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**WMO AMDAR PANEL
(Fifteenth Session)**

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ITEM: 3.3

Original: ENGLISH ONLY

AMDAR PROGRAMME STATUS

Status Reports on National and Regional Programmes

E-AMDAR Programme Status Report

(Submitted by Stig Carlbeg, E-AMDAR Programme Manager)

SUMMARY AND PURPOSE OF DOCUMENT

The Report provides a progress and activity report of E-AMDAR with some additional detailed information from its national contributions.

ACTION PROPOSED

1. The Panel is invited to note the information contained in the document.
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PROGRESS AND ACTIVITY REPORT

Current Status

Airline	Country of Airline	Aircraft Type	Number of Aircraft	AMDAR Software	Format on GTS
British Airways	UK	A318-112	2	AAAv3	FM42
		B737-436	19	AAAv3	FM42
		B747-436	52	AAAv3	FM42
		B767-336	21	AAAv3	FM42
easyJet	UK	A319-111	177	AAAv3	FM42
		A320-214	61	AAAv3	FM42
		A321	4	AAAv3	FM42
Blue1	Finland	B717-200	9	ARINC620 2	BUFR
Lufthansa (Passage)	Germany	A319-100	12	ARINC 620 (of 2005 or before)	BUFR
		A320-200	17	ARINC 620 (of 2005 or before)	BUFR
		A321-100	16	ARINC 620 (of 2005 or before)	BUFR
		A321-200	41	ARINC 620 (of 2005 or before)	BUFR
		A330-300	18	ARINC 620 (of 2005 or before)	BUFR
		A340-300	24	ARINC 620 (of 2005 or before)	BUFR
		A340-600	24	ARINC 620 (of 2005 or before)	BUFR
		A380-800	10	ARINC 620 (of 2005 or before)	BUFR
		B737-300	0	ARINC 620 (of 2005 or before)	BUFR
		B747-400	26	ARINC 620 (of 2005 or before)	BUFR
B747-8	3	ARINC 620 (of 2005 or before)	BUFR		
Lufthansa (CityLine)	Germany	CRJ-900	12	ARINC 620 (of 2005 or before)	BUFR
Lufthansa (Cargo)	Germany	MD11-F	18	ARINC 620 (of 2005 or before)	BUFR
Finnair	Finland	A319-112	11	ARINC 620 2	BUFR
		A320-214	12	ARINC 620 2	BUFR
		A321-211	6	ARINC 620 2	BUFR
SAS	Scandinavia	CRJ900	12	ARINC 620 2	FM42
		A340-300	7	ARINC 620 2	FM42
		A330-300	4	ARINC 620 2	FM42
		A321-200	8	ARINC 620 2	FM42
		A319-100	4	ARINC 620 2	FM42
		B737-400	3	ARINC 620 2	FM42
		B737-500	7	Honeywell (Proprietary)	FM42
		B737-600	28	Honeywell (Proprietary)	FM42
		B737-700	9	Honeywell (Proprietary)	FM42
		B737-700	9	ARINC 620 4	FM42
B737-800	18	ARINC 620 2	FM42		
Novair	Scandinavia	A321-211	3	ARINC 620 2	FM42
ThomasCook	Scandinavia	A320-214	2	ARINC 620 2	FM42
		A321-211	6	ARINC 620 2	FM42
		A330-200	1	ARINC 620 2	FM42
		A330-300	3	ARINC 620 2	FM42
KLM	Netherlands	MD-11	8	AAAv1	FM42
		B747-400	26	AAAv1	FM42
		B737-700	18	AAAv3	FM42
		B737-800	23	AAAv3	FM42

Airline	Country of Airline	Aircraft Type	Number of Aircraft	AMDAR Software	Format on GTS
		B737-900	5	AAAv3	FM42
Air France	France	A318	18	AFR Developed to MF requirements – based on ARINC620 (1999)	FM42
		A319	39	AFR Developed to MF requirements – based on ARINC620 (1999)	FM42
		A320	55	AFR Developed to MF requirements – based on ARINC620 (1999)	FM42
		A321	5	AFR Developed to MF requirements – based on ARINC620 (1999)	FM42

The requirements for E-AMDAR have remained unchanged since 2008 and the fulfilment during 2011 is presented in the table with some comments below. The Nett figures refer to the observations financed by E-AMDAR, whereas the Gross figures include also data financed by DWD, Météo France, Met Office and the NMHS:s in South Africa, and Singapore for their national requirements as well as data financed by SAS for their Green Landing Project at Stockholm-Arlanda airport.

