



World  
Organization

Meteorological

International Air  
Transport  
Association

Air Transport

## WMO-IATA Regional Workshop on AMDAR for WMO Easter Europe

7-8 December 2017, Budapest, Hungary



## WORKSHOP REPORT

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## WORKSHOP REPORT SUMMARY

### 1. Workshop Opening

The WMO-IATA Regional Workshop on AMDAR for Eastern Europe was held over 7 to 8 December 2017 at the Head Quarters of the Országos Meteorológiai Szolgálat (OMSZ, the Hungarian Meteorological Service) in Budapest, Hungary.

The workshop was opened by Dr Kornélia Radics, Director of OMSZ and Permanent Representative of Hungary with WMO. Dr Radics welcomed all participants to the workshop, to Budapest and in particular to the historical building in which OMSZ has been situated since 1910. Dr Radics was pleased to host the WMO workshop on AMDAR noting that, like many other meteorological services, OMSZ also has a need for more upper air observations to supplement the information available from conventional observing systems, particularly in support of numerical weather prediction systems and applications. OMSZ's interaction with the Air Transport Industry, mainly represented by the pilots, has confirmed the importance of (more and good quality) upper air information to support improved services and products for aeronautical meteorology. New challenges were recognised in the wider implementation of water vapour measurement for the provision of atmospheric humidity data. In concluding, Dr Radics wished the participants a successful and instructive meeting.

Mr Dean Lockett of the WMO Secretariat welcomed all participants to the workshop on behalf of the WMO Secretary-General, thanking OMSZ for hosting the event, the presenters, and, in particular, the OMSZ staff for their excellent support and coordination of the event in Budapest. Mr Lockett emphasised the importance of these AMDAR workshops as a means for expanding the AMDAR program, noting that this workshop was the first workshop organised collaboratively with IATA under the IATA-WMO Working Arrangement on the Operation of the AMDAR programme (signed in July 2017). In addition to providing information to regional WMO Member NMHSs on the operation of the AMDAR programme, another aim of the workshop was to convince regional airlines and other aviation-related organisations of the benefits of the programme to aviation, resulting in improved weather forecast products and services to aeronautical meteorology. Mr Lockett was therefore particularly pleased that there were many participants representing the aviation industry, in addition to those representing the regional NMHSs.

The workshop programme is provided within [Annex I](#).

The List of Participants in the workshop is provided within [Annex II](#).

### 2. Workshop Programme

The workshop programme consisted of a series of presentations by WMO and IATA-invited speakers from national and regional AMDAR programmes, international organisations and other experts, divided over six sessions and interspersed with periods for open discussions.

#### **Session 1**

Mr Dean Lockett, WMO, presented *“What is AMDAR and why we need more meteorological services and airlines to participate”*.

In his talk, Mr Lockett introduced a description of the AMDAR programme including its current global status, its technical and operational aspects and the roles and requirements of NMHS and airline partners in developing and operating a national programme. Mr Lockett highlighted that, while the programme consisted of 40 airlines from around 30 countries, the global AMDAR coverage was still very much sub-optimal, with many data-sparse areas that included many countries with airlines that had the potential to contribute. Eastern Europe in particular had been identified by WMO as a region where airline participation should be extended in order to increase the (near) real-time reporting of aircraft-based observations. While bringing benefits to the meteorological community through the national, regional and global use of AMDAR data to improve forecasting products and services, this would also benefit the airline industry through more efficient and safer airline operations.

Participants were referred to the available online WMO documentation and guidance<sup>1</sup> on data requirements, AMDAR programme development and operation and its benefits to both meteorology and aviation, in particular highlighting the forthcoming publication of WMO-No. 1200, Guide to Aircraft-Based Observations<sup>2</sup>.

