

2017 ANNUAL REPORT

CANADA'S ACTION PLAN to Reduce Greenhouse Gas Emissions from Aviation







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2017 ANNUAL REPORT

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This is the sixth Annual Report under Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation (the Action Plan).

In 2017, good progress was made on the implementation of measures under the Action Plan, including a number of noteworthy achievements associated with aircraft fleet renewal, Air Traffic Management (ATM), research and development pertaining to biojet and non-volatile particulate matter (nvPM) and Canada's involvement in the negotiation of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

Canadian air carriers have collected the necessary data to track fuel efficiency improvements achieved in 2017. As a result of a review undertaken in 2015, parties of the Action Plan agreed to evaluate progress against the Air Transport Action Group's (ATAG) industry accepted target to improve fuel efficiency by a 1.5 percent annual average until 2020 from a 2008 baseline of 39.47 litres per 100 Revenue Tonne-Kilometres (L/100 RTK). Compared with 2016, Canadian air carriers improved fuel efficiency by 2.8 percent, which represents a 1.87 percent annual average improvement, from a 2008 baseline, or a cumulative improvement of 15.6 percent from 2008 to 2017.

The Action Plan also continues to pursue and report against the 2012 aspirational goal of a 2 percent annual average fuel efficiency improvement until 2020, from a 2005 baseline of 40.43 L/100 RTK. In relation to the 2005 baseline, Canadian air carriers improved their fuel efficiency by an annual average of 1.60 percent, which is a cumulative improvement of 17.6 percent from 2005 to 2017. In addition to reporting annual fuel efficiency data, this report identifies and describes a series of measures taken in 2017 to address greenhouse gas (GHG) emissions across the aviation sector. These measures include:

- fleet renewals and upgrades;
- more efficient air operations;
- improved air traffic management capabilities;
- aviation environmental research and development;
- alternative fuels;
- airport ground operations and infrastructure use;
- regulatory measures; and
- international coordination.

This report also provides a preview of important milestones achieved in 2018, including the fleet renewal and upgrades of National Airlines Council of Canada (NACC) and Air Transport Association of Canada (ATAC) carriers, the accreditation of Moncton, Ottawa, Halifax, Québec City and Vancouver airports under the Airport Carbon Accreditation (ACA) program, the advancement of research and development projects such as the Canadian Biojet Supply Chain Initiative (CBSCI), the launch of the Government of Canada's Sky's the Limit Challenge and the International Civil Aviation Organization's (ICAO) adoption of the Standards and Recommended Practices (SARP) for CORSIA.

Background

On June 4, 2012, the Government of Canada and the Canadian aviation industry released *Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation* (the Action Plan) and submitted it to the International Civil Aviation Organization (ICAO). Developed by a joint industry-government Working Group on Aviation Emissions, the Action Plan:

- Builds on the success of previous collaborations between the Government of Canada and Canada's aviation stakeholders. This includes the world's first voluntary agreement to reduce GHG emissions from aviation, which was signed in 2005 between Transport Canada and the Air Transport Association of Canada (ATAC) on behalf of its member carriers.
- Commits to annual reporting to summarize and track progress towards meeting the fuel efficiency goal and other Action Plan activities. This is the sixth annual report published under the Action Plan.
- Describes ongoing and planned initiatives to address GHG emissions from Canada's domestic and international aviation activities.

The Working Group on Aviation Emissions committed to review the Action Plan and its associated activities every three years in accordance with section 7.3. As a result of the 2015 review, the parties agreed to evaluate progress against the ATAG¹ target to improve fuel efficiency by a 1.5 percent annual average until 2020 from a 2008 baseline of 39.47 litres of fuel per 100 Revenue Tonne-Kilometres (L/100 RTK). Canada will also continue to pursue and report against the 2012 aspirational goal to improve fuel efficiency of Canada's air carriers by a 2 percent annual average until 2020, from a 2005 baseline of 40.43 L/100 RTK. The decision to report against both the 1.5 percent target and the 2 percent aspirational goal was reconfirmed during the 2018 review (for details regarding the 2018 review, refer to Appendix F).



Canadian Biojet Supply Chain Initiative (CBSCI):

A major project milestone was achieved when a total 230,000 L of biojet-blended fuel (30 percent renewable and 70 percent conventional) entered Toronto Pearson International Airport's fuel system. The biojet fuel, which meets the same technical and safety requirements as conventional jet fuel, was produced from recycled cooking oil in California, transported by rail, and introduced into Toronto Pearson's shared fuel tank and distribution system. The fuel was allocated to 22 flights departing from Pearson airport travelling to a range of Canadian domestic destinations on Earth Day, April 22, 2018. The successful blending demonstrates the feasibility of the current fuel system to accept biojet which could reduce future costs.

In support of ambitious global action to combat climate change agreed to in Paris in 2015, the Government of Canada, in collaboration with the provinces and territories, jointly released the Pan-Canadian Framework on Clean Growth and Climate Change in December 2016. Many of the transportation-related actions identified in the framework, such as using cleaner fuels, investing in transportation infrastructure and improving efficiency, align with measures under the Action Plan.

¹ The Air Transport Action Group is an independent coalition that represents all sectors of the air transport industry, working to promote aviation's sustainable growth.

Results for 2017

The Air Transport Association of Canada (ATAC) and the National Airlines Council of Canada (NACC) have collected the data required to report on fuel efficiency improvements achieved in 2017.² Although progress towards the Action Plan's target is measured in terms of litres of fuel used per Revenue Tonne-Kilometre (RTK), the air operator associations have provided additional data (see Appendix B: Glossary of Key Terms and Acronyms for definitions) to calculate the industry's main activity measures. Other key aviation activity measurements include:

- Revenue Passenger-Kilometres (RPK);
- Passenger Revenue Tonne-Kilometres (Passenger RTK);
- Cargo Revenue Tonne-Kilometres (Cargo RTK); and
- Total Revenue Tonne-Kilometres (Total RTK).

Table 1 illustrates the combined results for ATAC and NACC air carriers for calendar years 2005 to 2017. It shows trends in fuel consumption and its conversion to GHG emissions, expressed in carbon dioxide equivalent (CO₂e); as well as ratios of litres of fuel and grams of CO₂e per RPK and total RTK.

Table 1 also shows the following results from the reporting carriers in 2017 (in slightly rounded figures):

- The combined fuel consumption rate was 33.31 litres per 100 RTK, which is an annual average improvement between 2008 and 2017 of 1.87 percent.
- Revenue service was 24.4 billion total RTK (21.2 billion passenger RTK and 3.2 billion cargo RTK).



Air Traffic Management – Modernizing Canadian Airspace:

NAV CANADA is working with industry partners to help reduce GHG emissions from aviation through efforts to modernize the design of Canada's airspace and international flight paths by implementing new technologies.