EUCOS Objectives for E-AMDAR	2008	2011 ACTUAL (Gross)	2011 ACTUAL (Nett)
Number of airports in EUCOS area observed daily	140	141	135 ¹
Number of 3 hourly observed airports	40	46	41
Total daily number of profiles within EUCOS area	780	1032 (1063 M-F/954 WE)	877
Data over Sensitive EUCOS Areas	27%	36.4%	30.94%
WWW contribution	12%	11.6% ²	9.86% ²
Annual number of E-AMDAR funded observations	12M	17.51M	12.58M ³
Total number of E-AMDAR aircraft equipped with development WVSS-II units	3	3 (2) ⁴	3 (2) ⁴
Timeliness T + 50	90%	95,4% ⁵	95,4% ⁵
Timeliness T + 100	95%	98,3% ⁵	98,3% ⁵

Notes:

1. The daily airport totals did not reach the EUCOS target level for an unexpected reason. The number of regional airports have been increased, but as these are close to main airports they cannot be included as “EUCOS airports.”
2. Due to a necessary reduction of en route observations outside EUCOS Area the target was not reached.
3. Total number of observations reduced for financial reasons compared to 2010.
4. Lufthansa has put one of the humidity aircraft out of service since the late part of 2011.
5. Timeliness again improved, now by 0.5% since 2010.

Currently the following airlines cooperate with E-AMDAR:

- Air France
- Blue1
- British Airways
- easyJet
- Finnair
- KLM
- Novair
- Lufthansa (Lufthansa Passage, Lufthansa Cargo and Lufthansa CityLine)
- SAS
- Thomas Cook Scandinavia

Further information on some of these fleets are available in Annexes 2 and 3.

Altogether these airlines provide more than 850 aircraft equipped for E-AMDAR. On a daily basis about 500 aircraft report. The annual production of more than 17 million observations (or around 40 000 – 45 000 per day) is seen in the table above. During the late part of 2011 and during 2012 this has been slightly reduced to 38 000 – 40 000 per day for budgetary reasons. See also Figure 1.

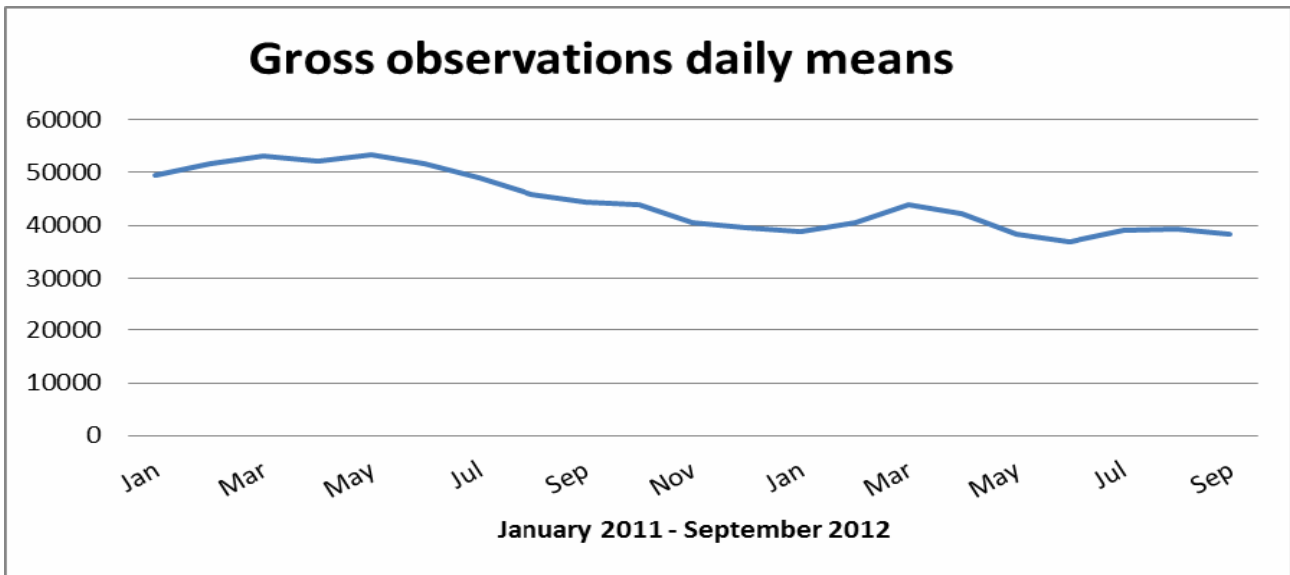


Figure 1 – Mean value of daily observations during the period January 2011 – September 2012.

