WORLD METEOROLOGICAL ORGANIZATION

CBS/OPAG-IOS/ET-ABO-1/3.1.2

COMMISSION FOR BASIC SYSTEMS
OPEN PROGRAMME AREA GROUP
ON INTEGRATED OBSERVING SYSTEMS

28.VIII.2013

EXPERT TEAM ON AIRCRAFT-BASED OBSERVING SYSTEMS
FIRST SESSION

ITEM: 3.1

Original: ENGLISH

Geneva, Switzerland, 10-13 September, 2013

STATUS OF THE AIRCRAFT-BASED OBSERVATIONS PROGRAMS

Reports of Operational National & Regional Programs

(*Submitted by Gilles Fournier, Canada)*

SUMMARY AND PURPOSE OF DOCUMENT

Provides a status report on the national/regional AMDAR Program of Canada.

ACTION PROPOSED

The Session is invited to review and discuss the content of the document.

Appendices

1. Program Metadata

References

2. NOAA, CMC and airlines' web resources

PROGRESS AND ACTIVITY REPORT

Current Status

1. NAV CANADA and Jazz (operated under Air Canada Express) continue to be the only active AMDAR data contributors to the Canadian AMDAR Programme. See Appendix 1 for details on current AMDAR fleet.

2. All Jazz CRJ-100 aircraft have been retired and partly replaced by DHC-8-Q402. Air Canada Express now operates a total of 26 DHC-8-Q402 aircraft, 21 by Jazz and 5 by Sky Regional. Jazz also operates 26 DHC-8-300 and 34 DHC-8-100 aircraft which could potentially resume their contribution to the Canadian AMDAR Programme if Jazz decided to upgrade their Universal Unilink software to get rid of a mis-coded temperature data smoothing algorithm with the current version.

3. The development of a new long-term contract with Jazz is still in progess.

4. NAV CANADA operates 2 AMDAR-capable CRJ-200 aircraft for unscheduled Flight Inspection at most Canadian airports (about 2 annual visits per airport).

Development & Other Activities

5. On 24-25 April, 2012, Environment Canada's Weather and Environmental Monitoring (WEM) and Science and Technology (S&T) directorates jointly held a workshop to discuss current and emerging technologies, user requirements, network planning and design, and science questions for the development of an optimum vertical atmospheric profiling system for Canada.

6. From the outcomes of the workshop of April, 2012, and focussing on the core mission of the Meteorological Service of Canada (MSC) with a timeframe of 5-10 years, the following activities appeared to offer good potential return for investment: assimilation of radar data; assessment of increasing existing data on assimilation/models/forecasting (e.g. better use of satellite data, benefit-cost of increasing radiosonde soundings to 4 times a day at selected Arctic sites); sustaining and expanding AMDAR (e.g. engaging more airlines, more aircraft, more coverage, longer temporal period, adding water vapor); developing partnership on meteorological application using Global Navigation Satellite System (GNSS) ground based infrastructure with operators of such networks; monitoring development of UAS/UAV technology with the goal to develop partnerships on multi-tasking platforms; and increasing/improving the linkage between Monitoring and S&T – the modellers on monitoring and network planning and design process (e.g. conduct of Observing System Experiments).

Future Plans

7. Environment Canada management will consider additional capacity to better influence airlines. Environment Canada will be looking at opportunities to present AMDAR benefits at major airline managers meetings, and reassess the interests and opportunities.