Increased flight efficiencies over the North Atlantic (NAT) through the implementation of reduced longitudinal and lateral separation requirements and optimal cruising altitude availability have safely increased the NAT capacity and efficiency. In 2017, more than 10,000 flights by Canadian and international operators used the new airspace routes, reducing fuel burn and GHG emissions.

Performance Based Navigation (PBN) is becoming the world standard for aircraft navigation. By using GPS technology and sophisticated communications and navigation systems, PBN makes it possible to design and use shorter flight paths and constant descent operations, which help to reduce fuel consumption and GHG emissions. As a component of PBN, Required Navigation Performance (RNP) is an advanced form of navigation that helped Canadian and international operators save more than 980,000 litres of fuel and reduce GHG emissions by 2,522 metric tonnes in 2017.

² It should be noted that the number of air carriers that provide data under the Action Plan have changed from year to year. As a result, the statistics presented in this report may not be entirely comparable with those in other years.

TABLE 1: Annual Results of Domestic and International	Operations ,	2005-2017 ³
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	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Fuel use (million litres)	4,887	5,186	5,543	5,575	5,098	5,659	6,089	6,256	6,314	6,579	7,023	7,555	8,137
GHG emissions (megatonnes of CO ₂ e)	12.619	13.390	14.312	14.396	13.164	14.611	15.721	16.153	16.303	16.987	18.132	19.506	21.010
Traffic (billions)													
Revenue passenger- kilometres (RPK)	105.22	112.98	124.15	125.55	117.62	128.77	141.27	148.74	150.92	161.62	175.66	193.98	212.06
Passenger revenue- tonne-kilometres (pass. RTK)*	10.52	11.30	12.42	12.55	11.76	12.88	14.13	14.87	15.09	16.16	17.57	19.40	21.21
Cargo revenue-tonne- kilometres (cargo RTK)	1.57	1.53	1.82	1.57	1.38	2.01	1.98	1.96	2.05	2.25	2.24	2.64	3.22
Total revenue-tonne- kilometres (RTK)	12.09	12.83	14.23	14.13	13.14	14.88	16.11	16.83	17.14	18.41	19.80	22.04	24.43
Fuel consumption ra	ites												
Litres/RPK	0.0464	0.0459	0.0446	0.0444	0.0433	0.0439	0.0431	0.0421	0.0418	0.0407	0.0400	0.0389	0.0384
Litres/Total RTK	0.4043	0.4043	0.3895	0.3947	0.3879	0.3802	0.3780	0.3716	0.3683	0.3574	0.3546	0.3428	0.3331
Emission rates**													
CO ₂ e grams/RPK	119.93	118.52	115.28	114.66	111.92	113.47	111.28	108.59	108.03	105.11	103.22	100.55	99.08
CO ₂ e grams/Total RTK	1,044	1,044	1,006	1,019	1,002	982	976	960	951	923	916	885	860

* Note that Passenger RTK are calculated by multiplying RPK by 100 kg (or 0.1 tonnes), which is the industry's conventional assumption of the average weight per passenger, including baggage.

** All GHG emissions included in this report have been calculated based on Environment and Climate Change Canada's (ECCC) National Inventory Report 1990–2016.

See Appendix E: Additional Figures Illustrating Key Trends for Figures 6, 7, 8, 9, 11, 12, 15 and 16 that illustrate trends presented in Table 1.

Canadian air carriers report aviation activity data for both domestic and international activities. Similar to the Intergovernmental Panel on Climate Change's definition of international and domestic activities, the Action Plan defines international activity as flight segments that begin or end outside of Canada, whereas domestic activity includes flight segments within Canada. Table 2 provides data on international versus domestic aviation activity for 2017.

- Separately, the fuel consumption rate for international activity was 30.67 litres per 100 RTK, and 40.80 litres per 100 RTK for domestic activity.
- Total fuel consumed amounted to 8.14 billion litres (68.3 percent for international activity and 31.7 percent for domestic activity).
- Total GHG emissions amounted to an estimated 21.01 megatonnes (Mt) (14.34 Mt for international activity and 6.67 Mt for domestic activity).

³ In submitting and reviewing their submission for 2017, one carrier revised substantially their cargo statistics for 2016. This changed the aggregated rate among ATAC carriers which impacts the cargo statistics of that year. The updated cargo statistics are represented in Table 1 and have been incorporated in all of the trend statistics and charts throughout this report.

TABLE 2: International vs. Domestic Aviation Activity, 2017

	INTERNATIONAL	DOMESTIC	TOTAL
Fuel use (million litres)	5,554	2,583	8,137
GHG emissions (megatonnes of CO_2e)	14.34	6.67	21.01
Traffic (billions)			
Revenue passenger-kilometres (RPK)	155.7	55.9	212.1
Passenger revenue-tonne-kilometres (pass. RTK)	15.6	5.6	21.2
Cargo revenue-tonne-kilometres (cargo RTK)	2.5	0.7	3.2
Total revenue-tonne-kilometres (RTK)	18.1	6.3	24.4
Fuel consumption rates			
Litres/Total RTK	0.3067	0.4080	0.3331
Emission rates			
CO2e grams/Total RTK	792	1,053	860

See Appendix E: Additional Figures Illustrating Key Trends for Figures 5, 10, 13 and 14 that illustrate trends presented in Table 2.

FIGURE 1: Fuel Consumption Rates – International and Domestic, 2017





Canada's progress (measured by ratio of fuel consumption to total traffic – litres/total RTK) is benchmarked against ATAG's target of 1.5 percent annual average improvement in fuel efficiency to 2020 against a 2008 baseline. Table 3 shows progress in improving fuel efficiency, illustrating the change in the measures and rates between 2016 and 2017, and between 2008 and 2017. Fuel efficiency in 2017 improved by 2.8 percent over 2016, and the cumulative improvement between 2008 and 2017 was 15.6 percent, or an annual average of 1.87 percent.

TABLE 3: Absolute and Proportional Changes Over Time, 2008–2017

	CHANGE	2016–2017	CHANGE 2008-2017			
	ABSOLUTE	PROPORTIONAL	ABSOLUTE	PROPORTIONAL	ANNUAL RATE	
Fuel use (million litres)	582	7.7%	2,562	45.9%	4.3%	
GHG emissions (megatonnes of CO ₂ e)	1.50	7.7%	6.6	45.9%	4.3%	
Traffic (billions)						
Revenue passenger- kilometres (RPK)	18.1	10.3%	86.5	68.9%	6.0%	
Passenger revenue-tonne- kilometres (pass. RTK)	1.8	10.3%	8.7	68.9%	6.0%	
Cargo revenue-tonne- kilometres (cargo RTK)	0.6	26.2%	1.7	105.2%	8.3%	
Total revenue-tonne- kilometres (RTK)	2.4	12.1%	10.3	72.9%	6.3%	
Fuel consumption rates*						
Litres/RPK	-0.001	-1.5%	-0.0060	-13.6%	-1.61%	
Litres/Total RTK	-0.010	-2.8%	-0.0616	-15.6%	-1.87%	
Emission rates						
CO ₂ e grams/RPK	-1.5	-1.5%	-15.6	-13.6%	-1.61%	
CO ₂ e grams/Total RTK	-25.1	-2.8%	-159.0	-15.6%	-1.87%	

* Note that fuel consumption rates are calculated using the Compound Annual Growth Rate (CAGR) formula. For more information, refer to Appendix C.

