regard, ICAO standards state that pilots are responsible for refusing further flights if they suffer from fatigue which may adversely affect flight safety.⁷⁰

Based on the data collected during the key informant interviews, the study determined that deadheading is also a common practice for pilots, who are required from time to time to travel regularly between several bases of operation, either by car or by airplane. Some pilots count this time in their duty time, while some do not. Accordingly, some pilots would be paid for this time and some would not, thus giving rise to a lack of uniformity. The study determined that employers with a good safety culture were more likely to count deadheading into a pilot's total duty time. The discussions with informants also revealed that there was no common practice for computing deadheading in the aviation industry, as the *CARs* do not specifically address the concept of deadheading, or specify whether it should count in a pilot's duty time. One informant noted that, when he was travelling away from his place of residence, sleeping in a hotel⁷¹ certainly affected his ability to recover from fatigue over a long period of time, and another informant mentioned that he actually enjoyed deadheading because it allowed him to relax. However, the study was not able to conclusively assess the adverse effects of deadheading on pilot performance.

5. FLIGHT INSTRUCTORS

The study found that informants who worked as flight instructors⁷² are often on duty for up to 12 hours a day, and up to 60 hours a week. These informants all noted that flight instructing is even more demanding than transporting passengers; as flight instructors must not only supervise and instruct unlicensed student pilots who possess

⁶⁹ Section 700.01 of the *Canadian Aviation Regulations* defines "sub-base" as follows: sub-base means a location at which an air operator positions aircraft and personnel and from which operational control is exercised in accordance with the air operator's operational control system.

⁷⁰ Annex 6, *supra* note 9 at ATT A-2.

⁷¹ If a pilot checks in at a hotel, this would be considered as a rest period under the *CARs*. Therefore, the time spent in a hotel cannot be counted towards a pilot's total duty time.

⁷² It must be noted that flight instructors are not subject to any FDT regulations in the *CARs*.

little to no flight experience, but also engage at the same time in all sorts of challenging flight maneuvers (e.g. simulated emergencies, landings, unusual attitudes etc.). Informant #5 stated that, in his view, this type of flying potentially increases the risk factor when fatigue comes into play.

Informants also noted that flight instruction was particularly fatiguing because flight instructors are usually at the beginning of their careers and relatively inexperienced from an industry perspective, which can create considerable pressure, i.e. maximizing their flight time to generate both experience and income. To meet this objective, these pilots are often on duty for very long hours, which can compromise flight safety. One informant remembered a time during his flight training where his own instructor fell asleep during a night flight. When the informant became an instructor himself, he understood how a pilot could become fatigued to the point of falling asleep; he noted that it was not uncommon for him to arrive at work at sunrise and leave after sunset, or in many instances to be on duty for up to 15 hours. In his view, these circumstances create a higher risk of pilot fatigue in the flight-instructing world and can compromise a flight instructor's ability to safely perform at times.

6. SECONDARY EMPLOYMENT

Four informants were required to hold secondary employment to make ends meet at the beginning of their careers. Three of these informants had a full-time job whilst holding a permanent flying job, with another informant holding a part-time job at the airport to generate additional revenue. This secondary employment time was not counted towards their duty time as defined by the regulations and therefore exposed these pilots to a higher risk of pilot fatigue.

For Informant #1, this additional duty time outside his flying job varied between 30 and 60 hours a week depending on the time of year and individual circumstances (e.g. family, financial commitments, etc.). The study found that holding a secondary employment might increase the risk of pilots becoming fatigued, when combined with a full-time flying schedule.

B. Pilot Remuneration

During the study, the informants were invited to discuss their method of remuneration as pilots, which proved in some cases to be a risk factor with respect to fatigue. The interviews revealed that some informants were paid strictly for their flight time, which creates pressure to fly as many hours as possible in order to maximize income. This pressure of maximizing income is particularly prevalent in the aviation industry, given that many pilots graduate from flight school with a considerable amount of debt. Secondly, the number of flying hours is important for a pilot, as the more hours the pilot accumulates, the more chance the pilot has of being hired by a large airline (hence the need to generate more flight time). Because salaries are relatively low in the early stages of a pilot's career, some informants felt pressured to fly more hours to maximize their income.

