

**2009 Canadian Aviation Industry Report on Emissions
Reductions**

October 2010

Foreword

This is the fourth annual report prepared under the Voluntary Memorandum of Understanding (MOU) on the Reduction of Aviation Greenhouse Gas Emissions, signed in June 2005 between Transport Canada and the Air Transport Association of Canada (ATAC).¹

Under the Terms and Conditions of the MOU, ATAC prepared and published annual reports for the first two calendar years, 2006 and 2007.^{2,3} Subsequently, in 2008, the four largest passenger air carriers – Air Canada, Air Transat, Jazz Air LP, and WestJet – elected to leave ATAC, and formed a new trade association, the National Airlines Council of Canada (NACC).

While no longer covered by the MOU, those carriers affirmed their continuing support of the agreement and its goals, and assumed their responsibilities as set out in the agreement. For calendar year 2008, NACC prepared a report containing aggregated data for its 4 member carriers,⁴ and ATAC provided a report on the activities in 2008 of six remaining member carriers.

A Consolidated Report for the two associations was then prepared and published by Transport Canada.⁵ For the current volume, the same procedures have been followed by the two associations to report on activities in calendar year 2009.

Executive Summary

The purpose of this Report is to outline the efforts and achievements of Canadian aviation industry in greenhouse gas emissions reductions during 2009 under the voluntary Memorandum of Understanding established between the Air Transport Association of Canada and Transport Canada in 2005. That agreement's quantitative goal is to reduce the industry's greenhouse gas emissions rate per unit of output (e.g. per revenue tonne-kilometre) by an average of 1.1 percent per year, with a cumulative reduction goal of 24 percent in 2012, compared to the 1990 baseline.

Information on activities during calendar year 2009, including relevant statistics describing operations and fuel use, have been reported by both ATAC and NACC, and consolidated in the present report.

Highlights of the report's findings are as follows:

- The worldwide downturn in economic activity resulted in reductions in 2009 in Canadian passenger and cargo traffic for the first year since 2001. Passenger traffic declined by 6.3 percent from 2008, to 118 billion revenue-passenger-km (RPK), while reported cargo traffic declined by 16 percent from 2008, to 1.21 billion revenue-tonne-km.
- Total fuel consumption by the reporting air carriers in 2009 was 5.015 billion litres, a reduction of 8.8 percent from the 5.5 billion litres reported for 2008. Total GHG emissions in 2009 were 13.07 Mt of CO₂-equivalent, also an 8.8 percent reduction from the 14.34 Mt reported in 2008.
- The fuel consumption rate reported for 2009 was 0.39 litres per revenue-tonne-km (RTK), combining both passenger and cargo traffic, and the emissions rate 1,008 grams CO₂e per RTK. Both rates were 1.6 percent below those reported for 2008.
- The annual average fuel efficiency improvement in litres per total RTK (combining passenger and cargo operations) was 1.9 percent between 1990 and 2009, surpassing the MOU-established target of 1.1 percent per year.
- Combined passenger and cargo RTK grew by 55 percent between 1990 and 2009. The total fuel consumption rose by only 8.6 percent during the same period. Fuel intensity per RTK fell by 30 percent over the entire period, surpassing the long-term objective of the MOU of a cumulative improvement of 24 percent between 1990 and 2012.

1. Background

Aviation emissions goals of ICAO and IATA

Under the Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC), domestic aviation greenhouse gas (GHG) emissions are included in the assigned amounts for which member countries have quantified targets. Emissions from international aviation are excluded from those targets, but reported separately in national emission inventories. Article 2 of the Protocol declared that countries would work through the International Civil Aviation Organisation (ICAO) to pursue limitation or reduction of emissions from international aviation fuels.⁶ In addition, the Subsidiary Body for Scientific and Technological Advice was asked to consider means by which emissions could be assigned to countries.⁷

ICAO's environmental activities are largely undertaken through the Committee on Aviation Environmental Protection (CAEP). Through CAEP, ICAO issued in 2004 a "Template and Guidance on Voluntary Measures", providing guidance to assist interested countries in establishing voluntary agreements to address emissions.⁸ The guidance material lends support to ICAO's objective of harmonized efforts and underscores the importance of voluntary initiatives in addressing the problem of aviation emissions. The Template proposed that quantified goals be established for emissions reductions, expressed as fuel consumption per unit of aviation activity, suggesting that "the Partnership Goal is a specified percent annual improvement in fuel per revenue tonne-kilometre over a 12-year period from 1998-2010."⁹

In September 2009, the International Air Transport Association (IATA) announced its four-pillar Climate Change Strategy of technology investment, efficient infrastructure, effective operations and positive economic measures.¹⁰ The Strategy also outlined the Association's commitment to three sequential targets:

- 1.5 percent average annual improvements in fuel efficiency to 2020,
- stabilizing emissions with carbon-neutral growth from 2020, and
- 50 percent absolute cut in emissions by 2050 compared to 2005.

In October 2009, ICAO recommended a global aspirational goal for improving fuel efficiency by 2 percent per year up to 2050 from the global aviation sector (carriers, airports, air traffic management service providers and airframe and engine manufacturers).¹¹

Memorandum of Understanding (MOU) - Voluntary Agreement for the Reduction of Greenhouse Gas (GHG) Emissions

On June 29, 2005 ATAC and Transport Canada signed the first voluntary agreement in the world that is based on ICAO's Template. Canada's air service providers became the first air carriers to have reached a voluntary agreement with their government to reduce the growth of GHG emissions, including both domestic and international operations. Under the MOU, ATAC undertakes to encourage its members to improve their fuel

efficiency, with a quantitative goal to:

“reduce collective ATAC member fleet greenhouse gas emissions on a per unit basis (through fuel efficiency improvements, e.g. reduction in litres of fuel/Revenue Tonne Kilometre) by an average of 1.1 percent per annum, reaching a cumulative improvement of 24 percent in 2012 compared to the 1990 base case scenario.”

The MOU also addresses the principles governing the Agreement, the responsibilities of the parties, and provisions for its management and administration. A key provision is that ATAC would obtain the necessary data from its members, and report annually on progress, including statistics illustrating performance relative to the goal.

The association therefore accepted a more ambitious target than the one that ICAO suggested at the time. At the time of the signing of the MOU, the 1.1 percent reduction target was consistent with the approach undertaken by IATA, of which some of the ATAC/NACC carriers are members. The IATA carriers had committed to achieving a fuel efficiency goal of 41.50 litres of fuel per 100 revenue tonne-kilometres by 2012. IATA goals were subsequently extended to 2020 and 2050, as noted above.

The first annual report under the MOU covered calendar year 2006, and was published by ATAC in February 2008. The subsequent report for 2007 was published in 2009. For the annual report covering 2008, ATAC and NACC provided reports on their respective members’ activities which were consolidated and published early in 2010.¹²

Audit of the MOU

As part of the management procedures for the agreement, the MOU also calls for their periodic audits, as follows:

“In order to allow the Parties to have continued confidence in the reliability of the reports, a qualified auditor will be given access, each year or periodically but not more frequently than once a year, to audit the reports, processes and supporting documentation residing with ATAC pertaining to the Agreement. Transport Canada and ATAC will select the appropriate auditor capable of independently verifying the reports. Transport Canada will cover all audit costs.”

The audit was undertaken during 2010. After examining the processes and reporting for the 2008 report, the independent auditor concluded that:

“The data collection, modification, aggregation and normalization processes used by ATAC and NACC meet the requirements of the MOU in all material respects.”