The infrastructure i.e. airline fleets and data transmission systems, is usually very stable but depending on variations in flight schemes and occasional disruptions e.g. technical server problems, industrial actions etc. the daily data volumes vary. One example is shown in the figure where the daily data volumes per airline during July 2012 are shown.

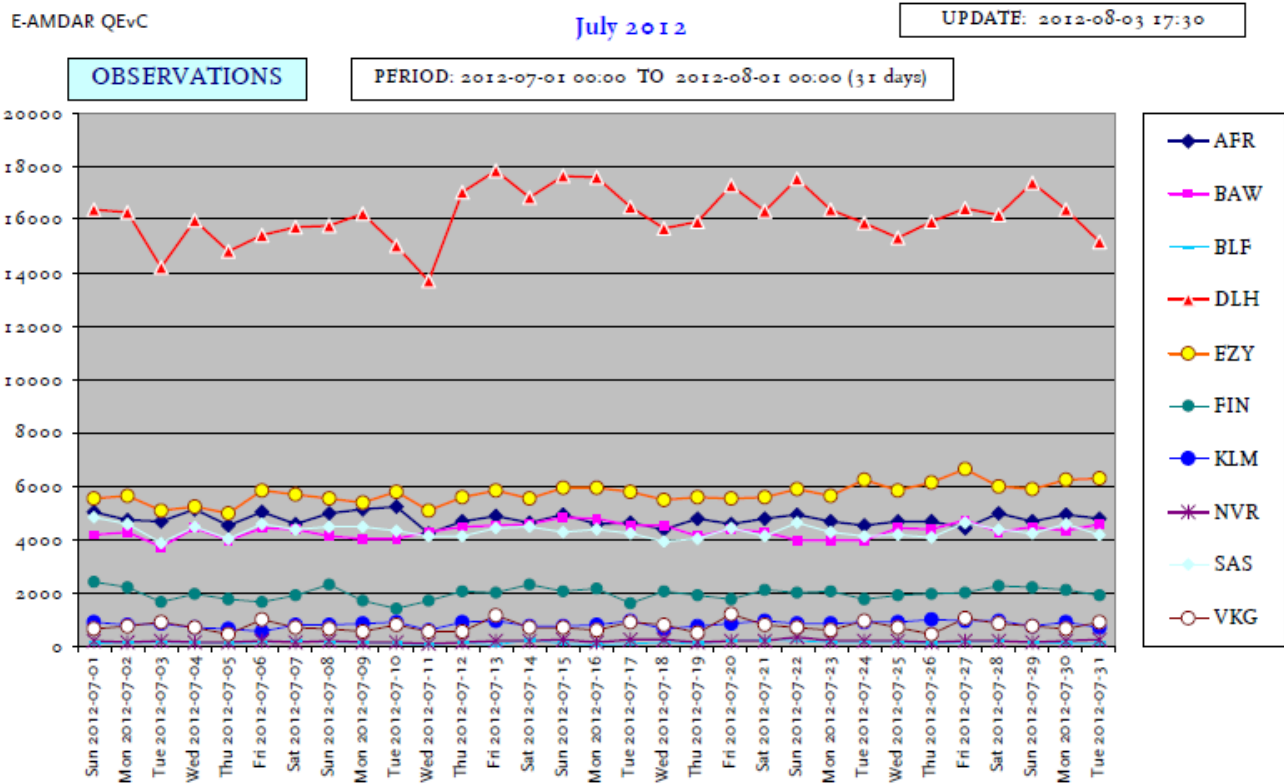


Figure 2 – Daily number of observations per airline during July 2012. Courtesy of E-AMDAR QEvC at KNMI.

Development and other activities Current Status

Discussions have been held with some airlines to enroll them in order to have observations in some under-sampled areas.