The figures presented in Tables 1, 2 and 3 allow for the following summary of trends:

- In 2017, reported RPK rose by 10.3 percent, compared to 2016. Between 2008 and 2017, RPK grew by 68.9 percent.
- Reported cargo RTK increased by 26.2 percent in 2017, compared to 2016. This improvement can be attributed, in part, due to recent fleet renewal and upgrades (refer to Section 5.0: Measure 5.1 for more detail).
- While changes in NACC and ATAC carrier reporting make it difficult to compare reported trends in cargo, the figures suggest there was an increase in total RTK of 12.1 percent from 2016 to 2017, and an increase of 72.9 percent between 2008 and 2017.
- A total of 8.14 billion litres of fuel was used in 2017, an increase of 7.7 percent from 2016.

- While fuel efficiency improved, GHG emissions from 2016 to 2017 also increased by 7.7 percent, to 21.01 Mt of CO₂e, largely due to increased traffic.
- GHG emissions per RTK improved by the same proportions as the fuel consumption rates (in litres per RTK) in 2017 compared to 2016 and 2008 (2.8 percent and 15.6 percent, respectively).

Figure 2 plots the target trajectory from 2008 to 2020 of reductions of 1.5 percent annual average improvement in fuel efficiency and the progress made between 2008 and 2017. It adds an indicative trajectory that would be required to meet the 2020 ATAG target, given the actual 2017 results.



FIGURE 2: Progress Towards ATAG Target, 2008–2020

Civil Aviation Alternate Fuel Contrail and Emission Research (CAAFCER):

In 2017, the Green Aviation Research and Development Network (GARDN) project CAAFCER was undertaken by a consortium of Air Canada, The Waterfall Group, The University of Alberta, SkyNRG, The Boeing Company and the National Research Council of Canada (NRC). This project is the world's first contrails biofuel flight research project using airline passenger jets in commercial service. Contrails and emissions, were measured from petroleum JetA1 and a blend of JetA1 and 43 percent Hydro-processed Ester Fatty Acids biofuel (HEFA) made from used cooking oil. Five Air Canada biofuel flights were made from Montreal with 43 percent HEFA blend. The NRC T33 research jet flew from Ottawa, intercepted the Air Canada aircraft and measured the contrails. Following these flights, the NRC jet intercepted the same Air Canada aircraft, this time using JetA1, flying from Toronto, and measured their contrails and particle emissions. The project found that both contrails and particle emissions reduced in proportion to the biofuel content of the jet fuel.



Figure 3 provides an illustration of the importance of fuel efficiency improvements to reducing GHG emissions. Between 2008 and 2017, if fuel efficiency had remained at 2008 levels of 39.47 litres of fuel per 100 RTK, total GHG emissions in 2017 would have reached 24.89 Mt, whereas actual 2017 emissions were 15.6 percent lower, at 21.01 Mt, a difference of 3.88 Mt. The Action Plan also continues to pursue and report against the 2012 aspirational goal of a 2 percent annual average fuel efficiency improvement until 2020, from a 2005 baseline of 40.43 L/100 RTK. In relation to this baseline, Canadian air carriers improved their fuel efficiency by 1.60 percent with a cumulative improvement of 17.6 percent from 2005–2017. For more information, refer to Appendix A.







SUSTAINABLE G ALS

In September 2015, Canada and 192 other United Nations member states adopted the 2030 Agenda for Sustainable Development. The 2030 Agenda is a 15-year global framework centered on an ambitious set of 17 Sustainable Development Goals (SDGs), 169 targets and over 230 indicators. The 2030 Agenda is a global framework of action for people, planet, prosperity, peace, and partnership. It integrates social, economic, and environmental dimensions of sustainable development, as well as peace, governance and justice elements. Canada is committed to implementing the 2030 Agenda and its SDGs. On July 17th, 2018, Canada presented its first **Voluntary National Review report** at the United Nations High Level Political Forum in New York, which highlights Canada's progress and plan to achieve the 2030 Agenda for Sustainable Development at home and abroad.

Through actions taken under Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation, the Government of Canada and the Canadian aviation industry contribute to seven of the 17 SDGs.





Reporting on Section 5.0 Measures

Section 5.0 of Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation identifies measures that represent the greatest opportunities to reduce GHG emissions and help improve fuel efficiency. The following table summarizes the results achieved and the status of each measure.



Summary Table of Section 5.0 Measures

MEASURE	RESULTS	STATUS
Business aviation operators will be encouraged to take advantage of opportunities to reduce emissions through fleet renewal.	The Canadian Business Aviation Association (CBAA) continued to build on its GHG reduction outreach efforts through its online forum and other member fora. The online forum increases awareness and provides a space for feedback on activities of interest to Canadian business aviation operators, including Canada's Action Plan. The CBAA will continue to encourage its members to take advantage of opportunities to reduce GHG emissions through fleet renewal.	0
5.2 More Efficient Air Operatio	ns	
Canadian air carriers expect to achieve average annual fuel efficiency improvements for domestic and international flights to 2020 through improved operations.	All ATAC and NACC members continued to re-emphasize the use of fuel saving operating procedures. Carriers continue to look for additional opportunities to reduce fuel burn by reviewing operating procedures and weight saving programs. The use of combi aircraft provide the opportunity to carry reduced passenger loads with cargo in the cabin of the aircraft. This segregation has increased operational efficiency.	0
Business aviation operators will be encouraged to adopt operational improvement to reduce emissions.	The CBAA continued to encourage its members to take advantage of opportunities to reduce GHG emissions through operational improvements. The CBAA Forum will continue to give these issues greater visibility to operators.	0
Canadian operators will continue to take advantage of the opportunities identified in ICAO guidance on minimizing fuel use and reducing emissions.	The input for the updated manual was built upon NACC and ATAC carriers' policies and procedures. NACC, ATAC and CBAA promoted the ICAO manual to its members when it came online in 2014.	0
	I PROGRESS DEHIND SCHEDULE	