The auditor made some recommendations for improvement, to which ATAC and NACC provided a consolidated Management Response, attached to this report as Annex 1.

2. Reporting of Activity and GHG Emissions

2.1 ATAC Reporting

Data from the ATAC air carriers is reported through the “ATAC GHG Reporting System”, referred to as AGERS.

Annual Data Requested

Each year, ATAC requested the following data from its membership in order to populate the AGERS database:

- Litres of fuel burned;
- Available seat-kilometres or miles (ASK or ASM);
- Available tonne-kilometres or ton-miles (ATK or ATM) (cargo only);
- Revenue passenger-kilometres or -miles (RPK or RPM);
- Revenue tonne-kilometres or ton-miles (RTK or RTM) (cargo only);
- Total available tonne-kilometres or ton-miles (total ATK or total ATM) (total of passengers weight at 220lbs each plus cargo weight);
- Total revenue tonne-kilometres or ton-miles (total RTK or total RTM) (total of passengers weight at 220lbs each plus cargo weight).

AGERS Output

Once data are collected, de-identified and aggregated, the AGERS database produces the following:

- Current and annual air sector GHG total emission summary reports;
- Annual air sector GHG emissions intensity trend reports;
- Individual company emissions reports, on request by company affected;
- Air sector reports using aggregate data.

AGERS Units

The measurement units used by AGERS are industry-wide recognized and accepted, including:

- Litres of fuels/available tonne-kilometre (and ton-mile);
- Litres of fuel/revenue tonne-kilometre (and ton-mile);
- Litres of fuel/available seat-kilometre (and mile);
- Litres of fuel/revenue seat-kilometre (and mile);
- Greenhouse gas emissions in megatonnes CO₂-equivalent (abbreviated to CO₂e), combining emissions of Carbon Dioxide (CO₂), Methane (CH₄) and Nitrous Oxide (N₂O) weighted by their radiative-forcing coefficients;
- grams CO₂e/passenger-kilometre;
- grams CO₂e/tonne-kilometre.

Industry Participation

The information contained in the AGERS database relates to aircraft fuel use and does not include fuel used in ground equipment and facilities. It includes domestic, transborder and international operations.

The ATAC member carriers who contributed data to the AGERS database in 2009 were:

- Air North
- First Air
- Sunwing.

It must be noted that the number of reporting carriers is fewer than in previous years. The bankruptcy of the passenger charter carrier Skyservice Airlines in the spring of 2010 unfortunately means that the company's records for 2009 are inaccessible. In addition, reports were unavailable for 2009 from the Canadian North Airlines and the cargo airline Morningstar Air Express, both of which were included in the ATAC annual reports for 2007 and 2008. These changes in reporting mean that the ATAC totals for passenger and (particularly) cargo activities are understated compared to those prior two years. For the purpose of establishing accurate long-term trends for the industry, 2008 levels of activity were assumed for the airlines that were not able to submit data for 2009. The combined totals for both associations are dominated by those of NACC members, so the effect of the ATAC understatement is only slight. Nevertheless, any interpretation of the annual change in activity from 2008 to 2009 should note the change in reporting, and its unknown effect on the totals.

2.2 NACC Reporting

For the reporting of the statistics under the MOU, NACC adopted the reporting system of one of its member carriers, standardized to fulfill the reporting requirements under the MOU. The use of this system ensured that the other member carriers reported their data in a consistent and standardized manner. NACC contracted an independent third party to collect and maintain all carrier data.

The information has been compiled and reported in a consolidated manner in order to ensure that no carrier can be identified.

The GHG emissions reported in the NACC database pertain to aircraft fuel use and do not include fuel used in ground equipment or facilities. The reporting includes domestic, trans-border and international operations. All the members of NACC, that is, Air Canada, Air Transat, Jazz Air LP, and WestJet, contributed 2009 data.

It should be noted that this report revises data contained in the 2008 report. The revisions were the result of revised cargo available ton-mile (ATM) and cargo revenue ton-mile (RTM) data from one of the carriers for the years 2005 through 2008 inclusive. All of the rates of emissions per tonne-kilometre for those years are consequently slightly modified from those contained in the report for calendar year 2008.

The member carriers of NACC provided the following 2009 statistics:

- Cargo Available ton-miles (ATM)
- Cargo Revenue ton-miles (RTM)
- Available seat-miles (ASM)
- Revenue passenger-miles (RPM)
- Litres of fuel burned per year

Output

NACC aggregated the data provided by members and performed the necessary calculations to provide the following output statistics:

- Cargo Revenue tonne-kilometres (RTK)
- Revenue passenger-kilometres (RPK)
- Total Revenue tonne-kilometres (Total RTK) (100 kg per passenger)
- Litres of fuel burned per year
- Litres per 100 Revenue tonne-kilometres (L/100 RTK)
- Litres per Revenue tonne-kilometre (L/RTK)
- Cargo Available tonne-kilometres (ATK)
- Passenger Available tonne-kilometres (ATK) (100 kg per passenger)
- Total Available tonne-kilometres
- Litres per 100 Available tonne-kilometres (L/100 ATK)
- Tonnes of CO₂e Emissions
- CO₂e emissions per Revenue tonne-kilometre
- CO₂e emissions per Available tonne-kilometre.

2.3 Calculations

The following factors and formulas were applied in Transport Canada's preparation of the consolidated industry Report. Note that industry statistics are customarily maintained in imperial units, including miles and tons, which are converted to International System (SI) units for the present Report. Note also that the emissions factors for all calendar years are the latest factors used by Environment Canada in Canada's National Greenhouse Gas Inventory, since 2007.¹³

Aviation Jet Fuel emission factors:

2534 grams CO₂ per litre
2607 grams CO₂e per litre

Conversion miles to kilometres:

1 m = 1.609344 km

Conversion tons to tonnes:

1 ton = 0.907185 tonnes

Formulae for CO₂-equivalents:

$$\text{CO}_2\text{e (grams)/RPK} = (\text{Fuel Used} \times 2607) / (\text{RPM} \times 1.609344)$$

$$\text{CO}_2\text{e (grams)/Cargo RTK} = (\text{Fuel Used} \times 2607) / (\text{Cargo RTM} \times 1.609344 \times 0.907185)$$

$$\text{CO}_2\text{e (grams)/Total RTK} = (\text{Fuel Used} \times 2607) / \{(\text{RPM} \times 1.609344 \times 0.907185) + (\text{Cargo RTM} \times 1.609344 \times 0.907185)\}$$

3. Results for 2009

The combined results for ATAC and NACC air carriers in 2009 are shown in Table 1, in comparison to each of the years from 2001, and also to 1990. The table includes the same quantities and rates reported in the previous annual reports, though for brevity omits those in imperial units.

The reported annual emission statistics do not account for 100 percent of Canadian aviation operations, and therefore will not be directly comparable to the National Greenhouse Gas Emissions Inventory, issued annually by Environment Canada. The MOU, and therefore this report, does not cover private aviation, military and other government operations. Nor does it cover those carriers (mostly small) which are not members of either ATAC or NACC. Further, the extent of reporting of activities by members of the Associations has varied year to year. ATAC estimated in its previous annual reports that coverage by reporting members was in excess of 97 percent of domestic passenger and cargo traffic in 2001, in excess of 92 percent in 2002, then in excess of 95 percent in each of the years from 2003 to 2007. Since its formation in 2007, NACC has obtained more complete coverage of activities by its members, and has revised reports of cargo statistics back to 2005. There appear to remain inconsistencies between years in reporting by ATAC members, including some notable under-reporting of cargo statistics in 2009.¹⁴ Nevertheless, it is clear that the reports cover most operations, and seems safe to conclude that inclusion of the remainder would not substantially affect the ratios and longer-term trends computed for fuel use and emissions per unit of traffic.