Other informants were paid a base salary, and, in some cases, the base salary included an hourly rate for each hour flown. Informant #2 revealed that being paid a base salary was not necessarily a positive factor. He discussed his experience flying for an air taxi operator who paid him a base salary but expected him to fly very demanding schedules to maximize its revenue and optimize its “investment” in him. This informant found his salary structure to be a stress factor, as a very demanding schedule was imposed on him where he had to fly as many hours as he could, regardless of whether he felt fatigued or was complying with FDT regulations. This method of remuneration forced him to optimize his employer’s time and money. In this company, money often prevailed over regulatory compliance (e.g. FDT regulations) and thus over flight safety.

Informant #2 stated that a base-salary method may be better than paying pilots for each hour flown, as long as the employer is responsible and safety-oriented, which was not the situation in his case. In his opinion, salary structures based on each hour or mile flown are an incentive for pilots to maximize in each workday, their flight time and revenue, even though flight safety is at risk of being compromised. Informant #2 compared pilots with politicians: if both are not paid enough, “corruption” will take over and pilots will be tempted to breach the *CARs* in order to further their self-interest, over the safety of others. In his view, a low pay structure cannot foster safe behavior in the long term.

Another interesting finding was the remuneration for secondary ground tasks when pilots are not flying. In some cases, these tasks outside the cockpit amounted to several hours a week and could be very demanding and tiring depending on the employer. While flight-planning tasks (e.g. navigation, aircraft weight and balance, weather, fuel calculations, etc.) were common for every informant, some were required to fuel the aircraft, load heavy cargo, de-ice or wash the surfaces of the aircraft, manage passenger bookings and boarding, maintain their flight base, remove snow at the airport and perform other tasks.

Some informants were paid for these secondary tasks. However, others were not, and this placed pressure on them to expedite their turnaround times on the ground in order to log more flight time— i.e. “billable hours”—and thus generate more income. This limited their ability to rest between flights. Some informants noted that this pressure to operate as efficiently as possible prevented them from attending to some of their most basic needs, such as hydrating, going to the washroom and eating properly.

In sum, based on the data collected in this study during the interviews with the five key informants, the study could not determine if a particular method of remuneration is more likely to mitigate or increase pilot fatigue.

C. Fatigue and Stress

Several informants shared their experiences dealing with fatigue and stress. Fatigue and stress were often aggravated or mitigated by the nature of their work schedules; the time of day when flying; and the workload imposed by their employers before and after each flight.

For instance, Informant #1 admitted that he had briefly fallen asleep more than once while flying early in the morning, or in the evening, when he was employed by an aerial work operator (CARs subpart 702). When he worked for an air taxi operation (CARs subpart 703) conducting medical evacuation flights in northern parts of Canada, Informant #1 often felt fatigued because approximately 75% of his flights would take place at night and prevented him from maintaining a regular sleep schedule. As a result, Informant #1 would sometimes find himself flying, even though he had not slept for 24 hours or more. In those instances, he admitted that he would struggle to remain focused and awake. He noted that night flights were more tiring because of the reduced lighting and reduced interaction in the cockpit, and that long breaks in between flights (e.g. waiting for medevac patients) could substantially increase his fatigue levels. When fatigued, he would drink caffeinated beverages or literally “pinch” himself to remain awake.

Informant #2 shared similar experiences and noted that he would often make more mistakes when he was tired. He noted that he would sleep on average between four and five hours each night because of his work schedule, although it would not be unusual for him to remain awake for up to 24 hours on busy days. Because of his passion for flying, and also because it was frowned upon to refuse a flight, Informant #2 had never refused a flight even when he felt fatigued, which he admits was not the safest approach to adopt. Informant #2 had never fallen asleep while he was at the controls of an aircraft but did remember several instances when he was “groggy” and felt like he may fall asleep at the controls of an aircraft.