5.3 Improved Capabilities in Air Traffic Management

RESULTS

NAV CANADA, in partnership with Transport Canada, Canadian air carriers, global Air Navigation Service Providers and other industry participants remains committed to taking advantage of opportunities to improve air traffic management (ATM) through further implementation of Performance Based Navigation (PBN), such as Public Required Navigation Performance -Authorization Required (RNP AR), new ATM technologies and procedures, as well as surveillance technologies, such as Automatic Dependent Surveillance-Broadcast (ADS-B) and multilateration. More specifically NAV CANADA will:	The Canadian Performance-based Aviation Action Team (CPAAT) is leading the implementation of Canada's PBN Implementation Plan and will provide opportunities for ongoing consultation and involvement throughout implementation.	0
• Implement RNP AR procedures at numerous airports, continue to expand the use of Area Navigation and implement broader access to ADS-B surveillance; all of which will improve flight path efficiencies, reduce fuel consumption and reduce GHG emissions.	RNP AR approaches allow aircraft to land using satellite-based navigation in place of ground-based navigation systems, the benefits of which include reduced flying time and GHG emissions. In 2017, NAV CANADA implemented and published new RNP AR approaches at Edmonton, Winnipeg and St. John's International Airports. Also, RNP AR project work was initiated at Regina, Saskatoon and Quebec City International Airports, as well as Brandon Municipal and Deer Lake Regional Airports for publication in 2018, which will bring the total number of sites with RNP AR procedures to 11. NAV CANADA will work with NACC through 2018 and onwards to continue to develop RNP AR procedures at more airports across Canada. Programs for gathering RNP AR usage metrics will allow for specific reportable GHG savings going forward. In conjunction with implementing RNP AR approaches, NAV CANADA conducted reviews of the airspace surrounding Regina, Saskatoon, Quebec City, Deer Lake and Brandon Airports, identifying and modernising standard departure and arrival procedures, with a focus on PBN. Improvements and efficiencies that benefitted NAV CANADA and customers were identified, and were implemented concurrently with the publication of RNP AR projects.	0
	Transport Canada, NAV CANADA and other key stakeholders (including customers, airport authorities, noise consultation, procedure design and operational Air Traffic Control) continue to work through a collaborative process to make the necessary regulatory and procedural changes to take even greater advantage of these approaches. The work underway includes new approvals and separation standards, which are required to allow the use of these types of procedures in a close parallel runway environment, such as at Vancouver International Airport.	
	N PROGRESS BEHIND SCHEDULE	

STATUS

MEASURE	RESULTS	STATUS
• Enable international navigation improvements through work at ICAO and through initiatives such as Aireon LLC's plan to provide global surveillance capabilities through the deployment of space-based ADS-B, anticipated for 2018.	Research, testing and deployment of space-based ADS-B through the Aireon initiative continued through 2017. Aireon launched and deployed four successful ADS-B payloads on Iridium Next satellites during 2017, and deployment will continue through 2018.	0
• Report annually on achievable fuel savings and emission reductions from joint efforts with domestic and international carriers operating in Canadian airspace and industry partners through the annual Corporate Social Responsibility Report (formally the Collaborative Initiatives for Emission Reductions (CIFER) report).	NAV CANADA's Corporate Social Responsibility Reports are available on the NAV CANADA website.	0
In addition, Transport Canada will continue to issue or update advisory circulars to provide guidance or approve new procedures or specifications, such as those related to RNP and ADS-B. While ADS-B is not being mandated in the near term, consideration could be given to airspace or route mandates for a geographic area or operational time period should equipage rates be insufficient to enable full system surveillance benefits.	In 2017, Transport Canada issues an advisory circular (AC 700-041 Required Communications Performance 240 and Required Surveillance Performance 180) for the North Atlantic. The advisory circular was also updated in 2018. Transport Canada's PBN State Plan outlines the actions that have and will be undertaken to develop and implement policy to ensure smooth transition to ADS-B and monitor future changes in the technology in Canada.	0
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Reporting on Section 6.0 Measures

Section 6.0 of Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation identifies additional GHG emission reduction measures and describes the progress made on activities essential to achieving long-term results.

Summary Table of Section 6.0 Measures





MEASURE	RESULTS	STATUS
National Research Council of Canada (NRC)	With financial support from the Government of Canada's Clean Transportation Initiatives, the NRC has:	0
	• Led the development of fuel composition correction models for nvPM regulatory standard development for civil aviation aircraft engine emissions, on the ICAO emissions working group.	
	 Contributed significantly to an improved assessment of the uncertainties associated with the measurement of nvPM mass and number emissions. 	
	 Contributed to the development and documentation of a system loss methodology for the sampling and measurement of nvPM mass and number emissions from aircraft engines. 	
	 Continued to support OEMs with their certification efforts with respect to their nvPM emissions data. 	
	 Continued to work with Transport Canada, Environment and Climate Change Canada (ECCC) and the US FAA to develop capabilities to conduct the required testing to transition to unleaded aviation gasoline; 	
	 Completed instrumentation of the NRC Harvard research aircraft as part of 10 aircraft test fleet to support US PAFI (Piston Aviation Fuel Initiative) Phase II testing of two experimental unleaded aviation gasoline formulations; 	
	 Conducted extensive phase II flight testing of experimental fuel in flight on the Harvard test aircraft in support of the FAA PAFI program; 	
	 Prepared the Testbed for Aviation Piston Engine Research (TAPER) for the next phase of simulated altitude testing of the experimental unleaded aviation gasoline formulations; and 	
	• Conducted in-flight emissions testing of biojet fuel using NRC Falcon and T-33 aircraft. Purpose of research was to measure actual in-flight emissions (gaseous and particulate matter) at cruise conditions to determine potential impacts of fuel chemical composition on contrail formation.	
	The NRC, with financial support from the Department of National Defence, ECCC and Transport Canada is also conducting research under the ASCENT National Jet Fuel Combustion Program. The prime goal of the program is to accelerate the approval of new alternative jet fuels.	
US Transportation Research Board's Airport Cooperative Research Program (ACRP)	Transport Canada and the Canadian Airports Council continue to support and participate in ACRP and share relevant information with Canadian airports.	0
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6.2 Alternative Fuels

RESULTS

The Government of Canada and the Canadian aviation industry will continue to work collaboratively to advance efforts related to alternative aviation fuel production and use in Canada and will take advantage of opportunities to collaborate with key trading partners.