A minor qualification must also be made to the comparisons to 1990: the figures for 1990 in Table 1 are not from the Associations, but are those officially reported by Statistics Canada in its publication entitled '*Aviation in Canada*'¹⁵ (as compiled for this report by Transport Canada), which cover strictly only carriers of Levels I and II (i.e. transporting at least 50,000 passengers or 10,000 tonnes of cargo in the year).

Table 1 demonstrates fuel consumption and its conversion to GHG emissions, expressed in CO₂-equivalent. Table 1 also provides the relevant traffic statistics namely:

- available seat-km (ASK), reflecting seating capacity multiplied by distance flown;

- revenue passenger-km (RPK), showing actual passengers carried multiplied by distance flown. (The ratio between RPK and ASK is the passenger load factor, not shown in the table);
- passenger revenue-tonne-km, estimated by converting RPK into weight using the industry's convention of 220 lbs/100 kg per passenger;
- cargo available tonne-km and revenue-tonne-km, the former reflecting available carrying capacity, while the latter reflects actual cargo carried;
- passenger and cargo measures, combined to provide total available tonne-km and total revenue tonne-km, as overall industry output is measured.

The table also provides the ratios of fuel and GHG emissions to the main traffic measures: litres of fuel and grams of CO₂e per ASK, RPK, total ATK and total RPK.

According to Table 1, in 2009 the reporting carriers used (in slightly rounded figures) 5.02 billion litres of fuel, provided capacity of 153 billion available seat-km and 16.6 billion available cargo tonne-km, and actually served 117.6 billion revenue-passenger-km and 1.2 billion revenue-cargo km. Total combined passenger and cargo capacity was therefore 31.9 billion available tonne-km, and combined service 13 billion revenue-tonne-km.

As demonstrated by Table 2, comparisons to 2008 confirm that in 2009 the industry was affected strongly by the worldwide downturn in economic activity: reported RPK actually declined by 6.3 percent, after consistent annual increases summing to 40 percent between 2002 and 2008. Reported cargo RTK fell even more substantially, by 16 percent compared to 2008 – though that decline appears to include some under-reporting. The average passenger load factor also declined slightly, to an average of 77 percent in 2009 compared to 81.5 percent in 2008.

The objective of the MOU is to encourage member airlines to achieve an average of 1.1 percent per annum fuel efficiency improvement, reaching a cumulative improvement of 24 percent in 2012 compared to the 1990 base case scenario, expressed in reduction in litres of fuel per RTK. Table 2 shows that, between 1990 and 2009, the achieved average annual improvement was 1.9 percent in fuel consumption per RTK.

Fuel consumption reported for 2009 amounted to 0.39 litres per revenue-tonne-km, and emissions amounted to 1,008 grams CO₂e per revenue tonne-km. Those rates were both 1.6 percent below the rates reported for 2008.

Table 1: Annual Results of Operations 2001 to 2009 and comparison with 1990.

	1990	2001	2002	2003	2004	2005	2006	2007	2008	2009
Fuel use (million litres)	4,616	4,760	4,560	4,514	4,496	4,817	5,115	5,471	5,500	5,015
GHG emissions (millions of tonnes of CO ₂ -equivalent)	12.034	12.409	11.889	11.767	11.722	12.557	13.334	14.262	14.340	13.074
Traffic (billions)										
Available seat-kilometres (ASK)	75.22	109.58	117.71	120.01	123.14	131.98	139.48	151.55	154.05	152.66
Revenue passenger-kilometres (RPK)	66.37	86.68	89.08	89.24	95.18	105.22	112.98	124.15	125.55	117.62
Passenger revenue-tonne-kilometres (pass. RTK) *	6.64	8.67	8.91	8.92	9.52	10.52	11.30	12.42	12.55	11.76
Cargo available tonne-kilometres (cargo ATK)	11.12	13.63	13.37	11.85	12.21	15.42	16.02	16.53	16.59	16.61
Cargo revenue-tonne-kilometres (cargo RTK)	1.72	1.71	1.74	1.49	1.54	1.45	1.41	1.69	1.43	1.21
Total available tonne-kilometres (ATK)	18.65	24.59	25.14	23.85	24.52	28.62	29.96	31.69	31.99	31.87
Total revenue-tonne-kilometres (RTK)	8.36	10.38	10.65	10.42	11.06	11.97	12.70	14.11	13.99	12.97
Fuel consumption rates										
Litres/ASK	0.0614	0.0434	0.0387	0.0376	0.0365	0.0365	0.0367	0.0361	0.0357	0.0329
Litres/RPK	0.0695	0.0549	0.0512	0.0506	0.0472	0.0458	0.0453	0.0441	0.0438	0.0426
Litres/Total ATK	0.2475	0.1936	0.1814	0.1892	0.1834	0.1683	0.1707	0.1726	0.1719	0.1574
Litres/Total RTK	0.5523	0.4585	0.4281	0.4333	0.4065	0.4024	0.4026	0.3878	0.3932	0.3867
Emission rates:										
CO ₂ e grams/ASK	159.98	113.24	101.00	98.05	95.19	95.14	95.60	94.10	93.08	85.64
CO ₂ e grams/RPK	181.31	143.16	133.46	131.86	123.15	119.34	118.02	114.87	114.21	111.16
CO ₂ e grams/Total ATK	645	505	473	493	478	439	445	450	448	410
CO ₂ e grams/Total RTK	1,440	1,195	1,116	1,130	1,060	1,049	1,050	1,011	1,025	1,008

*Please note that Passenger RTK are calculated by dividing RPK by 100 kg, which is the industry's conventional assumption of the average weight per passenger, including luggage.

Sources: Transport Canada/Statistics Canada for 1990, ATAC for years 2001-2007, ATAC and NACC for 2008 and 2009. See text for qualifications to comparability among years.

Table 2: Changes 2001-2009 and 1990-2009

	Change 2008-2009	Change 2001-2009	Average annual change 2001-2009	Change 1990-2009	Average annual change 1990-2009
Fuel use (million litres)	-8.8%	5.4%	0.7%	8.6%	0.4%
GHG emissions (millions of tonnes of CO ₂ -equivalent)	-8.8%	5.4%	0.7%	8.6%	0.4%
Traffic (billions)					
Available seat-kilometres (ASK)	-0.9%	39.3%	4.2%	103.0%	3.8%
Revenue passenger-kilometres (RPK)	-6.3%	35.7%	3.9%	77.2%	3.1%
Passenger revenue-tonne-kilometres (pass. RTK)	-6.3%	35.7%	3.9%	77.2%	3.1%
Cargo available tonne-kilometres (cargo ATK)	0.1%	21.8%	2.5%	49.3%	2.1%
Cargo revenue-tonne-kilometres (cargo RTK)	-16.0%	-29.6%	-4.3%	-29.9%	-1.9%
Total available tonne-kilometres (ATK)	-0.4%	29.6%	3.3%	70.9%	2.9%
Total revenue-tonne-kilometres (RTK)	-7.3%	24.9%	2.8%	55.2%	2.3%
Fuel consumption rates					
Litres/ASK	-8.0%	-24.4%	-3.4%	-46.5%	-3.2%
Litres/RPK	-2.7%	-22.4%	-3.1%	-38.7%	-2.5%
Litres/Total ATK	-8.5%	-18.7%	-2.6%	-36.4%	-2.4%
Litres/Total RTK	-1.6%	-15.6%	-2.1%	-30.0%	-1.9%
Emission rates:					
CO ₂ e grams/ASK	-8.0%	-24.4%	-3.4%	-46.5%	-3.2%
CO ₂ e grams/RPK	-2.7%	-22.4%	-3.1%	-38.7%	-2.5%
CO ₂ e grams/Total ATK	-8.5%	-18.7%	-2.6%	-36.4%	-2.4%
CO ₂ e grams/Total RTK	-1.6%	-15.6%	-2.1%	-30.0%	-1.9%

Table 2 and the following graphics illustrate the long-term trends in all of these quantities and ratios, and performance against the MOU target. Based on the information provided by ATAC/NACC, Table 2 demonstrates the cumulative percentage change in each reported value from 2001 to 2009, followed by an annual average percentage change over the same period.