Informant #3 also confirmed that it is not a myth that pilots sometimes fall asleep in the cockpit. He was aware of stories where one pilot would sleep while the other would fly the aircraft (i.e. in airplanes which are required to have two pilots onboard). He had also witnessed a fellow pilot struggling to stay awake in the cockpit. Informant #5 noted that, when he felt fatigued, he was more likely to miss items in his cockpit checklist and would find that his flying skills were not at the requisite level. Informant #5 learned to mitigate fatigue by self-imposing personal limits, working with management to arrange his schedule and refusing flights when he did not feel it was one hundred percent safe. On the other hand, Informant #4 noted that he did not experience fatigue at the controls of an aircraft, simply because he would not accept a flight if he felt fatigued.

Informants who experienced fatigue all agreed that their work schedule played a big role in their fatigue levels, as there was added pressure to conduct flights to help meet commitments made by their employers, generate income and increase their flight experience. This study found that demanding work schedules increase the risk of pilot fatigue, whereas reasonable work schedules, often found in larger flight operations (704-705 operators), allow pilots to rest adequately. Most informants found that pilot fatigue is a taboo subject in the aviation industry and is rarely discussed among pilots and employers. As a result, some employers may take advantage of their pilots, knowing full well that pilots are likely to remain silent and accept most (if not, all) flights because of the competitive nature of the industry. In all cases, the informants agreed that pilot fatigue affects the accuracy of their flying and can compromise their safety.

D. Company Safety Culture and Work Environment

The study found that the determining factor in relation to pilot fatigue was the employer's safety culture and inclination to comply, and in some cases, ignore or circumvent FDT regulations. The informants agreed that this factor was the strongest influence on the effectiveness of FDT regulations within each operation and the employer's ability to mitigate pilot fatigue. With only a sample of five informants, the study was not able to conclusively determine whether a particular type of operation (air taxi, commuter, airline, etc.) was more inclined to comply or not with FDT regulations. Moreover, the study was not able to determine whether compliance with FDT regulations is currently an issue in civil aviation. The study found that in all likelihood, most Canadian companies comply with FDT regulations.⁷³ However, this study noted that some operators who demonstrate a weak safety culture by ignoring FDT regulations do exist.

The study revealed that when operators struggle to generate a profitable revenue stream or operate in informal and less-structured work environments (e.g. in remote locations), it is more likely that unhealthy decisions will be made; pilots are then left with little operational support and therefore more vulnerable to pilot fatigue. In the study, pilots operating in northern parts of Canada, where government oversight is not as prevalent and where companies have a different culture, were sometimes pressured to ignore FDT regulations and conduct flights, even when they felt fatigued. This pressure is partly due to the realities of the North, where air operators constitute the sole lifeline for many isolated communities with no road access to the rest of Canada. Hence, refusing a flight can result in residents or workers being stranded in a remote location; a community not receiving food deliveries or other much needed supplies, on the one hand, or medical attention, on the other.

The study did reveal that commuter (*CARs* subpart 704) and airline (*CARs* subpart 705) operators were not exposed to the same level of risk as aerial work operators, air taxi operators or flight training units. Commuter and airline operations operate aircraft, which mostly require two pilots, whereas other operations often operate with only one pilot onboard. Flying along with another pilot provides an extra "safety defence" when mistakes are made; increases cockpit interaction, which keeps pilots alert; and provides a supporting figure in the cockpit when the other pilot is fatigued.