GARDN has funded five projects on bio-derived jet fuel applications for Canada, two under GARDN I and three under GARDN II (described below):

- WG-22 project: Civil Aviation Alternate Fuel Contrail and Emission Research (CAAFCER). The objective of this project is to enhance the T33 emissions instrumentation by the addition of a CPC3776 ultra-fine aerosol sensor and denuder to differentiate between volatile and non-volatile particulates and then undertake jet emissions and contrail measurement flights. It was found that both the contrail ice particle number and particle emissions reduced in proportion to the percentage of HEFA used in the biofuel blend. The NRC Laboratory Technical Report was drafted and vetted within the NRC, for public release in 2018.
- NEC-21 project: Assessment of likely technology maturation pathways used to produce biojet from forest residues. The objective of this project is to advance the development and production of biojet fuels in Canada from sustainable biomass feedstock by assessing the technical challenges relating to upgrading of bio-oils into finished fuels. The project assesses the upgrading part of the bio-oils supply chain by determining the feasibility of making biojet fuel using one thermochemical technology pathway from pine wood resources. A secondary direct objective is to further detail the body of knowledge regarding the complete supply chain from woody biomass collection through to use of upgraded bio-oils in a refinery setting.
- WG-21 project: Canada's Biojet Supply Chain Initiative (CBSCI): The primary objective of the project is to demonstrate the operational feasibility of biojet fuels in the domestic jet fuel supply system using existing delivery infrastructure to directly support carbon neutral growth of the Canadian aviation sector beyond 2020. The project also aims to validate the Canadian biojet supply chain elements (e.g. quantitative feedstock availability, sustainability certification, biojet integration in the jet fuel supply system, quantify regulatory/fiscal options) to enable a feasibility assessment for private sector investment in commercial scale biojet production in Canada. The project is currently assessing its learnings from hands-on experience in the one-time delivery of blended biojet fuel from California's AltAir Fuels facility to Toronto Pearson International Airport's commingled fuel infrastructure. Biojet handling and integration with existing airport fueling infrastructure will help to develop best practices in Canada.

Transport Canada maintains a dialogue with the US FAA to exchange information on biofuels development.

COMPLETE

IN PROGRESS

BEHIND SCHEDULE



RESULTS

The Government of Canada and the Canadian aviation industry will continue to support research, development and demonstration of alternative fuels for aviation through initiatives such as the ICAO Committee on Aviation and Environmental Protection (CAEP) Alternative Fuels Task Force, Sustainable **Development Technology** Canada (SDTC), ASCENT and the Commercial Aviation Alternative Fuels Initiative (CAAFI).

The Canadian aviation

Since 2010, SDTC has provided over \$12 million to two ongoing alternative aviation fuel projects that are in the demonstration phase:

- \$3.3 million to Agrisoma Biosciences Inc. for a Brassica carinata-based biofuel project; and
- \$9.6 million to MARA Renewables Corporation for an algae-based biofuel project.
- In 2017, there were no new alternative jet fuel projects funded under the SDTC.

In 2017, Transport Canada actively supported:

- The ICAO Alternative Fuels Tasks Force with Canadian experts, including two from the University of Toronto with specific expertise in biofuel lifecycle assessment;
- The ICAO Global Market-based Measures Task Force alternative fuels subgroup; and
- The US FAA through ASCENT Center of Excellence and collaborated with NASA on alternative aviation fuel research.

Transport Canada continues to liaise with other government departments through the ad-hoc aviation biofuels group to both share information on biojet development and discuss government-wide views on issues of common interest.

6.3 Airport Ground Operations and Infrastructure Use

Several emission reduction initiatives are advancing at Canadian airports. Examples include:

industry will collaborate • In 2017, six gates at Vancouver International Airport (YVR) were upgraded with preto reduce emissions at the conditioned air (PCA) units, which maintain the temperature and air quality of parked gate and on the ground aircraft by bringing external, filtered air into the cabin. With three additional gates from taxi operations, equipped, 84 percent of YVR's gates now have both PCA and ground power units auxiliary power units (GPU), up from 42 percent in 2012. YVR continues to actively work on electrical charging and ground support infrastructure to reach a 50 percent goal of ground handling fleet running on electric equipment. power by 2020. In 2017, 37 percent of the licensed Ground Support Equipment (GSE) operator fleet and 51 percent of baggage support equipment were electric. There are 38 common-use charging stalls to support the electrification goal. In 2017, YVR launched a passenger bussing initiative, transferring passengers from its international terminal. This was supported by the first fully electric COBUS in North America. • To alleviate vehicle traffic congestion and reduce GHG emissions at Montreal's Pierre Elliott Trudeau International Airport (YUL), a free CellParc waiting lot for passenger dropoffs and pickups has been introduced. A shuttle service serves the CellParc and terminal. In 2017, Toronto Pearson International Airport (YYZ) installed a total of 32 electric vehicle charging stations across the airport. Of those, 10 level two charging stations were installed in both Terminal 1 and Terminal 3 parking garages while five level three and two level two charging stations were installed at the Administration building and another five level three charging stations were installed at the cell phone parking lot.

COMPLETE

IN PROGRESS

BEHIND SCHEDULE

STATUS

MEASURE	RESULTS	STATUS
	 Greater Moncton Romeo LeBlanc International Airport (YQM) has implemented a Carbon Management Plan, which includes: 	0
	• carbon reduction initiatives to continually reduce emissions from the airport	
	 monitoring fuel and energy consumption 	
	 awareness and training programme for staff 	
	 control measures in place to minimise emissions 	
	 internal auditing programme 	
	In addition, carbon reduction initiatives currently underway include an LED retrofit of lighting in the Terminal Building, and a voltage optimisation project to reduce energy consumption of key equipment.	
	• Quebec City Airport has implemented a Carbon Management Plan and produced its first Sustainable Development Report in accordance with the Global Reporting Initiative. In addition, twelve measures concerning the reduction of energy consumption (e.g. heating, air conditioning, etc.) have been implemented in their new terminal, resulting in a significant reduction of CO_2 emissions in 2017.	
	Multilateration systems make it possible to see all airport ground movement. Initially adopted for safety reasons, these systems can promote efficiencies and reduce emissions. Such systems were introduced in Montreal in 2012, in Toronto in 2013, Calgary in 2014, and will be operational in Vancouver in 2019.	
	The ability to monitor taxi times helps manage and reduce aircraft operating times and emissions. A cost-sharing agreement between NAV CANADA and the Toronto Airport uses a program called EXCDS to produce taxi times. Toronto, Montreal and Calgary Airports have the capability to use EXCDS to develop average baselines for taxi times.	
	The Greater Toronto Airports Authority Air Traffic Management Working Group has extended the Airline/NAV CANADA working partnership to aircraft movements from gate- to-gate. This has improved performance and reduced emissions by balancing and improving runway use, and arrival and departure flows (holding and taxi times). In 2016, the Visual Departure Separation, which allows for the reduction of the minimum separation standard of three miles, was implemented. Results have shown an estimated benefit of one additional flight per hour, when utilized in the north-south operation. The process continues on a full- time basis whenever appropriate conditions allow.	
Partners will work together to improve the quantification of GHG emissions associated with ground operations.	 In 2017, the Airport Ground Operations Subgroup, made up of industry and government representatives, reviewed and updated its workplan, which includes the following objectives: To explore GHG emission reduction opportunities from airport ground operations and quantify the impacts from these opportunities where possible; and To establish a forum for research, information sharing, and discussion of emerging initiatives involving the reduction of GHG emissions within Canada's airport 	0
COMPLETE	ground operations. IN PROGRESS BEHIND SCHEDULE	