From the above Table 2, as well as from **Figures 1 to 4** (on trends from 2001-2009 in fuel consumption and the main traffic measures) and **Figures 5 to 8** (on main rates of fuel consumption and GHG emissions), the following observations can be drawn:

- The industry has achieved continuous improvements in fuel efficiency and consequent reductions in emissions intensity of aviation operations, exceeding the annual average fuel efficiency improvement goal of 1.1 percent. As illustrated in Figure 1, from 2001 to 2009, fuel use increased 5.4 percent, while capacity rose by 30 percent.
- Fuel and emissions intensity per ATK fell by 18.7 percent over the eight years, equal to an annual average improvement of 2.6 percent per year. Fuel and emissions intensity per RTK is the overall measure that combines all the elements of an air carrier operation, including aircraft fleet, operations, actual demand for services and current economic conditions, as reflected in passenger and cargo load factors, expressed by the RTK. As demonstrated by Figure 5, the fuel consumption rate per RTK was reduced by 15.6 percent from 2001 to 2009, resulting in an average annual improvement of 2.1 percent.

- Over the period from 1990 to 2009, passenger and cargo traffic grew by 71 percent, as expressed by total available tonne-kilometres, while fuel consumption rose by only 8.6 percent. Fuel consumption trends for combined passenger and cargo operations for the period 2001-2009 are illustrated in Figure 6.
- Consequently over that period from 1990 to 2009 fuel use and emissions intensity per ATK fell by 36.4 percent, or an average of 2.4 percent per year, while overall intensity per RTK fell by 30 percent, an average of 1.9 percent per year.
- Clearly those annual and cumulative reductions continue to surpass substantially the MOU goals of 1.1 percent annual reduction and 24 percent cumulative reduction between 1990 and 2012.
- It can also be noted that the fuel consumption rate per RTK in 2009 of 38.67 litres per 100 RTK also surpassed the IATA goal for 2012 of 41.5 litres per 100 RTK.