⁷³ For instance, an analysis of the public decisions rendered by the Transportation Appeal Tribunal of Canada, the quasi-judicial body established to hear reviews and appeals relating to the *Aeronautics Act* and the *CARs*, reveals that, since 1989, only four decisions have found either a pilot or an operator guilty of contravening FDT regulations in Canada: *102643 Aviation Ltd v Minister of Transport* (15 June 2009), TATC File No W-3375-41, online: Transportation Appeal Tribunal of Canada <www.tatc.gc.ca/decision/decision.php?dc_id=1340&lang=eng>; *Blair William Jensen v Minister of Transport* (15 June 2009), TATC File No W-3373-33, online: Transportation Appeal Tribunal of Canada <www.tatc.gc.ca/decision/decision.php?dc_id=1339&lang=eng>; *Minister of Transport v Frederick Olaf Martin* (15 October 1997), CAT File No O-1473-33, online: Transportation Appeal Tribunal of Canada <www.tatc.gc.ca/decision/decision.php?dc_id=620&lang=eng>; *Minister of Transport v Peter George Dmytriv* (15 October 1997), CAT File No O-1474-33, online: Transportation Appeal Tribunal of Canada <www.tatc.gc.ca/decision/decision.php?dc_id=621&lang=eng>.

1. COMPANY APPROACH TO FDT LIMITS AND REGULATORY COMPLIANCE

Informant #1 and #2 had similar experiences when they were working for an air taxi operator (CARs subpart 703). They both experienced instances where incorrect information was intentionally entered into FDT time records (e.g. aircraft journey logs and pilot logbooks) in order to circumvent regulations. These informants felt like they had to turn a blind eye to such violations, since they were at the beginning of their careers and feared that they may be “blacklisted” or viewed as whistleblowers in the industry, if they ever complained. For example, the pilot’s actual FDT would sometimes be higher than recorded in the company and aircraft records. These informants believed that this practice might be more common than one may think, since there is little oversight focusing on FDT records. These informants stated that this practice had emerged because of the pressure from employers to optimize time and money, which often conflicts with the FDT limits found in the regulations. Indeed, labor costs account for 30% to 40% of an airline’s expenses,⁷⁴ which may explain why some air carriers are more inclined to breach FDT regulations and maximize the utilization of their air crews.⁷⁵

Informant #2 had worked for a particularly demanding air taxi operator who pressured him to fly as many hours as possible. He noted that, if he had ever brought to his employer his concerns about pilot fatigue or breaching FDT limits, he would have risked being fired. He did not feel that he could challenge his employer’s practices, which sometimes ignored FDT regulations. He discussed one situation where his aircraft had suffered a catastrophic engine failure and an in-flight fire. He conducted an emergency landing alone in a remote location and did not sustain any injuries. He did, however, suffer from stress, anxiety and fatigue as a result of this traumatic experience. Because he did not feel safe to fly the next day, he asked his employer for a day off. He remembers having bags under his eyes and feeling completely distraught at the time of his request. The employer said that, if he took the next day off, he would be fired. This event taught him that, regardless of his fatigue levels, even on the tail of exceptional circumstances, he was not in a position to refuse any flight assignment if he wanted to keep his job.

He found this situation to be very difficult, as he had to choose between safety and his “dream job” as a bush pilot. As many pilots would, he chose the second option; he flew the very next day after his emergency landing; and continued working for that employer for the rest of the flying season. Informant #2 further noted that an employer’s

⁷⁴ Dempsey & Gesell, *supra* note 3 at 606.

⁷⁵ Indeed, if employers are required to reduce their pilots’ FDT under more strict regulations, employers will likely need to hire more pilots, thus increasing their operational costs. If FDT limits were to be reduced even further with improved regulations, air carriers would not be able to utilize their pilots as much and would need to hire additional pilots to meet the demand. Therefore, industry experts have predicted that stricter FDT limitations could potentially result in the increase of operational costs by up to 30%. Some industry stakeholders have even predicted a significant reduction in profit, unless airlines increase their prices or reduce their pilots’ salaries. See Bruce Campion-Smith, “Sleepy Pilots Target of New Transport Canada rules”, *The Star* (18 September 2014), online: <https://www.thestar.com/news/canada/2014/09/18/sleepy_pilots_target_of_new_transport_canada_rules.html>; Taylor, *supra* note 11 at 413.

complacency and resistance towards FDT regulations often spread like cancer throughout the entire company, namely among the company's pilots. He concluded by stating that, in northern Canada, "it is the Wild West: anything goes." Informant #2 believes the reason for the problem with pilot fatigue in aviation may be the potential for operator abuse. Informant #2 stated that complying with regulations, such as FDT limits, is not viewed by some operators as a profitable approach; thus, regulations are not always followed.