MEASURE	RESULTS	STATUS
Canadian airports will refine and improve emissions inventories and will explore further opportunities for emissions reduction strategies.	 There are 10 Canadian airports participating in the Airport Carbon Accreditation (ACA) program under Airports Council International (ACI). Within this program, there are four levels of certification: Mapping – footprint measurement; Reduction – carbon management towards a reduced carbon footprint; Optimization – third party engagement in carbon footprint reduction; and Neutrality – carbon neutrality for direct emissions by offsetting. Canadian airports have achieved the following levels of certification: Level I: Edmonton, Halifax, Victoria and Winnipeg Level II: Moncton (2018), Ottawa (2018), Halifax (2018) and Quebec City (2018) Level III: Montreal, Toronto and Vancouver (2018) Participation in the ACA program is voluntary and is a step that a subset of Canadian airports have chosen to take to demonstrate their commitment to reducing emissions. However, it should be noted that a number of airports who are not participating in this program have also made strong commitments to reducing emissions through their environment programs. 	0
6.4 Regulatory Measure	es	
Transport Canada will continue to participate at CAEP on the finalization of the new CO ₂ emissions standard for airplanes.	The new international CO ₂ standard certification requirement and regulatory level were adopted at ICAO Council in 2017. ICAO published the new Annex 16 Volume III – Aeroplane CO ₂ Emissions in July 2017. With the publication of this First Edition, the CO ₂ standard development has been completed.	0
Transport Canada will continue to help develop a new nvPM standard for aircraft engines, through CAEP, with Phase II targeted for 2019.	Canada continues to make significant contributions in the development of the new nvPM international standard. Phase I, the new international mass standard, was adopted by ICAO Council in early 2017. The new international mass and number standard (Phase II) has a tight schedule, but is still scheduled for completion by 2019.	0
Once completed and adopted by ICAO, Transport Canada will adopt both standards domestically under the <i>Aeronautics Act</i> . Transport Canada will also incorporate CORSIA into the <i>Aeronautics Act</i> for Canadian operators operating internationally.	The notice for proposed amendment for Phase I of the nvPM standard has been prepared and will be published in 2018. The CO ₂ standard requires an enabling regulation in the <i>Aeronautics Act</i> for the new Annex 16 Volume III. Work is underway on the amendment to the regulations. The drafting process for CORSIA will be completed in 2018.	0
COMPLETE	IN PROGRESS DEHIND SCHEDULE	

6.5 International Coordination

RESULTS

Transport Canada will continue to actively participate, through ICAO, on the development and implementation of global approaches and standards to address climate change, including system efficiencies and market-based measures and the development of alternative fuels for aviation. Transport Canada will continue to engage the Canadian aviation industry as part of the international dialogue.	Canada supports CAEP's working groups and task forces with technical experts and provides significant leadership in a number of key areas. Canada continues to actively participate in CAEP to develop the nvPM mass and number standard for aircraft engines, as well as the technical requirements for CORSIA. Canada is also a member of the Advisory Group to Council on CORSIA that will provide guidance during the development of the scheme. On June 27, 2018, ICAO Council adopted the Standards and Recommended Practices (SARP) for CORSIA. The SARPs include the majority of the rules underpinning the system and their adoption is a key step in the process. Future decisions are still needed on the detailed requirements for emission units and sustainable aviation fuels. Canada resumed its leadership role of ICAO Working Group 2 which deals with airports and operations. Several of the work items of this group deal with minimizing emissions that affect the global climate and local air quality.	0
NAV CANADA will continue to support the air navigation interests of Canadian aviation stakeholders internationally through representation in ICAO groups and panels.	 Transport Canada and NAV CANADA are supporting efforts under ICAO's Global Air Navigation Plan and Aviation System Block Upgrades, as well as NAV CANADA's PBN Operations Plan, through planned upgrades on: Communications; Navigation; Surveillance; and Air traffic management. These upgrades maximize the benefits for operators of aircraft that are best equipped to take advantage of the PBN procedures, while recognizing the needs for airspace access to operators not eligible for these procedures. 	0
As a member of the International Coordinating Council of Aerospace Industries Associations (ICCAIA), the Aerospace Industries Association of Canada (AIAC) will continue to lead Canadian aerospace manufacturers in working with international partners to develop and produce aircraft and engines that meet or exceed ICAO requirements for fuel efficiency and emissions.	AIAC member companies continue to provide subject matter experts to advise CAEP; and AIAC provides the link to the international community through its membership in ICCAIA. The President and CEO of AIAC also plays a key leadership role by chairing and facilitating the work of GARDN.	0
COMPLETE	IN PROGRESS O BEHIND SCHEDULE	





Summary of Results

Aviation activity and associated fuel use data for 2017 provided by members of ATAC and NACC, demonstrate continued progress towards the Action Plan's fuel efficiency target and aspirational goal.

Since 2010, the demand for aviation services has continued to grow. Combined revenue passenger and cargo operations increased by 12.1 percent in 2017, compared with 2016. Canadian air carriers used 8.14 billion litres of fuel, a 7.7 percent increase compared with 2016. Consequently, total GHG emissions also increased by 7.7 percent to 21.01 Mt in 2017.

In 2017, the overall rate of fuel efficiency (i.e. litres per RTK) improved by 2.8 percent, compared with 2016. The combined domestic and international fuel efficiency rate reported for 2017 was 33.31 litres per 100 RTK (combining both passenger and cargo traffic). This translates to an annual average fuel efficiency improvement of 1.87 percent per year between 2008 and 2017, and a cumulative improvement of 15.6 percent.

In relation to the aspirational goal, Canadian air carriers improved their fuel efficiency by 1.60 percent with a cumulative improvement of 17.6 percent from 2005–2017.

Look Ahead 2018

This section provides a snapshot of advancements being made under measures of the Action Plan in 2018. More detail will be provided in the 2018 Annual Report, which is scheduled to be released in fall 2019.

Fleet Renewals

Updates on NACC and ATAC carrier fleet renewal plans

- Air Canada and WestJet will continue to take delivery of 14 and seven new Boeing 737 Max 8 aircraft, respectively. Air Canada will also take delivery of five Boeing 787-9 aircraft.
- Porter Airlines will operationalize three new Bombardier Q400 regional aircraft to their fleet bringing their total of Q400 operated to 29.
- Sunwing will add two Boeing 737 MAX 8 aircraft to its fleet.

Air Traffic Management

Updates on the NAV CANADA PBN projects

- RNP AR and PBN airspace project work to be commenced in 2018 at Thunder Bay, Québec City, Hamilton, Kitchener/Waterloo and London Airports.
- Plans to implement the new Established on RNP AR separation standards projected to be incorporated into ICAO PANS ATM in November 2018.

Research and Development – Alternative Fuels

As part of Canada's Biojet Supply Chain Initiative (CBSCI), 230,000 litres of biojet-blended fuel was introduced into the Toronto Pearson International Airport's fuel system. The successful blending indicates the feasibility of the current fuel system to accept biojet which could reduce the biojet cost.