Figure 1: Fuel use (million litres) 2001-2009

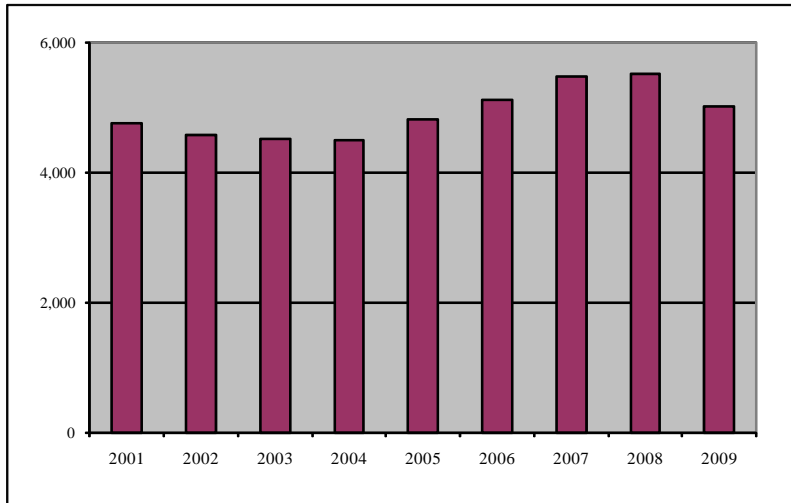


Figure 2: Passenger capacity and service, 2001-2009

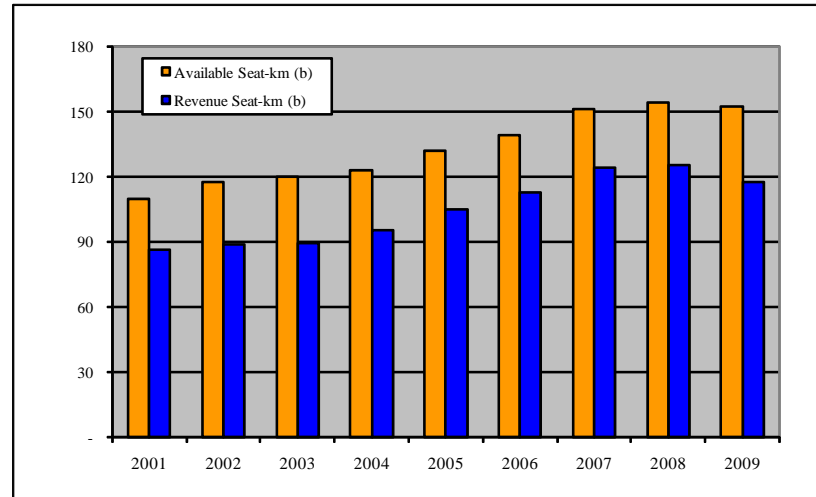


Figure 3: Cargo capacity and service, 2001-2009

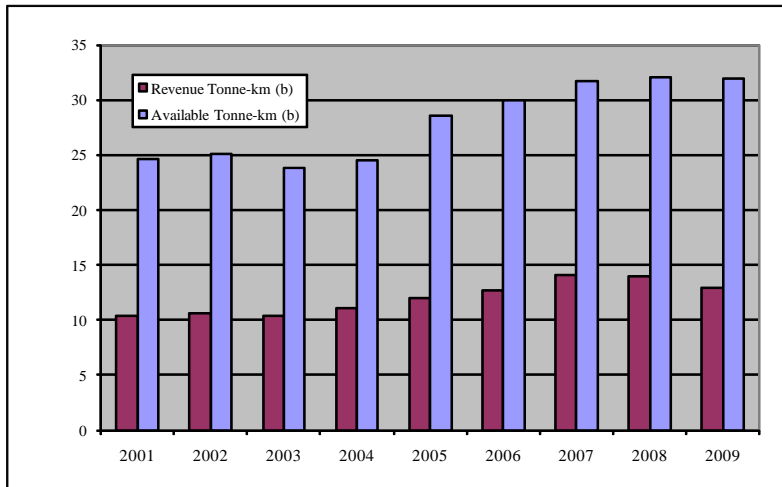


Figure 4: Total passenger plus cargo capacity and service, 2001-2009

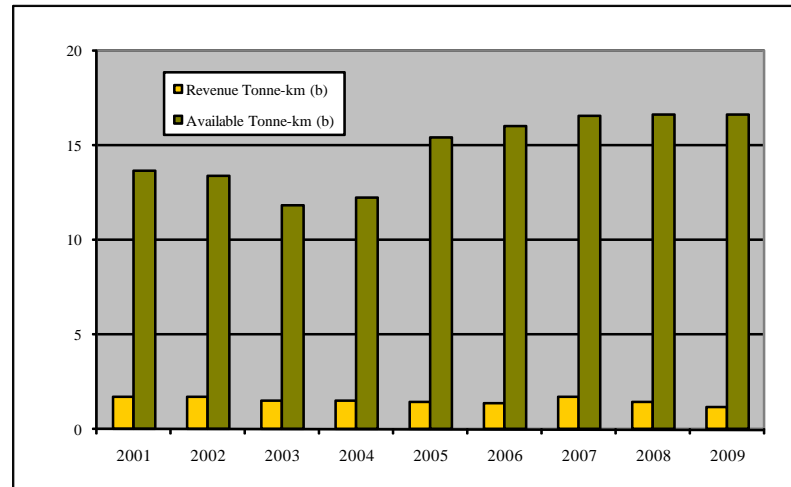


Figure 5: Fuel consumption rates – passengers 2001-2009

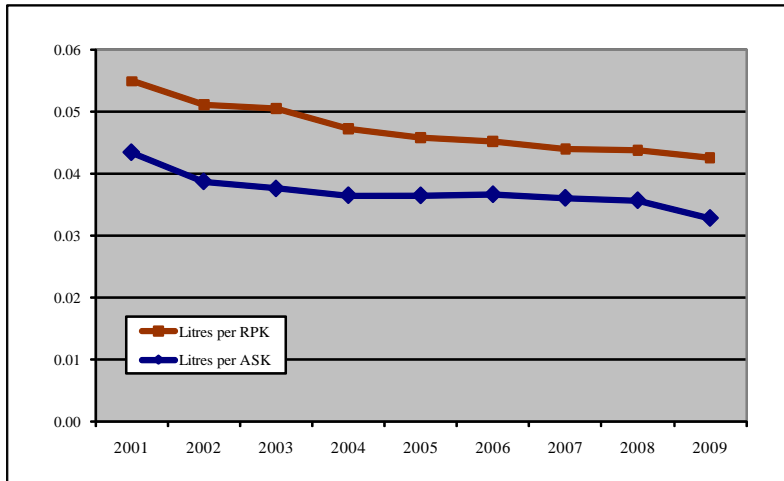


Figure 6: Fuel consumption rates – combined passengers and cargo, 2001-2009

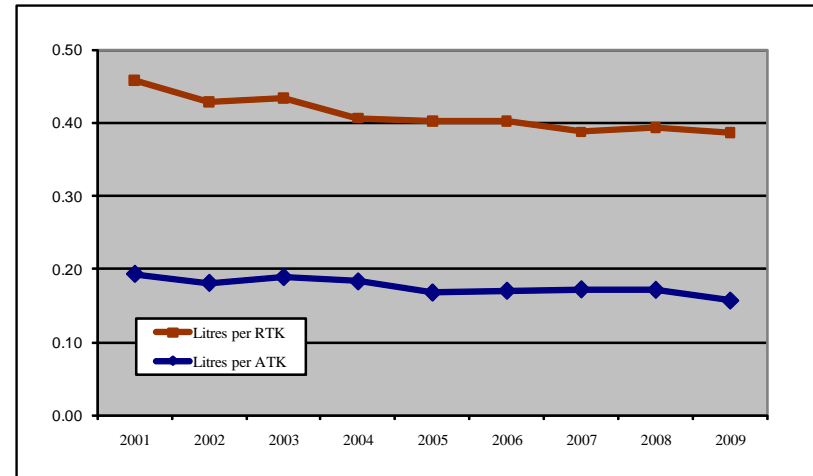


Figure 7: GHG emission rates – passengers 2001-2009

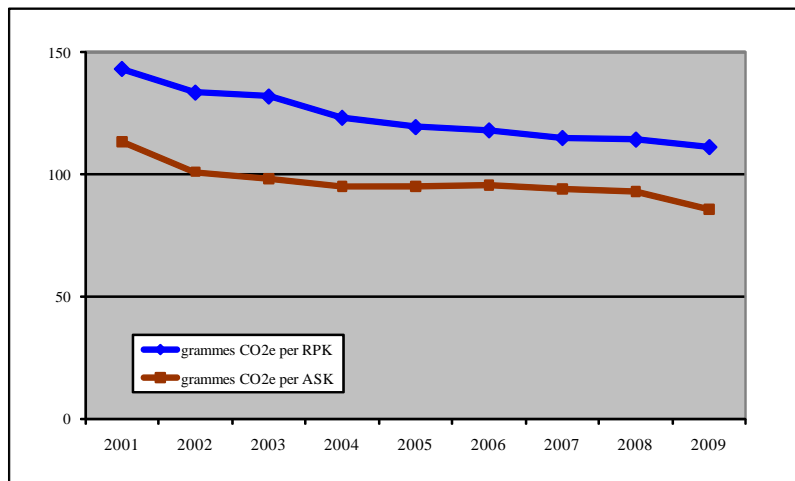
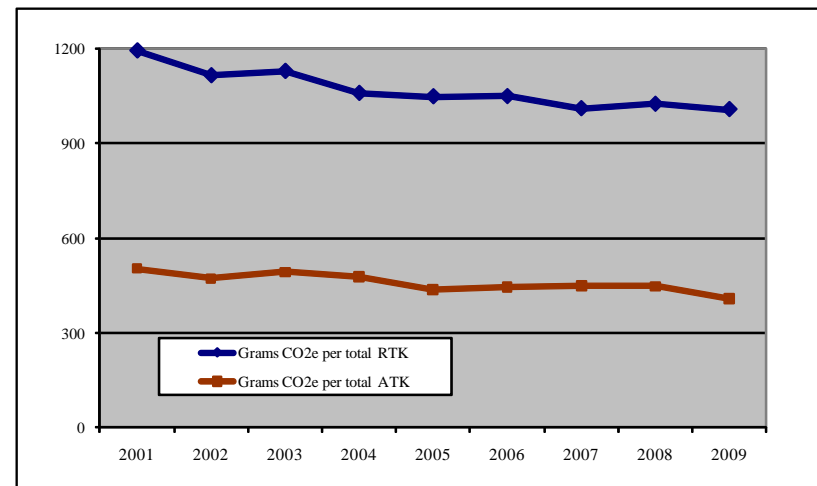


Figure 8: GHG emission rates – combined passengers and cargo, 2001-2009



4. Activities Supporting the MOU

4.1 ATAC Activities

Activities Undertaken by ATAC

In addition to initial development and subsequent maintenance of the AGERS database, ATAC has continuously encouraged its member companies to submit data for AGERS under the auspices of the MOU. This has taken place through regular emails and articles in Flightplan, ATAC's magazine. Presentations have also been given directly to member companies and at the annual Airline Operations Environmental Affairs Committee meeting.

As a result of these efforts, ATAC has been able to capture data covering Canadian domestic passenger and cargo traffic. ATAC continues to promote participation in this system and in the objectives of the MOU to its membership.

ATAC was actively involved and also encouraged its members to participate in ICAO meetings and conferences providing valuable input into discussions of the international emissions reductions initiatives.

Activities Undertaken by ATAC Members

In addition to the data collected in the AGERS system, the MOU sets out an action plan for the reduction of GHGs from the aviation sector. Various methods for improving operational efficiencies and reducing emissions are set out in the MOU and its appendices.