In the discussion following this presentation the following points were raised:

- Participants requested information on the availability and versions of AMDAR onboard software (AOS), noting that a way to minimise development costs was to avoid the need to develop new software. Participants were advised that WMO had recently compiled a list of existing AOS which could be found on the WMO website<sup>3</sup> and would later be available as metadata from WMO OSCAR/Surface<sup>4</sup>.
- Participants were informed that in new aircraft so called Electronic Flight Bags (EFB) are installed which has a uniform and much friendlier environment for IT developers. It was believed there might be some benefits to implement AMDAR software into the EFB using an AID (Aircraft Interface Device) as the interface with the avionics (easy to program, update, etc.), instead of into the ACMS of the aircraft. Existing AMDAR software might also be directly installed in the AID. It was recommended that the ABO programme should investigate this opportunity.

Mr Curtis Marshall, Chairman of the Expert Team on Aircraft-Based Observing Systems, made the presentation *“Use and benefits of AMDAR data to airlines and the wider aviation and meteorological community”*.

Mr Marshall highlighted the positive impact of the use of AMDAR data on NWP which, consequently, resulted in more accurate forecasts and improved meteorological services. To the airline operations this would result in a more efficient fuel loading and consumption, and to improved flight safety.

Mr Marshall further referred to the requirements for aircraft reports (including meteorological information) as regulated by ICAO<sup>5</sup> in Document 8896, and in Annex 3 to the Convention on International Civil Aviation (Meteorological Service for International Air Navigation). The critical component of AMDAR is that observations are made during ascent and descent. These observations can be represented as profiles, similar to data available from radiosondes, with comparative data quality. AMDAR

<sup>1</sup> See : [http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/resources/index\\_en.html](http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/resources/index_en.html)

<sup>2</sup> See: now available at: [https://library.wmo.int/opac/doc\\_num.php?explnum\\_id=4120](https://library.wmo.int/opac/doc_num.php?explnum_id=4120)

<sup>3</sup> See : [http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/resources/AMDAR\\_Programme\\_Development.html](http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/resources/AMDAR_Programme_Development.html) and [http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/resources/WMO\\_AMDAR\\_Software&Avionics\\_Metadata\\_VD10\\_Aug2016.docx](http://www.wmo.int/pages/prog/www/GOS/ABO/AMDAR/resources/WMO_AMDAR_Software&Avionics_Metadata_VD10_Aug2016.docx)

<sup>4</sup> See: <https://oscar.wmo.int/surface/index.html#/>

<sup>5</sup> International Civil Aviation Organization

WIGOS/AMDAR Workshop for West Asia WMO Region VI, Workshop, Report, p. 5 profiles are produced at a fraction of the cost for radiosonde profiles and because of their higher temporal frequency are complementing effectively to other operational upper-air observing systems.

In a variety of examples, the benefits of AMDAR data were presented to a diverse number of applications, including climatology, meteorology/NWP and the airline operations. Also, the positive impact on the results of several (global and regional) NWP models was presented.

Also, the recently established partnership between WMO and IATA on the operation of the AMDAR Programme was presented as a benefit for both the AMDAR Programme and the meteorological and aeronautical user community.

Captain Brent King, IATA, informed the audience about "*IATA and airlines role in the AMDAR Programme*".

Captain King used practical examples from his own professional experience showing why the accuracy of forecasting products, preferably enhanced by using AMDAR data, would be of great benefit to airline operations and never should be underestimated. Examples of situations, where running out of fuel has played a critical role, had shown that there is a global requirement for (more) AMDAR observations and that weather and fuel loading are inextricably linked. Airlines make strategic route and fuel decisions based on forecasted weather and pilots make tactical in flight decisions based on near real time actual weather observations.

Captain King showed an example fuel plan for a commercial airliner, explaining the various components that contribute to a final fuel figure for a particular flight e.g. taxi, trip, extra, alternate, contingency, final reserve etc. Depending on the forecast weather a commercial jet's fuel load would vary, especially its choice of alternate aerodrome, and the amount of contingency fuel or extra fuel carried on a particular sector.