In August 2018, the Government of Canada announced the launch of the Sky's the Limit Challenge. This challenge consists of two competitions with significant prize money to develop innovative sustainable aviation fuel solutions and also produce enough made-in-Canada biojet to fuel a cross-Canadian commercial flight. The prize winners will be announced by the end of March 2021. Partners in the initiative include Air Canada, WestJet and GARDN.

Airport Ground Equipment and Certifications

Vancouver International Airport is installing six more PCA units resulting in 95 percent of bridged gates having PCA by the end of 2018. They will also continue to expand bussing operation capacity in the Transborder and International terminals; these operations will be supported by seven additional electric buses, bringing the fleet total to eight.

Moncton, Ottawa, Halifax and Quebec City airports have or will achieve Level II and Vancouver airport will achieve Level III certification through the ACA program.

Domestic and International Coordination

In 2018, Transport Canada will finalize the drafting for CORSIA and will work with Canadian operators operating internationally to complete their emission monitoring plans ahead of its start on January 1, 2019.





Appendix A: Progress Towards Canada's 2 Percent Aspirational Goal

In addition to reporting against the industry-accepted ATAG target of 1.5 percent annual average fuel efficiency until 2020 from a 2008 baseline, Canada continues to pursue and report against the 2012 aspirational goal to improve fuel efficiency by a 2 percent annual average until 2020, from a 2005 baseline of 40.43 L/100 RTK.

Table 4 provides the combined ATAC and NACC results for measuring progress towards the aspirational goal between 2005 and 2017.

TABLE 4: Absolute and Proportional Changes Over Time, 2005–2017

	CHANGE 2005–2017		
	ABSOLUTE	PROPORTIONAL	ANNUAL RATE
Fuel use (million litres)	3,250	65.5%	4.3%
GHG emissions (megatonnes of CO ₂ e)	8.39	65.5%	4.3%
Traffic (billions)			
Revenue passenger-kilometres (RPK)	106.8	101.5%	6.0%
Passenger revenue-tonne-kilometres (pass. RTK)	10.7	101.5%	6.0%
Cargo revenue-tonne-kilometres (cargo RTK)	1.7	105.8%	6.2%
Total revenue-tonne-kilometres (RTK)	12.3	102.1%	6.0%
Fuel consumption rates*			
Litres/RPK	-0.008	-17.4%	-1.58%
Litres/Total RTK	-0.061	-17.6%	-1.60%
Emission rates			
CO2e grams/RPK	-21.0	-17.4%	-1.58%
CO ₂ e grams/Total RTK	-185.7	-17.6%	-1.60%

* Note that fuel consumption rates are calculated using the Compound Annual Growth Rate (CAGR) formula. For more information, refer to Appendix C.

The figures presented in Table 4 allow for the following summary of trends between 2005 and 2017:

- Fuel consumption and GHG emissions rose by 65.5 percent, an average of 4.3 percent per year;
- RPK grew by 101.5 percent;
- Total reported RTK increased by 102.1 percent; and
- The cumulative improvement in fuel efficiency (litres/RTK) was 17.6 percent, or an annual average of 1.60 percent.

Figure 4 shows the goal trajectory of the 2 percent aspirational goal and the fuel efficiency improvements made between 2005 and 2017. It also shows an indicative trajectory that would be required to meet the 2020 aspirational goal, given the actual 2017 results.



FIGURE 4: Aspirational Goal Trajectory, 2005–2020



Appendix B: Glossary of Key Terms and Acronyms

Key Aviation Activity Measurements:

Revenue Passenger-Kilometres (RPK): is a measure of traffic showing revenue-paying passengers carried, multiplied by distance flown.

Passenger Revenue Tonne-Kilometres (Passenger RTK): is the total tonnes of revenue-paying passengers carried, estimated by converting RPK into weight using the industry's convention of 100 kg (220 lbs) per passenger, multiplied by distance flown.

Acronyms

ACA: Airport Carbon Accreditation **ACRP:** Airport Cooperative Research Program **ADS-B:** Automatic Dependent Surveillance-Broadcast AIAC: Aerospace Industries Association of Canada **ASCENT:** Aviation Sustainability Center **ATAC:** Air Transport Association of Canada ATAG: Air Transport Action Group ATM: Air Traffic Management **CAAFCER:** Civil Aviation Alternative Fuel Contrail and Emissions Research **CAEP:** Committee on Aviation and **Environmental Protection CBAA:** Canadian Business Aviation Association **CBSCI:** Canadian Biojet Supply Chain Initiative **CIFER:** Collaborative Initiatives for Emission Reductions **CORSIA:** Carbon Offsetting and Reduction Scheme for International Aviation CO2: Carbon Dioxide CO2e: Carbon Dioxide Equivalent ECCC: Environment and Climate Change Canada FAA: Federal Aviation Administration

Cargo Revenue Tonne-Kilometres (Cargo RTK): is the total tonnes of revenue-generating cargo (freight and mail) multiplied by distance flown (reflects actual cargo carried).

Total Revenue Tonne-Kilometres (Total RTK): is the total tonnes of passengers, freight, and mail carried (revenue load) multiplied by distance flown.

GARDN: Green Aviation Research & Development Network **GSE:** Ground Support Equipment ICAO: International Civil Aviation Organization ICCAIA: International Coordinating Council of Aerospace Industries Associations Mt: Megatonnes NACC: National Airlines Council of Canada NRC: National Research Council nvPM: Non-volatile Particulate Matter **PAFI:** Piston Aviation Fuel Initiative **PBN:** Performance-based Navigation PCA: Pre-conditioned Air **RNP:** Required Navigation Performance **RNP AR:** RNP Authorization Required **RPM:** Revenue Passenger-Miles **RPK:** Revenue Passenger-Kilometres **RTM:** Revenue Ton-Miles **RTK:** Revenue Tonne-Kilometres **SDTC:** Sustainable Development Technology Canada



Appendix C: Calculations and Caveats

The following factors and formulas were applied in preparation of the aggregated report from ATAC and NACC. Note that industry statistics are still maintained in imperial units, including miles and tons, which are converted to International System (SI) units (kilometres and tonnes) for the present report. The emissions factors for all calendar years are the latest factors from ECCC's National Inventory Report 1990–2016.

Aviation jet fuel emission factors:

2560 grams CO₂ per litre

2582 grams CO₂e per litre

Conversion miles to kilometres:

1 m = 1.609344 km

Conversion tons to tonnes:

1 ton = 0.907185 tonnes

Formula used to calculate annual fuel efficiency:

Compound Annual Growth Rate (CAGR) = (ending value/ beginning value) ^(1/# of years) -1

The fuel efficiency goals are expressed as cumulative annual reductions; therefore, the actual trends are calculated consistently as compound average annual growth rates.