Informant #5 also felt an underlying pressure from his employer to fly as much as he could, which he felt was draining at times. Informants #1, #2 and #5 all agreed that management has a direct impact on the fatigue levels of their pilots through the schedules they decide to impose. In their opinion, management is the first line of defence against pilot fatigue, followed by the pilots themselves. If the pilots are offered reasonable work schedules, they are more likely to be well rested, make safe decisions and perform well in the cockpit. If they are pressured to fly too many hours, this will increase the likelihood of pilot fatigue, bad decision-making and put their safety at risk.

2. COMPANY STRATEGIES AND "SAFETY DEFENCES" FOR PREVENTING AND MITIGATING PILOT FATIGUE

The study investigated the various mechanisms (otherwise known as "safety defences" in civil aviation) used to prevent and mitigate pilot fatigue in civil aviation. Informant #1 (when he worked for an airline—*CARs* Subpart 705) and informants #3 and #4 each had to work with an FDT tracker system with which the company would accurately record and monitor their pilots' FDT. When they would approach their maximum FDT, the system would send an alert to both the pilots and management. The system would also prevent pilots from being scheduled by the system on a flight which would cause them to exceed their maximum FDT.

Moreover, two of these informants (#1 and #3) were unionized and stated that their collective-bargaining agreement did provide additional protections against unreasonable work schedules. FDT limits were reiterated in this agreement, which also provided for additional rest time for pilots. Indeed, the agreement had FDT limits which were stricter than the FDT limits in the *CARs*. Although these two informants are part of the very small sample used in this study, the study noted that unionized pilots were more likely to have stringent FDT rules within their collective-bargaining agreement, in comparison with existing FDT regulations in the *CARs*. In other words, these air carriers view FDT regulations as the floor, rather than the ceiling.

Informant #3 also mentioned that, if he exceeded his maximum FDT, he would have to file a safety report, meaning that the safety officer of the company would have to investigate the reasons for this breach and how any breach of the same type could be prevented in the future. As a result, these informants' employers closely monitored the FDT limits.

To prevent fatigue, the employer of Informant #4 also had a policy where recent hires could not fly more than 5 hours each day. This informant also felt

comfortable discussing fatigue with his employer and felt encouraged to take time off if needed or even refuse a flight when he felt fatigued. One interesting employer-related comment made by Informants #1 (when he worked for an airline), #3 and #4 was that their employers allowed pilots to remove themselves from a flight roster due to fatigue. If the pilot mentioned that his or her absence from work was due to fatigue, he or she would not lose a sick day or lose any salary; nor would that absence be questioned by his or her employer.

In sum, the study revealed that while some employers may have an approach where profitability prevails over regulatory compliance and their pilots' fatigue, others have a safer working culture where a non-punitive approach is endorsed, with a view to protecting the health and safety of the pilots.

E. Industry Issues

The study revealed that certain sectors in the civil-aviation industry might be associated with a greater risk of pilot fatigue. The study found that smaller companies often operate with a thin profit margin, which increases their risk of favoring profitability over regulatory compliance. While this is not the case for every small operator, the study revealed that pilots working for these operators are nonetheless prime subjects for pilot fatigue. In addition, these operators often employ less experienced pilots, who are more susceptible to the effects of pilot fatigue. Finally, the informants also revealed that operators working in remote locations are not provided the same levels of infrastructure and are not subject to the same level of oversight from Transport Canada. All the aforesaid factors make a perfect recipe for pilot fatigue that can threaten flight safety.

1. SMALLER OPERATORS VERSUS LARGER OPERATORS

Informants with experience working for air taxi operations noted that it is more challenging to work for smaller operations, especially since many of these companies operate in remote and northern locations. Doing so exposes pilots to more challenging weather conditions, provides them with less infrastructure and in general represents an unorthodox work environment.