In a de-identified example, a large commercial jet had loaded reduced contingency fuel due to forecasted weather before commencing the flight. This was in accordance with authorized documented procedures. In flight, the weather at destination deteriorated to the point where the aircraft could not land at the destination and had to divert to the next available airport. It landed with less than 30 minutes of fuel on board and had to declare an emergency.

Ms Katya Vashchankova, IATA, explained that these examples underline how crucial the weather situation can be in operational aviation. It is therefore important that global requirements for AMDAR, developed by the air transport industry, are included into the expansion of the AMDAR Programme.

IATA is willing to support this expansion in encouraging more airlines to participate through increasing the awareness of AMDAR and to engage the right stakeholders within the airline industry. Education is also an important issue as is the commercialization of the existing AMDAR data to the benefit of the participating airlines.

Ms Vashchankova ended this duo presentation with the motto: We should let grow the AMDAR Programme together to enhance [airline] industry safety and efficiency by producing more accurate weather forecasts.

## **Session 2**

Mr Máté Mile (OMSZ) informed the participants about the "*AMDARE data use in OMSZ*". Mr Máté highlighted the OMSZ capabilities in NWP and in particular regarding the

WIGOS/AMDAR Workshop for West AsiaWMO Region VI, Workshop, Report, p. 6 assimilation of AMDAR data into their Limited-area Models (namely AROME with 2.5 km and ALADIN with 8 km grid). Mr Mile explained that AMDAR data is a key component of OMSZ's data assimilation and NWP systems. Furthermore in AROME 3D-Var assimilation system, the use of AMDAR humidity and so called Mode-S aircraft observations were highlighted showing their added value as well.

OMSZ uses the output from the above NWP systems to produce special products in support of their aeronautical meteorology services.

The workshop participants visited the OMSZ Forecaster's Room where Mr Imre Bonta, Head of Forecasting, and his staff explained to the visitors how a wide variety of products were displayed and used within a range of forecasting applications and areas. Many of these products were the result of in-house development.

Captain Vincent Boschat, an Air France pilot, informed the audience about the "*Benefits of AMDAR-A Pilot's Perspective*".

Captain Boschat approached the importance of having more and better upper-air data by using the Threat and Error Management (TEM) model to explain the responses (steps and decisions) that have to be taken in order to avoid or reduce risks to aircraft operations during flight. It was explained that any condition that increases the complexity of the operation should be avoided. These conditions were mainly caused by weather situations, like storm, icing conditions, turbulence, windshear, significant temperature inversion. By having better information on weather situations, risks could be better managed. Pilots need to anticipate changes to operational requirements in weather situations in order to mitigate effects on flight safety and to optimize the flight plan. Therefore they need accurate and reliable weather products. But not only pilots, dispatchers also need these data for flight planning and flight watch for optimizing flight plans and to improve fuel savings resulting in a reduction of CO<sub>2</sub> emissions.

It is Captain Boschat's opinion that airlines must provide the NMHSs with a wealth of meteorological data to improve the understanding and modelling of weather phenomena. And this is the purpose of the AMDAR project and the ABO Programme. Captain Boschat reminded the participants of the successful AMDAR implementation in the Air France B777 fleet (70 aircraft) which was realized with full financial support of Météo France and EUMETNET, at no cost to Air France.

Based on lots of evidence, from real cases and scientific studies, AMDAR is important and beneficial to the airline industry, Captain Boschat ended his presentation with re-phrasing the question *Why should an airline be joining the AMDAR project?* into *Is there a good reason [for an airline] not to join the AMDAR project?*

Mr Bjorn Syren, Rockwell Collins (RC), reported from his former work at SAS on the "*Benefits of AMDAR to airline operations*".

Mr Syren informed the audience that SAS started to implement AMDAR in the middle of the 1990s starting to equip their B767-300ER fleet. Nowadays a large variety of SAS aircraft types are equipped with AMDAR software and the SAS AMDAR provision is brought under the E-AMDAR programme. The participation in AMDAR is cost-neutral for SAS.