Formulae for CO₂-equivalents:

CO₂e (grams)/RPK = (Fuel Used x 2582) / (RPM x 1.609344)

CO₂e (grams)/Cargo RTK = (Fuel Used x 2582) / (Cargo RTM x 1.609344 x 0.907185)

CO₂e (grams)/Total RTK = (Fuel Used x 2582) / {(RPM x 1.609344 x 0.907185) + (Cargo RTM x 1.609344 x 0.907185)} Reports by ATAC and NACC members have been revised from time to time, notably of activity statistics. The consolidated statistics presented in this report include all the latest figures reported by ATAC and NACC carriers, including all such revisions. It should be noted that the statistics are not entirely comparable between years.

The reported annual emission statistics do not account for 100 percent of Canadian aviation operations, and therefore will not be directly comparable to ECCC's annual National Greenhouse Gas Emissions Inventory. Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation, and therefore this report, does not cover private aviation, military and other government operations, or foreign carriers' operations in Canada.

There has been some variability in reporting from year to year, particularly from including more carriers. Coverage in 2017 was similar to that of 2016. Adding carriers does not substantially affect the industry-wide ratios and longer-term trends computed for fuel use and emissions per unit of traffic.



Appendix D: List of Signatories and Air Operator Member Companies Reporting

Members of the Working Group on Aviation Emissions, which developed the Action Plan, include:

- Aerospace Industries Association of Canada;
- Air Transport Association of Canada;
- Canadian Airports Council;
- Canadian Business Aviation Association;
- National Airlines Council of Canada;
- NAV CANADA; and
- Transport Canada.

All four members of NACC contributed 2017 data for this annual report,⁴ including:

- Air Canada;⁵
- Air Transat;
- Jazz Aviation LP; and
- WestJet.⁶

The ATAC member carriers who contributed 2017 data for this annual report were:

- Air Georgian;
- Air North;
- Bearskin;
- Canadian North;
- Cargojet;
- Central Mountain Air;
- EVAS Air;
- First Air;
- Flair Airlines;
- Harbour Air;
- KF Aerospace;
- Morningstar;
- Nolinor;
- North Cariboo Air;
- Porter Airlines;
- Sunwing; and
- Transwest.

- 5 Air Canada reporting includes data from Rouge
- 6 WestJet reporting includes data from Encore

⁴ Sky Service reporting was included as part of NACC's submission



9,000 8,137 8,000 7,000 5,554 5,000 4,000 3,000 2,583 2,000 1,000 0 International Domestic Total

FIGURE 5: Fuel Use – International and Domestic, 2017









FIGURE 8: Cargo Revenue Tonne-Kilometres, 2005–2017





FIGURE 9: Total Passenger and Cargo Tonne-Kilometres, 2005–2017







FIGURE 11: Fuel Consumption Rate – Passengers, 2005–2017







FIGURE 13: GHG Emissions – International and Domestic, 2017

FIGURE 14: GHG Emission Rates – International and Domestic, 2017









FIGURE 16: GHG Emission Rate – Combined Passenger and Cargo, 2005–2017





Appendix F: Action Plan Update 2018

Purpose of Review

The Action Plan commits the Canadian aviation sector to report annually on progress towards achieving of the fuel efficiency target. In addition, the Action Plan's Working Group on Aviation Emissions committed to a review of the Action Plan pursuant to section 7.3. This is in line with ICAO guidance which states that updates to the Action Plan should be submitted every three years.

Current Policy Context

In December 2016, in support of ambitious global action to combat climate change agreed to in Paris, federal and provincial governments jointly released the Pan-Canadian Framework (PCF) on Clean Growth and Climate Change. This framework lays out Canada's plan to meet its emissions reduction target and grow the economy. It includes a pan-Canadian approach to pricing carbon pollution, a clean fuel standard and measures to achieve reductions across all sectors of the economy.

Progress to Date

The Canadian aviation industry and the Government of Canada have made GHG emission reduction efforts in the aviation sector for many years, beginning in 2005 with the world's first voluntary agreement to reduce GHG emissions from aviation. These collaborative efforts continue through this Action Plan and will continue going forward.

A comprehensive review of the Action Plan was conducted in 2015. An addendum outlining the findings from the review is included in an appendix within the 2014 Annual Report. Canada has made good progress towards implementing the Action Plan. In 2016, fuel efficiency reported by Canadian air carriers improved by an annual average of 1.73 percent compared to 2008, which represents a cumulative improvement of 13.0 percent from 2008 to 2016. In addition, a number of key activities were advanced under the Action Plan's measures.

In addition to the scheduled review, to ensure continued confidence in the reliability of the annual reporting under the Action Plan, a third-party auditor was commissioned to evaluate the methodology pertaining to the collection, analysis, and production of aggregated data contained in the 2015 Annual Report under Canada's Action Plan to Reduce Greenhouse Gas Emissions from Aviation and to demonstrate the credibility of the data. In carrying out the audit, the auditor concluded that the data are reliable and of good quality and that data collection and aggregation by experienced thirdparty consultants provides year to year consistency and quality assurance.

Elements of the Review

As part of the Action Plan review and in anticipation of a federal approach to carbon pricing, a national clean fuel standard and the international carbon offsetting scheme (CORSIA), Transport Canada hosted a workshop in March 2018 to bring industry and government stakeholders together to share information and explore opportunities to further reduce GHG emissions from Canada's aviation sector.

Given the relatively recent adoption of ATAG's 2020 annual fuel efficiency target, members agreed that a discussion on a potential post-2020 target would be more appropriate for the next review cycle. The Working Group also considered ICAO's request that States include a baseline scenario (without action) and quantify the expected results from individual measures in their action plans. Analysis undertaken as part of the 2015 review of Canada's Action Plan suggested that developing a baseline scenario would be too speculative and that estimating efficiency gains from any one measure in isolation from other measures could be difficult and misleading. Experience has demonstrated that it is not possible to accurately apportion fuel efficiency gains to any one measure, as they are interconnected initiatives working together. To do so would result in a significant risk of double-counting. Therefore, the Working Group agreed to maintain its position to not develop a baseline scenario and estimate the impacts associated with each measure.

Canada's Continuing Commitment

Parties to the Action Plan will continue to work towards the 1.5 percent target and continue to pursue and report against the 2 percent aspirational goal while advancing key measures outlined in the Action Plan. The Working Group will also serve a more strategic function by sharing information amongst parties and bringing key issues to the table for discussion. Furthermore, work will continue to be advanced on the following areas of focus:

- Air Traffic Management (includes PBN and Surveillance);
- Airport Ground Operations (includes Auxiliary Power Units / Ground Support Equipment and Taxi Operations); and
- Alternative Fuels.

Through these efforts, Canada will continue to improve the efficiency of its aviation sector as well as contribute to airspace initiatives enabling fuel savings opportunities that benefit domestic and international carriers operating in Canadian airspace.

The next review of the Action Plan is planned for 2021, which will be released with the 2020 Annual Report.