Some informants noted that not every small operator considers pilot fatigue when scheduling flights; indeed, money is often the driving force in the airline industry, given its very slim profit margins. Because of the fierce competition amongst operators, management often finds creative ways to cut down on operational costs by reducing pilot salaries and optimizing its use of pilots. This method of conducting business is conducive to more pilot fatigue. Several informants noted that a lot of this pressure comes from clients, who are often very demanding. Informant #1 mentioned that operators are sometimes faced with the difficult choice, on the one hand, of declining a flight and losing business or, on the other, of accepting a flight and breaking the law. In his view, compliance and safety have a price in the eyes of employers wishing to

maximize their revenue. Informant #2 had a similar point of view and stated that, while a company must mitigate safety risks, it must do so in light of its ability to remain in business.

However, most informants agreed that this pressure is not as prevalent in the commuter and airline industry sectors, where companies are usually healthier financially and where pilots are protected by collective-bargaining agreements that impose strict scheduling limits. It was noted by some informants that, given the size of these larger operators, commuter and airline operations usually have the infrastructure and the resources necessary to closely monitor and enforce FDT limits without these requirements affecting their ability to operate or generate a decent revenue. Smaller operators, on the other hand, often rely on a very small roster of employees and may not have the “luxury” to monitor FDT or remove a pilot from their flight schedule, simply because a pilot is fatigued.⁷⁶

Informants #3 and #4 argued that most companies do follow FDT regulations and make an effort to mitigate pilot fatigue by adopting reasonable work schedules. Informants #3 and #4 never witnessed a pilot or an employer breaching FDT limits. The factor distinguishing these two informants, on the one hand, and the other informants (#1 [when he was employed by a 703 operator], #2 and #5), on the other hand, was the safety culture promoted by their employers; Informants #1 and #2 worked for employers who were more inclined towards the profitability of their businesses, and the others worked for employers that had a better safety culture.

2. TRANSPORT CANADA OVERSIGHT

Another issue raised by the informants was the lack of government oversight, in particular surveillance activities, in specifically verifying whether operators comply with FDT regulations. Nowadays, Transport Canada audits are pre-announced and are usually scheduled on average every two years. This situation allows delinquent companies to circumvent FDT regulations with little Transport Canada surveillance to proactively identify and address potential safety deficiencies in connection with pilot fatigue.

For instance, Informant #1 mentioned that his employer would create false records, including forged FDT documentation, prior to a Transport Canada inspection, either because proper records had never been created, even though required by regulation, or to give the impression that the operation was compliant with the *CARs*. This practice gave Transport Canada the impression that his employer was compliant with the FDT regulations, even though the reality was likely different. Because these inspections are generally pre-announced, some operators in the industry simply do not

⁷⁶ While some informants were paid for each hour flown, including overtime pay, some were not paid for any overtime, which increased their exposure to longer work schedules. Even if pilots are paid overtime rates, air operators generate the bulk of their profit when their aircraft are flown. Therefore, the revenue generated from these flights usually outweighs the cost of paying overtime when pilots go beyond a standard work schedule.

follow the regulations, waiting until their inspection cycle is due to create fraudulent FDT records. It is very easy for some operators to produce incorrect or false documents to cover up their contraventions of the *CARs*, giving the regulator the impression that these operators comply with FDT regulations, when in fact they may be running an unsafe operation. In other cases where operators unintentionally breach FDT regulations, it is very difficult to address this problem because of the paucity of Transport Canada resources allocated to this particular issue (FDT regulations).

Informants #1 and #2 noted that this practice is likely more prevalent in northern “bush flying” operations, where it is even more difficult for Transport Canada to conduct regular inspections given the geographical remoteness of some companies. Informant #2 noted that, in his time working for an air taxi operator, there was a “leave no trace” mentality when it came to FDT records; a lot of documentation was never produced or was intentionally “fudged” (sic) to avoid documenting his employer’s violations of the *CARs*. Once again, the study found that the employer’s culture and approach to safety had a strong influence on its overall regulatory compliance.