ATAC members have instituted new procedures to limit fuel burn and make their operations more efficient and respectful of the environment.

ATAC members have taken very seriously the goals set out in the voluntary agreement, and have achieved better than projected efficiency improvements.

While it is clear that more work can be done, particularly on the freight side of the industry, ATAC members implemented operational changes, modifications and renewal of aircraft fleets that contributed to a reduction of the amount of fuel consumed and improvements in fuel efficiency in the aviation sector. These changes occurred during a period of increased demand for air services.

4.2 Activities by NACC and its Members

NACC members were asked to provide information on any activities or initiatives in the following areas:

- The Freight Sustainability Demonstration Program (FSDP) and the Freight Efficiency Program (FEP)
- Aircraft modification and maintenance
- Aircraft operating procedures

- Cargo and baggage operations
- In-flight/catering

Activities Undertaken by NACC

NACC and its member carriers are committed to delivering environmentally responsible air travel and working to continually reduce the industry's environmental impact and aggressively curtail its emissions. To demonstrate to Canadians that the NACC airlines are committed to finding cost-effective solutions for better environmental performance, the association has a standing Environment Subcommittee. Through this committee, the member carriers are working towards:

- developing a principled industry position on environmental issues;
- informing governments and the public on significant environmental improvements made by the airlines;
- demonstrating the airline industry's commitment to the environment.

The committee also ensures that its carriers have a forum to jointly address mutually applicable issues. One important issue was the commitment, support and participation of its member airlines with regard to the MOU. NACC made available the resources to facilitate the generation of this report and ensured that all of its members participated in the data gathering. It also ensures the Environmental Subcommittee has engaged in dialogue with Transport Canada and Environment Canada.

In 2009, NACC launched its association web site, which outlines its commitment to reducing its environmental impact. The 2008 MOU report is posted on the web site.

NACC continues to promote to its members' participation in the MOU.

Activities Undertaken by NACC Members

NACC's member companies continue to develop and implement new aircraft operating procedures to limit fuel burn and improve the efficiency of their operations. Because of the collective nature of the reporting, these activities are listed below but are not attributed to specific airlines.

Certain members of NACC are also members of other industry associations such as the International Air Transportation Association (IATA), the Air Transport Association of America (ATA), and the Regional Airline Association (RAA). Participation in the environmental committees of these other industry associations allows respective NACC carriers to keep abreast of environmental issues internationally and in the United States of America. It also allows them to participate in international forums such as those for alternative fuels and in the ICAO Committee for Aviation Environmental Protection (CAEP) and its various working groups and task groups.

Activities under the Freight Sustainability Demonstration Program (FSDP) and the Freight Efficiency Program (FEP)

In 2009, no new activities were undertaken by NACC member companies in either the FSDP or the FEP.

Other Activities Undertaken by NACC Members

NACC members continue to invest in their respective fleet renewal programs, which will continue to introduce new, more efficient aircraft into their fleets. The carriers also continue to institute policies, procedures, programs and projects that impact their operations by either improving efficiency or reducing fuel burn and hence reducing CO₂ emissions. The ongoing benefits fall into the following categories:

- Aircraft modifications and maintenance
- Aircraft operation
- Cargo and Baggage Operations
- In flight/catering

Aircraft Modifications and Maintenance

Various physical modifications were made that will have an effect on the overall carbon footprint of the operator. Ongoing and new activities in 2009 included:

- **Ozone Scrubbers:** In 2009, one member company completed the installation of Ozone Scrubbers on an aircraft fleet, which eliminated flight level restrictions and allows the aircraft to fly at higher, more optimum altitudes, thus reducing fuel burn and providing ongoing benefits.
- **Engine modification:** One member company is currently installing EP (Enhanced Performance) kits on one of its engine types to improve fuel efficiency.
- **Aircraft drag:** As part of their regular aircraft maintenance programs, member companies inspect aircraft structures to identify and minimize aerodynamic drag to improve fuel efficiency. In 2009, one company initiated a project to study the modification of NACA fuel vents to reduce drag.
- **Aircraft tires:** Two member companies have completed projects to install lighter-weight tires on certain models of their aircraft. This provides ongoing benefits.
- **Engine washing:** All member companies have instituted programs for the regular internal washing of engines to improve engine performance, resulting in better fuel efficiency characteristics of the engine. This provides ongoing benefits.

Aircraft Operation

Some NACC member companies made changes in the areas of training, flight planning/aircraft dispatch and aircraft operating procedures in order to reduce fuel consumption and therefore emissions. Implemented changes or completed projects continue to provide ongoing benefits. Some of these new changes and ongoing activities in 2009 include:

Training

- Presenting and explaining Cost Index (the optimization of time cost and fuel cost) in recurrent ground-school classes.
- Development and implementation of a fuel conservation training program for pilots and key personnel involved in aircraft operations.
- Providing additional fuel guidance to dispatch based on historical operations.

Flight Planning/Aircraft Dispatch

- Continued focus on No Alternate Instrument Flight Rules (IFR) planning (NAIFR) as allowed by regulations, which reduces the amount of excess fuel carried, is an ongoing day-to-day activity.
- The refinement (removal and/or adjustment) of all fuel burn factors imbedded in the flight plan BURN calculation has been completed.
- The implementation of an additional descent profile on an aircraft fleet, which allows the flight planning system to select the optimum speed based on ambient conditions (weight/temp), has been completed.
- Dispatch route optimization is an ongoing day-to-day activity.
- The development and implementation of Required Navigation Performance and Area Navigation (RNP RNAV) departures and approaches is an ongoing project.
- Work is ongoing with NAVCANADA on Airspace Redesign Projects.
- Implementation of Smart Operational Empty Weight Management (removing unnecessary equipment from the aircraft to reduce weight) has been completed.
- Creating a Fuel Efficiency Key Performance Indicator in combination with current Aircraft Performance Monitoring Program is an ongoing project.
- Refinement of the climb power settings used for a new aircraft fleet has been completed and implemented. This enables the aircraft to climb faster to cruise altitude, reducing overall fuel consumption.
- A study to optimize the descent speeds used on a new aircraft fleet has been initiated to minimize fuel consumption while accommodating air traffic control requirements. The study will also look at the application to other aircraft fleets. The study is to be completed by the end of 2010.
- Improving loading procedures for cargo and passengers to improve Centre of Gravity (CG) is an ongoing activity.
- A program has been instituted to greatly improve the accuracy of determining aircraft weight including actual weighing of aircraft as required during regular maintenance checks.
- A project has been completed to refine the calculation for determining the amount of alternate fuel carried for close-in alternate airports to ensure it reflects actual flight distance. This ensures aircraft do not carry fuel exceeding the regulatory requirement.
- The refinement of Cost Index to determine the most economical speed for each route/city pair is ongoing. This determines the most economical speed for operation of the aircraft taking into account the cost of time versus the cost of fuel for each route operated. Phase one of the project has been completed and is being expanded to incorporate a larger proportion of the carrier's network.