The SAS AMDAR contribution to the E-AMDAR programme covers mainly the Scandinavian countries, supplemented by some long haul flights to the USA and the Far East. SAS AMDAR provision is optimized by means of the EUMETNET Optimization System, operated by Lufthansa Systems (LSY).

Mr Syren reported further that SAS near real-time AMDAR data were used during the period 2005-2010 in several large-scale SESAR ATM trials and demonstrations. Among

WIGOS/AMDAR Workshop for West Asia WMO Region VI, Workshop, Report, p. 7 these trials was the Continuous Descent Approach (CDA) project at Stockholm's Arlanda Airport, requiring up-to-date descent AMDAR wind information. Descent wind profiles from preceding arrivals were uploaded (as ARINC 702A FMS message) to next arriving aircraft for use during their CDA.

This trial was successful and the results will be used by SESAR under their expanded FMS meteorological data processing as part of the SESAR2020 plan.

Mr Syren ended his talk with the following recommendations:

- i. Encourage WMO to work with the industry to specify and implement AMDAR capability as a baseline capability, available to be enabled based on WMO needs and agreements with individual carriers.
- ii. Same applies to work with OEMs to install humidity sensors as baseline equipment or offer as a standard catalogue option.
- iii. Extend AMDAR capability to regional aircraft fleets operating into small/remote airports.
- iv. AMDAR optimization possible via in-house ground data link solution (e.g. RC Hermes) or via external hosted optimization application (e.g. E-ADOS or ARINC OpCenter).

Mr James Shapland, Met Office, is a Met Office Operations Manager at London Heathrow (LHR) and his talk covered the "*Benefits of AMDAR to terminal forecasting and Air Traffic Management (ATM)*".

Mr Shapland explained the environment in which Operational Meteorologists are positioned, their collaboration with ATC and Airport Duty Managers and the aim of their work at LHR, with the focus on weather situations and potential disruption to airport and airline operations.

It was mentioned that, at LHR, approximately 75% of the delays in 2016 were weather related. As an example, the financial loss to the airlines involved in fog situations was roughly calculated at €81 for every minute of delay. In 2016 around 469.912 minutes of delay was caused by fog, which equals to an amount of €38 million.

The UKMO NWP is the basis for the forecast products and it was emphasised that the use of actual observations are key for verifying NWP and for enhancing NWP downstream.

Mr Shapland explained further that vertical profiles of the atmosphere were required to forecasts to alert forecasters to changing weather situations and to verify the NWP's vertical profile. Because the number of profiles from radiosondes in the region is not sufficient, more profiles would be needed. That gap in the radiosonde network is filled by AMDAR profiles, be it that more humidity information on top of the conventional wind and temperature data was required.

Despite the lack of sufficient AMDAR humidity, Mr Shapland could present the AMDAR potential benefits, with regard to the available AMDAR parameters. Developments are foreseen in order to improve the needed upper air data availability.

### **Session 3**

Captain Brent King, IATA, presented the "*IATA role in the development of turbulence monitoring and its use in airline operations (Pilot's view)*".

Since turbulence impacts every aspect of the airline operation (turbulence is the 2<sup>nd</sup> leading cause of impact to National Air Space capacity, according to FAA), airlines have requested IATA to look into developing a turbulence data repository. Another reason is that turbulence is predicted to increase in frequency and strength in the coming years.

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Captain King referred to an IATA Global Turbulence Study with the result that 96% of the respondents wanted real-time objective data and believe it would improve the outcome of a flight. Current tools (such as forecasts, radars) for managing turbulence in-flight were considered as being less than perfect. Other obstacles were that there is no industry standard for turbulence reporting and that data would be kept proprietary.