Successful tests of the WVSS-II v3 on the UK research aircraft FAAM were concluded in 2011. A final report was published on the AMDAR Panel collaborative site:

<https://sites.google.com/a/wmo.int/amdar-projects-and-collaboration/information-resources/references/amdar-data-parameters/water-vapour>

Further information is described in Annex 2. Much work has also been invested in a working group producing a business case report for convincing EUMETNET to continue investing in humidity sensors for aircraft.

Much work has been carried out by the E-AMDAR Technical Coordinator and by the E-AMDAR Technical Advisory Group within the WMO WIGOS Pilot Project for AMDAR concerning upgrading the communication standard ARINC 620 and also for developing a universal AMDAR BUFR Template.

The new WMO/WIGOS AMDAR BUFR Template (3 11 010 version 7), was verified during the spring by ECMWF, CHMI and Environment Canada. Through a fast-track procedure the template was approved for implementation on 2nd May. This was notified on 23 April 2012 in the WWW Operational Newsletter at:

http://www.wmo.int/pages/prog/www/ois/Operational_Information/Newsletters/current_news_en.html

Release of the newsletter was notified by email to WMO Members.

The information is also available from the page of the Manual on Codes at;

<http://www.wmo.int/pages/prog/www/WMOCodes/VolumeI2.html#VolumeI2>

The work on upgrading the communication standard ARINC 620 v4 Annex 5 was approved by AEEC Standards Subcommittee on 1st May. On the 18th July ARINC reported that the new version (ARINC620-7) was released. The next challenge for the AMDAR community will be to get the airlines or avionics vendors to implement this new standard.

Future Plans

From 1 January 2013 SMHI will no longer be in charge of the E-AMDAR Programme. The responsibilities will be assumed by a different Member NMHS of EUMETNET and the Management Team will have a partly new composition.

In 2013 the three WVSS-II v2 humidity sensors on the three Lufthansa A319 will be replaced with the WVSS-II v3 sensors. The same version as already in operation in the USA. Another six sensors of version three will be mounted on another six Lufthansa A319 aircraft. Thus, by the end of 2013 nine aircraft with humidity sensors will be in daily operation.

There is also a need to update onboard and ground system software to handle the new versions of ARINC 620 and the BUFR Template. This will require a review of the E-AMDAR infrastructure for data transmission and, when this is complete, E-AMDAR will ingest all data to GTS using the AMDAR BUFR Template (3 11 010 version 7).

Annexes

- Annex 1 The Météo France AMDAR Programme
 - Annex 2 The DWD AMDAR Programme
 - Annex 3 The UK Met Office AMDAR Programme
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1. FRENCH AMDAR PROGRAMME

The French Program Amdar covers different levels of needs. For each of them, objectives are defined:

1. Intensification of AMDAR data for national forecasting and meso scale model
2. Valorisation of AMDAR data produced by E-AMDAR for regional model
3. Development of AMDAR data over French overseas territories for global use
4. Preparation of real time delivery of physico-chemical data for air quality model

To progress, Météo France is working in priority within the E-AMDAR organization:

- By valorising the existing contracts with Airline companies;
- In using the technical solutions already developed and implemented;
- And by facilitating the transfer from research to operations for the new measurements.

2. METEO FRANCE AMDAR ACTIVITIES

Contribution to the E-AMDAR program

Météo France contributes financially and technically to the E-AMDAR program, allowing getting AMDAR data every 250 km and 3 hourly. Météo France would like to generalise the use of AMDAR data by the forecasters, the frequency should be enhanced. Therefore, a MoU has been signed between Météo France and E-AMDAR, to intensify AMDAR profiles through a selection of airports in France.

Météo France contributes to facilitating the relationships between Air France and E-AMDAR about the data dissemination into the GTS and the development of new AMDAR data on long haul flights, and towards French overseas territories. Meteo France encourages implementing AMDAR production for B777 fleet over French West Indies, French Guyana and La Reunion.

Contributions to the AMDAR Panel

Météo France contributes financially to the AMDAR panel (cost)

3. IMPLEMENTATION OF NEW AMDAR DATA

A progress is noticed by the implementation of an Air Vanuatu Aircraft software, for flights over the new Caledonian area in cooperation with the BOM. This progress will be effective at the end of 2011 and be made possible (financially and practically) through the MoU between Meteo-France and E-Amdar,.