- Flight planning systems have been purchased, introduced or refined to increase efficiency and reduce fuel costs through improved calculations of taxi, holding and contingency fuel and optimization of flight profiles, aircraft speed and cost index.
- Initiatives to improved payload planning have been completed.
- Processes for conducting internal Fuel Audit to regularly examine all areas of the operation have been implemented to verify effectiveness of fuel saving policies and procedures.
- The process to provide more accurate taxi fuel to allow for improved flight planning has been implemented and updating of data is ongoing.
- Projects to more accurately determine the zero fuel weight for aircraft are complete or ongoing. The objective is to more accurately determine the true weight of the aircraft, including passengers and cargo, with a higher level of accuracy over existing methodology. One member has implemented the process for its Canadian and European operations and will expand to the rest of its network by the end of 2010.
- A process has been implemented to optimize the location of the Centre of Gravity (CG), through a better distribution of passengers in the cabin whenever the load factor is below 90-95 percent. CG location has a direct influence on fuel burn during the climb and descent portions of the flight, as in cruise Airbus aircraft incorporate a fuel transfer to the trim tank (tail section) to optimize CG location.
- A project is ongoing to reduce gate arrival delays. This will reduce the amount of time arriving aircraft are held off gate, thereby reducing fuel burn. The project is to be completed by the end of 2010.
- A project is ongoing to reduce Auxiliary Power Unit (APU) utilization to a minimum in favour of more efficient ground power and air conditioning.

Aircraft Operating Procedures

All of the following aircraft operating procedures were reported in the 2008 NACC MOU report. They have all been incorporated into the respective members' standard operating procedures.

- Employing single engine taxi-in and taxi-out procedures when conditions permit.
- Limiting APU usage on ground to 10 minutes on arrival and 20 minutes before departure at North American and European destinations.
- Reducing fuel consumption during the first 3000 feet of climb by using ICAO's Noise Abatement Departure Procedure 2 (NADP2) take-off climb procedure.
- Utilizing Economy climb profile, which reduces fuel burn by accelerating to en-route climb speed as soon as flap retraction is complete.
- Utilizing idle reverse and braking on landing rather than selecting maximum reverse thrust.
- Whenever possible, use of only one air conditioning pack during operation of the APU on the ground to reduce fuel burn.
- Introduction of a reduced APU operations procedure aimed at cutting fuel consumption and per-hour lease costs.
- Utilizing ground power units wherever possible to reduce APU usage.

Cargo and Baggage Operations

In 2009, one member completed the replacement of wooden skids with lighter composite skids. Previously it had switched from aluminum-constructed cargo containers to ultra light Kevlar containers (bomb-resistant luggage type of containers). The member has also developed and instituted a program to maximize the number of bags per baggage container, thus reducing the number of baggage containers carried per flight. All of these activities provide ongoing benefits through weight reductions.

In 2009, another member also initiated a project to switch from aluminum-constructed cargo containers to ultra light Kevlar containers.

In 2009, one member initiated a project to study the modification of current loading procedures to optimize the use of bulk holds on its aircraft.

In-flight/Catering

NACC member companies continue to study and implement changes to in-flight/catering services in order to reduce the overall weight of the aircraft, thus reducing fuel consumption and providing ongoing benefits. The following are some of the changes made in 2009:

- Two member carriers completed projects to optimize the amount of potable water carried on their flights. Historical usage data per route was analyzed and now water carriage requirements are based on specific routes.
- One member re-initiated a project to optimize the carriage of service items on board the aircraft. Weight savings are achieved by reducing return catering, matching catering provisioning with actual requirements and eliminating/minimizing items such as headsets, amount of ice, magazines, newspapers and substituting lighter-weight products wherever possible.
- One member completed a project to remove the ovens from the aft galley of one of its single-aisle aircraft fleet. The member also completed a project to remove infrequently used trash compactors from one of its wide-body aircraft fleet.
- One member initiated a project to study the replacement of existing galley carts with new lighter-weight units.
- One member continued its ongoing project examining the removal of a galley from one of its single-aisle aircraft fleet and replacing it with additional passenger seating, resulting in a net reduction in aircraft weight.
- Through periodic audits one company monitors the usage of all catering items and makes adjustments to avoid carrying excess quantities.

5. Conclusions

The expressed goal of the MOU was to:

“... reduce collective ATAC member fleet greenhouse gas emissions on a per unit basis (through fuel efficiency improvements, e.g. reduction in litres of fuel/Revenue Tonne Kilometre) by an average of 1.1 percent per annum, reaching a cumulative improvement of 24 percent in 2012 compared to the 1990 base case scenario.”

Statistics of passenger and cargo operations and associated fuel use provided by ATAC and NACC for 2009 show that the combined performance of their reporting members continues to exceed that goal.

In the period from 2008 to 2009, the aviation industry continued to experience consequences of the global economic downturn, which is reflected in the reduction of 8.8 percent in total fuel consumption by the reporting air carriers from the 5.5 billion litres reported for 2008 to 5.015 billion litres in 2009. Consequently, the total GHG emissions in 2009 were also 8.8 percent less than in 2008, reduced from the 14.34 Mt reported in 2008 to 13.07 Mt of CO₂e in 2009. The fuel consumption rate reported for 2009 was 0.39 litres per RTK (combining both passenger and cargo traffic), and the emissions rate was 1,008 grams CO₂e per RTK. Both rates were 1.6 percent below those reported for 2008.

From 1990 to 2009, an average annual reduction in fuel consumption and GHG emissions per RTK of 1.9 percent was achieved, compared to the target of 1.1 percent per year under the MOU. To date, the industry has already achieved a 30 percent cumulative reduction between 1990 and 2009, compared to the target of 24 percent in 2012.

Contact Information

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Glossary of Acronyms

APU:	Auxiliary Power Unit
ASK:	Available Seat Kilometres
ASM:	Available Seat Miles
ATAC:	Air Transport Association of Canada
ATK:	Available Tonne Kilometres
ATM:	Available Ton Miles
CH ₄ :	Methane
CAEP:	Committee on Aviation Environmental Protection
CG:	Center of Gravity
CO ₂ :	Carbon Dioxide
CO _{2e} :	Carbon Dioxide equivalent, which for aviation jet fuel includes CO ₂ , CH ₄ , and N ₂ O
Fuel Used:	Aviation Jet Fuel measured in litres
GHG:	Greenhouse Gases
IATA:	International Air Transport Association
ICAO:	International Civil Aviation Organization
IFR:	Instrument Flight Rules
MOU:	Memorandum of Understanding
NACC:	National Airlines Council of Canada
NADP2:	Noise Abatement Departure Procedure 2
N ₂ O:	Nitrous Oxide
RNP:	Required Navigation Performance
RPK:	Revenue Passenger Kilometres
RPM:	Revenue Passenger Miles
RTK:	Revenue Tonne Kilometres
SI:	Système international d'unités – International System of Units
TC:	Transport Canada

ANNEX 1

Management Response to the Audit of Voluntary Agreement on the Reduction of Greenhouse Gas Emissions 2008 Annual Report

The Air Transport Association of Canada's (ATAC) and National Airlines Council of Canada (NACC) have prepared the following management response to the "Audit of Voluntary Agreement on the Reduction of Greenhouse Gas Emissions 2008 Annual Report".

Listed below are the recommendations extracted from the Audit report of the 2008 Canadian Aviation Industry Report on Emissions Reductions. Corresponding to each recommendation is the Management Plan of action that ATAC and NACC will take.

Non-Conformities

NC-01 Recommendation: The Management Committee for the MOU should ensure that the 2009 Report and subsequent Annual Reports are submitted by the responsible party in accordance with the deadline stated in the MOU.

Management plan: ATAC and NACC will ensure that the 2009 Report and subsequent Annual Reports submitted by ATAC and NACC members are submitted in accordance with the timelines stated in the MOU or other instructions provided by Transport Canada.