8. A partial listing of Canadian airline operational fleets is shown in the table below using airline web sources.

Airline	**Aircraft number, model and type**	**Coverage (in development, info partial)**
Air Canada	22 Boeing 777-333ER	international, Canada (hubs),
	6 Boeing 777-233LR	international, Canada (hubs),
	8 Airbus 330-300	international,
	28 Boeing 767-300ER	international, Canada (hubs), US,
	10 Airbus 321-200	Canada (hubs), US, MX and the Caribbean,
	41 Airbus 320-200	Canada (hubs), US, MX,
	35 Airbus 319-100	international, Canada (hubs), US, MX and the Caribbean,
	45 Embraer 190AR	Canada (hubs), US,
	13 Embraer 175SU	Canada (hubs), US,
Air Canada Express	16 Bombardier CRJ 705 (Jazz)	Canada (hubs), US,
	21 Bombardier DHC-8-402Q (Jazz)	Canada (hubs), US,
	5 Bombardier DHC-8-402Q (Sky Regional)	
	VANISHING 9 Bombardier CRJ 100 (Jazz)	Canada, US,
	26 Bombardier CRJ 200ER (Jazz)	Canada, US – currently contributing to Canadian AMDAR Programme
	26 Bombardier DHC-8-300 (Jazz)	Canada,
	34 Bombardier DHC-8-100 (Jazz)	Canada, US,
	17 Beechcraft 1900D (Air Georgian and EVAS)	Canada, US,
	2 Embraer 175SU (Sky Regional)	Canada (hubs), US,
Jazz Air-in addition to fleets under AC Express	3 Bombardier DHC-8-100	Canada,
	2 Bombardier DHC-8-300	Canada,
Air Canada Rouge (expanding AC Leisure)	2 Boeing 767-300	MX and the Caribbean, Europe, US
	2 Airbus 319-100	MX and the Caribbean, Europe, US
NAV CANADA (Air Nav System Operator)	2 Bombardier CRJ-200ER	Unscheduled flight inspection. Most Canadian airports are visited about 2 times per year – currently contributing to Canadian AMDAR Programme
	2 Bombardier DHC-8-102	Unscheduled flight inspection. Most Canadian airports are visited about 2 times per year
Westjet	13 Boeing 737-600	Canada, U.S., Mexico and the Caribbean
	69 Boeing 737-700 (30 orders)	Canada, U.S., Mexico and the Caribbean
	21 B737-800 (12 orders)	Canada, U.S., Mexico and the Caribbean
Westjet Encore	4 Bombardier DHC-8-Q400 (16 orders, 25 options)	Canada
First Air	2 L382G Hercules	Connects 30 northern communities with major centres Ottawa, Montreal, Winnipeg and Edmonton
	1 Boeing 767-223SF carfo	
	2 Boeing 737-400 Combi	
	4 Boeing 737-200	
	3 Boeing 737-200 Combi	
	9 ATR 42-300	
	2 ATR 72	
Canadian North	12 Boeing 737-300, Boeing	Scheduled flights and cargo services

	727-200 and Combi 4 Bombardier DHC-8-106	throughout Nunavut and the Northwest Territories, as well as charter operations throughout Canada and the U.S.
Porter Airlines	18 Bombardier DHC-8-Q400 8 Bombardier DHC-8-Q400 /NextGen (10 options) 12 orders and 18 options of Bombardier CS100	Regularly scheduled flights between Toronto and locations in Canada (SERN) and USA (NERN).
Air Transat	11 Airbus 310-300 (potential to be replaced by CanJet B737-800 fleet over 2013-2020) 8 Airbus 330-200 4 Airbus 330-300	Leading charter holiday travel airline in Canada. To about 60 destinations in 25 countries in Europe, the Caribbean, Mexico and the Mediterranean Basin, plus Florida (code shared with CanJet)
Canjet Airlines	5 Boeing 757-800WL	Holiday charter airline with Headquarters in Halifax and departures from Montreal, Toronto, Quebec to MX, Jamaica, Cuba, Florida
Air Creebec	2 Embraer 100 1 Beechcraft 1900D 6 Bombardier DHC-8-100 1 Bombardier DHC-8-300 1 Beechcraft King Air 100 2 Hawker 748 series Cargo	Regional airline servicing central and NWRN Québec and central and NERN Ontario
Air Inuit	10 Bombardier DHC-8-300 in combi and cargo configurations 2 Boeing 737-200C 7 DHC-6 Twin Otter 4 Hawker Siddeley 748 3 Beechcraft King Air 100	Regional scheduled airline servicing Nunavik, Nunavut and Labrador. Charter services available
Air North	2 Boeing 737-500 1 Boeing 737-400 2 Boeing 737-200 5 Hawker Siddeley 748 (cargo)	Yukon's Airline with services to 9 locations across Yukon, British Columbia, Alberta, Northwest Territories and Alaska
Arctic Sunwest Charters	1 Beechcraft 99 1 Beechcraft King Air 100 2 DHC2 MK III amphibious 2 DHC5A cargo 3 DHC6 Twin Otter 100/300 Combi 2 DHC8-102 Combi 2 Piper PA-31 Navajo	Charter airline based in Yellowknife, NWT. Cargo and passenger charter services all over the North.
Calm Air International	Dornier 328JET ATR 42-300 Hawker Siddeley 748	Scheduled passenger, cargo and charter airline based in Winnipeg and servicing central Canada and the North
Central Mountain Air	To be developed (TBD)	To be developed (TBD)
Flair Airlines	TBD	TBD
Hawkair Aviation Services	TBD	TBD
Kelowna Flightcraft	TBD	TBD
Labrador Airways	TBD	TBD
Morningstar Air Express	TBD	TBD