The purpose of this study was to analyze the effectiveness of FDT regulations in Canada. Due to the small sample of key informants interviewed during this study, it is not possible to generalize the findings of this study to the entire aviation industry in Canada. However, this study provides a glimpse into the daily realities of professional pilots in Canada and how they cope in a competitive and demanding industry.

One finding did stand out: an employer’s safety culture concerning FDT regulations has a strong influence on the wellbeing of pilots, particularly their fatigue levels. Employers with a generally safe approach to all facets of their operations appear to favor safety over profitability. Short-line and cash-strapped operators (struggling to balance safety with profitability), on the other hand, appear to be more inclined to breach FDT regulations in order to maintain a competitive position in the market. It appears that these companies are also more inclined to employ older aircraft and less experienced pilots to minimize costs. This study also found that operators, who cut into core safety aspects of their operations, for example by increasing their pilots’ actual FDT times, are at risk of having fatigued pilots at the controls of their aircraft.

It is difficult to deny that the nature of a work schedule is one of the main factors affecting the fatigue of employees in any industry. Fatigue can be positively affected by a company’s organizational culture and safety policy, which should take into account scheduling and pilot fatigue. It remains uncertain whether the new FDT regulations scheduled to come into force in 2020-2021⁷⁷ (under a phased approach

⁷⁷ *Canada Gazette*, Vol 151, No 26, “Regulations Amending the *Canadian Aviation Regulations* (Parts I, VI and VII — Flight Crew Member Hours of Work and Rest Periods)” (1 July 2017), online: Department

that will vary depending on the category of operation) will be more effective and mitigate pilot fatigue even more. The new rules do not in themselves guarantee their effectiveness, but they could contribute to prevention and foster a good safety culture across the civil-aviation industry.⁷⁸ The findings of this study suggest that FDT regulations are effective only when the operator commits to a good safety culture and is supported by adequate oversight by Transport Canada. When both these elements are in place, existing and future FDT regulations will have a stronger effect in reducing the fatigue levels of Canadian pilots. While fatigue is not unique to pilots and exists in other professions too, the stakes are higher when one is flying an aircraft. While there is much emphasis on the regulator adopting new rules, individual operators are in the best position to address pilot fatigue with their organizational approach to this issue.

In sum, this study found that FDT regulations are generally effective when operators are compliant with the *CARs*. This study found that pilots are perhaps less fatigued than media stereotypes would suggest, but that a fatigue problem does exist with some operators, particularly with less experienced pilots at the beginning of their careers. Current FDT regulations are certainly not perfect, but they do mitigate pilot fatigue when the regulations are followed and not circumvented. However, current regulations do not comply with international standards set out by ICAO. This is the reason why several informants endorsed the recommendation for updating Canada's FDT regulations with new regulations that comply with international standards.

Informants also highlighted systemic economic issues in the industry that must be considered; financially healthy operators usually make healthier safety decisions, and conversely, financially unhealthy operators may not.⁷⁹ The results of this study show that the effectiveness of FDT regulations will require particular attention once the new regulations come into force in order for operators to commit to these upcoming changes. To implement a healthy safety culture, informants noted that it is up to the regulator to ensure its presence in the industry with active oversight not solely focused on enforcement, but also on cooperative outreach and awareness strategies aiming to foster organizational changes with operators struggling to balance profitability and compliance. However, this study identified a lack of oversight by Transport Canada in the form of a lack of action to address non-compliance issues with FDT regulations. This lack of action is the reason why some informants recommended that Transport

of Transport <<http://www.gazette.gc.ca/rp-pr/p1/2017/2017-07-01/html/reg2-eng.php>> ("The proposed regulatory amendment would introduce a range of flight duty period from 9 to 13 hours" depending on the time when a flight is scheduled to take off. Moreover, the number of hours a pilot would be entitled to fly each year would be reduced from 1,200 to 1,000. Another notable change would be the introduction of a period of time free from duty of 33 consecutive hours every eight days, where the time free from duty would commence no later than 22:30 and end no earlier than 7:30. This mandated period of time free from duty would provide pilots with two sleep opportunities and therefore allow them to recover from the effects of cumulative fatigue).