Opportunities for Improvement:

OFI-01 Recommendation: Some consideration should be given to providing ATAC and NACC members with current conversion factors and emission factors used to generate the Annual Reports at the time the request is sent out for data for the Annual Reports. As member companies are requested to report RTK values, they should be provided with all the conversion factors such as "miles to kilometres" and "tons to tonnes".

Management plan: ATAC and NACC will ensure its members are provided with the list of conversion and factors, as agreed by the MOU Management Committee, at the time the request is sent out to the member carriers to provide data for the Annual Report.

OFI-02 & 04 Recommendation: Some consideration should be given to utilizing data import functionality (Excel and Access) or copy/paste functions to improve data quality.

Management plan: To minimize the potential for human error, ATAC will endeavour to maximize the use of available software to manage all data entries and conversions; NACC will instruct its consultant to give consideration to utilizing data import functionality (Excel and Access) or copy/paste functions to minimize data entry and transfer errors.

OFI-03 Recommendation: Some consideration should be given to adding details and timing to the reporting of performance improvement initiatives included in the Annual Reports. More emphasis could be placed on current initiatives or planned action items rather than general or historical activities. Current year initiatives should be highlighted and use of statements such as "planned to commence

next year” and “has been fully implemented by two operators” would add useful context for readers of the Annual Reports.

Management plan: ATAC will endeavour to provide sufficient detail to the reporting of performance improvement initiatives to maximize the value of the Annual Report; NACC will collaborate with the MOU Management Committee to consider options for enhancing the reporting of performance improvement initiatives included in the Annual Reports taking into consideration recommendations from the auditor with respect to adding details and timing. NACC commits to informing its member carriers on the agreed upon framework for reporting the performance improvement initiatives at the time the request is sent out to the member carriers to provide data for the Annual Report.

OFI 05 Recommendation: Some consideration should be giving to encouraging more members of ATAC to participate in the annual reporting.

Management plan: ATAC will continue to promote that more air operators participate in the MOU.

OFI 06 Recommendation: Some consideration should be given to providing contact information within the Annual Reports to allow interested parties to make enquiries and to provide feedback.

Management plan: Feedback contact information will be included in future annual reports; ATAC and NACC are posting the Annual Report on its website and interested parties can contact ATAC and NACC directly for inquiries and feedback.

ANNEX 2

Table 2 showing absolute as well as proportional changes

	Change 2008-2009		Change 2001-2009			Change 1990-2009		
	Absolute	Proportional	Absolute	Proportional	Annual rate	Absolute	Proportional	Annual rate
Fuel use (million litres)	-485	-8.8%	255	5.4%	0.7%	399	8.6%	0.4%
GHG emissions (millions of tonnes of CO ₂ -equivalent)	-1.266	-8.8%	0.665	5.4%	0.7%	1.040	8.6%	0.4%
Traffic (billions)								
Available seat-kilometres (ASK)	-1.39	-0.9%	43.08	39.3%	4.2%	77.44	103.0%	3.8%
Revenue passenger-kilometres (RPK)	-7.93	-6.3%	30.94	35.7%	3.9%	51.25	77.2%	3.1%
Passenger revenue-tonne-kilometres (pass. RTK)	-0.79	-6.3%	3.09	35.7%	3.9%	5.12	77.2%	3.1%
Cargo available tonne-kilometres (cargo ATK)	0.02	0.1%	2.97	21.8%	2.5%	5.48	49.3%	2.1%
Cargo revenue-tonne-kilometres (cargo RTK)	-0.23	-16.0%	-0.51	-29.6%	-4.3%	-0.51	-29.9%	-1.9%
Total available tonne-kilometres (ATK)	-0.12	-0.4%	7.28	29.6%	3.3%	13.22	70.9%	2.9%
Total revenue-tonne-kilometres (RTK)	-1.02	-7.3%	2.59	24.9%	2.8%	4.61	55.2%	2.3%
Fuel consumption rates								
Litres/ASK	-0.0029	-8.0%	-0.0106	-24.4%	-3.4%	-0.0285	-46.5%	-3.2%
Litres/RPK	-0.0012	-2.7%	-0.0123	-22.4%	-3.1%	-0.0269	-38.7%	-2.5%
Litres/Total ATK	-0.0146	-8.5%	-0.0362	-18.7%	-2.6%	-0.0902	-36.4%	-2.4%
Litres/Total RTK	-0.0064	-1.6%	-0.0717	-15.6%	-2.1%	-0.1656	-30.0%	-1.9%
Emission rates:								
CO ₂ e grams/ASK	-7	-8.0%	-28	-24.4%	-3.4%	-74	-46.5%	-3.2%
CO ₂ e grams/RPK	-3	-2.7%	-32	-22.4%	-3.1%	-70	-38.7%	-2.5%
CO ₂ e grams/Total ATK	-38	-8.5%	-94	-18.7%	-2.6%	-235	-36.4%	-2.4%
CO ₂ e grams/Total RTK	-17	-1.6%	-187	-15.6%	-2.1%	-432	-30.0%	-1.9%

ENDNOTES

1. Memorandum of Understanding Between Transport Canada and the Air Transport Association of Canada, signed June 29, 2005, available from Transport Canada Environmental Policy Directorate.
2. Air Transport Association of Canada: “Voluntary Agreement on the Reduction of Greenhouse Gas Emissions 2006 Annual Report,” February 2008.
3. Voluntary Agreement of the Reduction of Greenhouse Gas Emissions, 2007 Annual Report available from Transport Canada Environmental Policy Directorate, at <http://www.tc.gc.ca/programs/environment/ecofreight/about/voluntary/atacemissions2007/menu.htm>.
4. See National Airlines Council of Canada: Report for Voluntary Agreement for the Reduction Of Greenhouse Gas Emissions Annual Report 2008, at: http://www.airlinecouncil.ca/pdf/NACC_Voluntary%20Emissions%20MOU%20Annual%20Report%202008_final.pdf.
5. 2008 Canadian Aviation Industry Report on Emissions Reductions, January 2010.
6. UNFCCC: Report of the Conference of the Parties Held at Kyoto from Dec 1-11, 1997, Annex: Kyoto Protocol, Article 2. http://unfccc.int/methods_and_science/emissions_from_intl_transport/items/1057.php
7. UNFCCC: Report of the Conference of the Parties Held at Kyoto from Dec 1-11, 1997, Decision 2/CP.3, para. 4.
8. ICAO, Committee on Aviation Environmental Protection: “Template and Guidance on Voluntary Measures”, available at http://www.icao.int/icao/en/env/Caep_Template.pdf.
9. “Template and Guidance...”, p.1.
10. See IATA statement at http://www.iata.org/SiteCollectionDocuments/Documents/Global_Approach_Reducing_Emissions_251109web.pdf.
11. See ICAO declaration at <http://www.icao.int/icao/en/Env2010/ClimateChange/PoA.htm>.
12. “2008 Canadian Aviation Industry Report on Emissions Reductions”, January 2010, available at <http://www.tc.gc.ca/media/documents/programs/atac2008-eng.pdf>.
13. The emission factors remain the same in the latest version of the Inventory, for 2008, available from Environment Canada through: <http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=492D914C-2EAB-47AB-A045-C62B2CDACC29>.
14. The report from ATAC for 2009 included no cargo ATK or RTK figures, when each previous year’s report had provided cargo statistics, including in the 2008 report some 100 million ATK and 58 million RTK. However, the omission is minor compared to the 16.6 billion ATK and 1.2 billion RTK reported by NACC in 2009.
15. Statistics Canada: *Aviation in Canada*, Catalogue no. 51-206.