No progress was achieved over La Reunion in the Indian Ocean and Polynesia in the Pacific Ocean.

Humidity sensor

Meteo France participates in the design of a future European humidity network via the Working Group on E-AMDAR Humidity Business Case for Eumetnet

IAGOS

Météo France is involved into the IAGOS projects (IAGOS DS and IAGOS ERI) for the design and conception of the real time transmission of physico-chemical data (Real Time Transmission Unit)and for the coordination with AMDAR.

The design and the production of the RTTU (Real Time transmission Unit) are successfully done . All the test onboard an airbus 340 of Lufthansa (D-AIG) are successfully done

Eumetnet agreed to cooperate with IAGOS-ERI in the real-time data transmission (Eumetnet general assembly, May 2011). The cooperation allows the use of E-ADAS (E-AMDAR Data Acquisition System) And E-ADAS received the test IAGOS reports, encode them in BUFR format and send them into the GTS (WIS real-time network).

4 FUTURE PLANS

Contribution to the TAG E-AMDAR , to the AMDAR Panel and collaborate to the WMO Expert Team on Aircraft Based observing Systems (ET-ABO)

Certification of the RTTU will be done by an call for tender during 2013 (CNRM (National research Center) and LA (Laboratoire d'Aerologie cooperation).

Submitted by Yvan Lemaitre, Météo France.

The German ADAR Programme

Current Status

1. The AMDAR Fleet

The German part of the EUMETNET-AMDAR fleet currently consists of aircraft operated by

- Lufthansa Passage,
- Lufthansa Cargo,
- Lufthansa CityLine.

The aircraft types currently operated actively for E-AMDAR are listed in the following table:

Airline	Country of Airline	Aircraft Type	Qty.	AMDAR Software	Format On GTS (BUFR / FM42)
Lufthansa Passage	Germany	A319-100	12	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A320-200	17	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A321-100	16	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A321-200	41	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A330-300	18	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A340-300	24	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A340-600	24	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	A380-800	10	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	B737-300	0	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	B747-400	26	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Passage	Germany	B747-8	3	ARINC 620 (of 2005 or before)	BUFR
Lufthansa CityLine	Germany	CRJ-900	12	ARINC 620 (of 2005 or before)	BUFR
Lufthansa Cargo	Germany	MD11-F	18	ARINC 620 (of 2005 or before)	BUFR

During the last 12 months more than 100 units of the Lufthansa fleet were loaded with a faulty on-board software. Hence, only 221 aircraft of 323 have been activated for AMDAR. The software defect is identified. Within the coming months these units will be fixed successively during maintenance steps.

2. Aircraft with Humidity Instruments

On three of the Airbus A319 the humidity sensor type WVSS-II is operated (SpectraSensors Inc.). Because of known reasons all of the three sensors (version of the year 2006) show biases mainly on the dry side between – 10 % and – 20 % of relative humidity. During the last 12 months no changes have been done for the 3 existing humidity aircraft of the Lufthansa fleet. The replacement by instruments of the latest generation is planned for 2013.

3. Optimization

In the German fleet the main part of costs is coupled to the amount of data transmitted via the worldwide communication networks. In order to save data transmission costs the system E-ADOS (E-AMDAR Optimization System) ensures an adjustable and equally distributed data coverage in time and space without redundancies. The airlines of Lufthansa, Finnair and KLM belong to the E-ADOS pool of coordinated activation. The AMDAR activity of aircraft within this pool is structured by configurable priorities of aircraft, airports and regions. For example a small amount of special aircraft like those with humidity sensors can get a high priority level. On demand the atmospheric data sampling is targeted to sites beyond the standard range of EUCOS.

Development & Other Activities

4. Test Flights with New Generation Humidity Instruments on Research Aircraft

Of the new WVSS-II generation (year 2009) two units each have been flown in 2011 on two different test beds:

- Bae 146 operated by FAAM (Facility for Airborne Atmospheric Measurements, UK):
In a piggy-back mode the WVSS-II units are operated together with reference humidity instruments during routinely scheduled campaigns. For the second instrument an alternate sample air inlet is tested. It provides an increased pressure in the sample gas flow to yield sufficiently dry conditions even without electrical heating of the sampling tube. In doing so, the locally increased absolute humidity shall lead to an extension of the instrument's operation range by an altitude of about 100 hPa or more.
The results of the report give a hint on a slightly different behavior of WVSS-II in the upper troposphere depending on the kind of inlet unit. The countercheck after having swapped the two sensor units is planned.
- Lear Jet 35 on behalf of EUFAR (European Facility for Airborne Research):
In the flight trial DENCHAR (Development and Evaluation of Novel Compact Hygrometer for Airborne Research) two WVSS-II units have been part of a comparison between several sophisticated humidity measurement techniques.
Above a mass mixing ratio of 0.05 g/kg the instruments showed a very good congruence with the reference instruments. Below that level the unit with the conventional inlet showed a sensitivity threshold which may depend on the kind of inlet. The pathway of the incoming sample air is assumed to play an important role, especially in the upper troposphere.

Future Plans

5. Continued Humidity Instrument Tests

The piggy-back operation of the two WVSS-II units on the FAAM aircraft will be continued after having swapped the instruments.

6. Humidity Instrumentation of the Fleet

It is planned to replace the old WVSS-II humidity sensor units operated up to now on three aircraft by those of the latest version. Within 2013, a number of 6 additional aircraft of the Lufthansa fleet will be equipped with humidity instruments. The corresponding contract with the airline Lufthansa is fixed.

7. Software Upgrades

The Lufthansa fleet will have to get the ARINC 620 upgrade. As a precondition the ground software for receiving and GTS transmission of the downlinked data will have to be upgraded for both the new ARINC 620 as well as the latest BUFR template version. In addition to that the optimizer software needs to be adapted for an appropriate prioritization of the increased amount of humidity aircraft. Another adaption of this software concerns ARINC 620's enriched possibilities of triggers for additional quality control parameters. By all this the overdue improvement of the humidity's resolution as well as increased resolutions of time stamps, position values and humidity together with new parameters such as GNSS and quality control data should be available on GTS within the next 2 years.

Submitted by Axel Hoff, Deutscher Wetterdienst.

The UK Met Office AMDAR Programme

Current Status

8. The AMDAR Fleet

The United Kingdom (UK) part of the EUMETNET-AMDAR fleet currently consists of aircraft operated by

- British Airways (BAW) and easyJet (EZY).

Airline	Country of Airline	Aircraft Type	Qty.	AMDAR Software	Format On GTS (BUFR / FM42)
British Airways	UK	A318-112	2	AAAv3	FM42
		B737-436	19	AAAv3	FM42
		B747-436	52	AAAv3	FM42
		B767-336	21	AAAv3	FM42
easyJet	UK	A319-111	177	AAAv3	FM42
		A320-214	61	AAAv3	FM42
		A321	4	AAAv3	FM42

Figures based on latest information from airlines.

EZY have orders for further A320 family aircraft.

BAW will phase out the B747 fleets over the next 5-10years and replace with a mixed fleet of B777, B787 and A380.

9. Optimization

The Flight Selection System (FSS) in place with BAW is a basic system based on a specified airport list and the aircraft OOOI information. The FSS will integrate the Airbus fleets once software developed and loaded to the aircraft.

The EZY FSS is a module within the ARINC OpCenter used by the airlines. A MET module was developed and again is based on airport specific table and OOOI information. The EZY FSS has remote web access allowing access to the fleets without troubling the airline operations staff.

Other airlines can be added to the MET Module in OpCenter.

Development & Other Activities

10. Airbus Software development at BAW

Following the integration of AMDAR test software on the A318, the airline was tasked to finalise this development for roll out on all Airbus fleets within the airline. It is hoped that this can be achieved early 2013, with a dependency on airline resources being available and fitting in with BAW operational plans.

Future Plans

11. Development of UK AMDAR Programme

The UK Met Office is looking at upper air data provision in their UK mesoscale domain and discussions have taken place with flyBe and AirDat. This is in parallel to EUMETNET discussions. Inclusion of flyBe would provide TAMDAR equipped aircraft.

12. Software Upgrades

With the acceptance of the upgrade to ARINC620 there will be a need to ask the airlines to upgrade any onboard software which has any element of this specification. This may be relevant for BAW B777 fleets which are Honeywell equipped.

The E-AMDAR data processing system (E-ADAS) has been upgraded to the latest AMDAR BUFR Template and will allow formatting of data to this compliancy.

Submitted by Stewart Taylor, UK Met Office.