Nolinor Aviation	TBD	TBD
North Cariboo Air	TBD	TBD
Pacific Sky Aviation	TBD	TBD
Pascan Aviation	TBD	TBD
Perimeter Aviation	TBD	TBD
Provincial Airlines	TBD	TBD
Regional 1	TBD	TBD
Sunwing Airlines	TBD	TBD
Voyageur Airways	TBD	TBD
Wasaya Airways	TBD	TBD
West Wind Aviation	TBD	TBD

9. This table shows some potential to sustain and expand coverage of AMDAR in Canada. A development on Westjet B737-NG aircraft could be relatively easy with the support of Westjet officials and would open an opportunity for some WVSS-II and EDR turbulence algorithm deployment. Development on Air Canada and Air Transat fleets could also be relatively easy but, apart from the frequent profiles at major Canadian hubs, most of the coverage would be international. As Jazz's 26 Bombardier DHC-8-300 and 34 Bombardier DHC-8-100 are already fitted with AMDAR, they could be potentially brought back in the AMDAR fleet if Jazz upgraded their Unilink software. There would also be the possibility to develop AMDAR out of Jazz's 16 Bombardier CRJ 705, and Air Canada's 45 Embraer 190AR and 13 Embraer 175SU. Again, coverage restriction would be major hubs in Canada. For coverage in the north, involvement of airlines such as Canadian North and First Air would have to be reassessed and new innovative solutions sought. Benefits of involving FLYHT (AFIRS), AirDat (TAMDAR) and ARINC/SITA will have to be explored further. For Canada, a major breakthrough would be to find a permanent solution to the Bombardier's factory temperature probe installed on all DHC-8 aircraft, including the Q400s.

10. It is noted that Air Canada, Air Canada Rouge, Westjet, Air Transat and Canjet Airlines all operate modern Boeing and Airbus aircraft and, if they were AMDAR-enabled, could deliver target observations over Mexico and the Caribbean.

APPENDIX 1

PROGRAM METADATA

Operational Fleet

Airline	Country of Airline	Aircraft Type (e.g. B737-400)	Number of Aircraft	AMDAR Software	Format On GTS (BUFR / FM42)
Jazz (Air Canada Express)	Canada	CRJ-200ER	26	ARINC 620-4 v2/3	BUFR
'NAV CANADA'	Canada	CRJ-200	2 (for flight inspection)	ARINC 620-4	BUFR