⁷⁸ David-Cooper, *supra* note 6 at 46. In the context of civil aviation, good safety culture exists when there is strong managerial leadership which supports the wellbeing of the organization's workforce and prioritizes regulatory compliance over profitability. Strong communication about safety between senior management and employees and using safety newsletters, notices and bulletins, for example, enhances the overall promotion of safety within the organization.

⁷⁹ David-Cooper, *supra* note 6.

Canada implement targeted inspections to ensure compliance with FDT regulations. While Transport Canada cannot “regulate” a company’s safety culture, informants noted that the regulator certainly has a role in fostering such a culture. Therefore, the effectiveness of FDT regulations relies on their legal framework, as well as the individual safety culture adopted by each operator and their air crews.

Appendix 1—Maximum Flight Time

	Within 365 consecutive days	Within 90 consecutive days	Within 30 consecutive days	Within 7 consecutive days	Within 24 consecutive hours
Aerial work 702 Operators	1,200 hours	300 hours	120 hours or 100 hours for flight-crew members on call	60 hours	8 hours for single-pilot IFR operations No flight time limits for VFR operations
Air taxis 703 Operators	1,200 hours	300 hours	120 hours or 100 hours for flight-crew members on call	60 hours	8 hours for single-pilot IFR operations No flight time limits for VFR operations
Commuters 704 Operators	1,200 hours	300 hours	120 hours or 100 hours for flight-crew members on call	40 hours if operating an aircraft other than a helicopter	8 hours for single-pilot IFR operations No flight time limits for VFR operations
Airlines 705 Operators	1,200 hours	300 hours	120 hours or 100 hours for flight-crew members on call	40 hours if operating an aircraft other than a helicopter	8 hours for single-pilot IFR operations No flight time limits for VFR operations
Helicopter operators	1,200 hours	300 hours	120 hours or 100 hours for flight-crew members on call	60 hours	8 hours for single-pilot IFR operations No flight time limits for VFR operations

(*Canadian Aviation Regulations*, s 700.15, Part VII, Division III—Flight Time and Flight Duty Time Limitations and Rest Periods)

Appendix 2—Maximum Duty Time

<i>Canadian Aviation Regulations</i>	Maximum duty time		
	Within 24 hours	Within 7 days	Within 2 weeks
	14 hours	60 to 90 hours (depending on the type of operator), based on the maximum flight time allowed in the <i>CARs</i>	120 to 180 hours (depending on the type of operator), based on the maximum flight time allowed in the <i>CARs</i>

(*Canadian Aviation Regulations*, s 700.16, Part VII, Division III—Flight Time and Flight Duty Time Limitations and Rest Periods)

Appendix 3 — Key-Informant Profiles

Participant	Years of experience flying (at the time of the interview)	Qualifications	Flight experience (at the time of the interview)	Current employer (operator type)	Past employers (operator type)
Informant #1	8	Airline transport pilot licence	3000 hours	- CARs subpart 705 operator (airline) - Unionized pilot	CARs subpart 702 (aerial work operator) & 703 (air taxi operator)
Informant #2	18	- Commercial pilot licence - Flight instructor rating - Seaplane rating	1500 hours	- CARs subpart 703 operator (air taxi operator) - Non-unionized pilot	Flight training unit as a flight instructor
Informant #3	8	- Commercial pilot licence - Flight instructor rating	2300 hours	- CARs subpart 705 Operator (airline) - Unionized pilot	- Flight training unit as a flight instructor - CARs subpart 703 (air taxi operator) & 704 (commuter) operator)
Informant #4	20	- Airline transport pilot licence - Flight instructor rating	5600 hours	- CARs subpart 702 operator (aerial work operator) - Non-unionized pilot	Flight training unit as a flight instructor
Informant #5	9	- Commercial pilot licence - Flight instructor rating	700 Urs	- Flight training unit (flight instructor) - Non-unionized pilot	N/A