Program Coverage

Airport Country	Airport Name	Airport ID (IATA)	Profiles per day (average)
Canada	ABBOTSFORD, BC	CYXX	4,23
Canada	CALGARY, AB	CYYC	15,06
Canada	CHARLOTTETOWN, PE	CYYG	2,29
Canada	CHURCHILL, MN	CYYQ	0,06
Canada	CRANBROOK, BC	CYXC	0,06
Canada	DEER LAKE, NL	CYDF	0,16
Canada	EDMONTON, AB	CYEG	7,87
Canada	FORT MCMURRAY, AB	CYMM	4,16
Canada	FORT ST-JOHN, BC	CYXJ	5,84
Canada	FREDERICTON, NB	CYFC	0,06
Canada	GANDER, NL	CYQX	4,16
Canada	GOOSE, NL	CYYR	3,71
Canada	GRANDE PRAIRIE, AB	CYQU	0,84
Canada	HALIFAX, NS	CYHZ	9,71
Canada	HAMILTON, ON	YHM	1,10
Canada	KELOWNA, BC	CYLW	4,32
Canada	LONDON, ON	CYXU	0,52
Canada	MONCTON, NB	CYQM	3,87
Canada	MONTREAL, QC	CYUL	23,58
Canada	MONTREAL/MIRABEL, QC	CYMX	0,68
Canada	NORTH BAY, ON	CYYB	0,00
Canada	OTTAWA, ON	CYOW	18,81
Canada	PRINCE GEORGE, BC	CYXS	0,10
Canada	PRINCE RUPERT, BC	CYPR	0,23
Canada	QUEBEC, QC	CYQB	0,68
Canada	REGINA, SK	CYQR	9,19
Canada	SAINT JOHN, NB	CYSJ	0,26
Canada	SASKATOON, SK	CYXE	9,77
Canada	SUDBURY, ON	CYSB	0,13

Canada	SYDNEY, NS	CYQY	2,52
Canada	TERRACE, BC	CYXT	0,13
Canada	THUNDER BAY, ON	CYQT	3,84
Canada	TIMMINS, ON	CYTS	0,13
Canada	TORONTO, ON	CYYZ	52,55
Canada	VANCOUVER, BC	CYVR	33,84
Canada	VICTORIA, BC	CYYJ	0,39
Canada	WHITEHORSE, YT	CYXY	0,26
Canada	WINDSOR, ON	CYQG	0,19
Canada	WINNIPEG, MB	CYWG	20,13
USA	ATLANTA, GA	KATL	2,48
USA	BALTIMORE, MD	KBWI	0,13
USA	BOSTON, MASS	KBOS	14,03
USA	CHARLOTTE, N.C	KCLT	3,48
USA	INDIANAPOLIS, IN	KIND	3,68
USA	KANSAS CITY, MO	KMCI	2,03
USA	MILWAUKEE, WIS	KMKE	3,06
USA	MINNEAPOLIS, MN	KMSP	0,90
USA	NASHVILLE, TN	KBNA	3,74
USA	NEWARK, N.J	KEWR	7,26
USA	PITTSBURGH, PA	KPIT	0,13
USA	PORTLAND, OR	KPDX	4,16
USA	RALEIGH, NC	KRDU	5,32
USA	ST. LOUIS, MO	KSTL	3,42
USA	WASHINGTON/NAT VA	KDCA	7,10
USA	WHITE PLAINS, NY	KHPN	4,45

Notes

a) The above table presents, for each identified Canadian and US airport, the average daily number of AMDAR profiles for the month of July, 2013.
b) The source of the data used for the terminals in Canada was NOAA, i.e. source: http://amdar.noaa.gov/new_soundings/?O=D. The data includes profiles from both Canadian and US airlines operating at the identified terminals, and maybe a few from British Airways B-747 aircraft (E-AMDAR).
c) The source of the data for the terminals in the USA is from CMC and only includes data provided from Canadian carriers.
d) Note that by comparing the statistics between NOAA and CMC it is possible to estimate the contributions of US carriers at Canadian terminals.