Therefore, IATA was requested to develop a global, real-time and objective aircraft-sensed turbulence data exchange to improve safety and operational efficiencies. IATA is also investigating various implementation options for automated in-situ Eddy Dissipation Rate (EDR) reporting to facilitate the adoption of the technology by the airline industry. As was highlighted by Captain King, this is a big challenge for IATA because getting the Critical Mass is essential to realize the benefits.

IATA is developing a technical framework for an IATA Global Turbulence Sharing Platform. The goals for such technical framework are, among others;

- to transform objective, in-situ turbulence messages into a common format,
- ensure that blatantly incorrect data is excluded from platform dissemination, and
- offer data dissemination options to fit all use cases.

By ending his presentation, Captain King presented the time frame in which the development was to be performed, showing that the operational platform would be available as of 2019.

Mr Frank Grooters presented "*AMDAR data use and visualisation*".

Apart from the use of AMDAR data to the benefit of operational meteorology and aviation, AMDAR data is currently also supporting various other applications, directly related to social, health and safety issues.

Aircraft-Based Observations, including AMDAR, do indeed improve forecasts and warnings. Operational applications are, among others:

- i. comparison with data from radiosondes. Weather radars and wind profilers;
- ii. marine forecasting, in particular wind and wave forecasts;
- iii. fire weather, with a need for the detection of mixing heights and information on surface wind for defining the Haines (smoke dispersion) index, cases where information on wind (direction and force) and drought are crucial;
- iv. high wind events, for instance caused by a Front Range;
- v. winter weather, for defining the precipitation type and detecting lake effect snow;
- vi. convective storms, important to forecast these in time for watch and warning decisions.

Supported by some real cases, Mr Grooters highlighted the importance of the use of AMDAR data to these application areas. These applications also may have an effect on human life since they all imply a threat.

As in other presentations, Mr Grooters spoke well for more atmospheric humidity information because that would make AMDAR information used in these applications even more useful.

Visualization of the AMDAR data is very important in order to make the right decisions based on the displayed information.

Although all AMDAR data is available on the Global Telecommunication System (GTS) in the WIGOS Information System (WIS), there are not many universal display systems that can be used. Many NMHSs have the availability of in-house developed display facilities, incorporated into their existing infrastructure. These systems are special and

WIGOS/AMDAR Workshop for West Asia WMO Region VI, Workshop, Report, p. 9 in most cases cannot easily be migrated to another IT environment or are not accessible to third parties.

Mr Grooters mentioned however, that the NOAA/ESRL/GSD<sup>6</sup> has developed the Aircraft Data Web, with the use of it all (on the GTS available) aircraft data can be displayed. This web site is password protected and can be found at <https://amdar.noaa.gov/>.

NMHSs and meteorology related institutes can apply for access through the e-mail address shown at the bottom of the web page.

Mr Steve Stringer, E-AMDAR Programme Manager, described "*The current European AMDAR Programme*" and provided his views on the potential for further AMDAR expansion and new development in Europe.

Mr Stringer explained that the European E-AMDAR programme was one of the six programmes under the EUMETNET Observations Programme and presented the various components of E-AMDAR. These components formed the decentralized (components are distributed over several EUMETNET member states' NMHSs) infrastructure on which the E-AMDAR programme is established. The AMDAR programme is mainly responding to EUMETNET regional NWP and forecaster requirements, but a small percentage of AMDAR data is provided outside of the European area as a contribution to the WMO global AMDAR programme. As a result, the majority of the data coverage is over central, north and south Europe. Mr Stringer also explained to the participants that, on a regular basis, the performance of the E-AMDAR programme are compared with agreed annual minimum targets.

Regarding water vapour measurement (WVM), Mr Stringer confirmed that currently 9 Lufthansa (DLH) aircraft are equipped with WVSS-II sensors, providing water vapour information from many European airports but the majority are concentrated at German hub airports.

The current coverage of AMDAR data over Europe is not uniform and does not fully meet the EUMETNET requirement, leading to certain gaps in coverage. These gaps are mainly found in the eastern, south-eastern and south-western part of Europe (WMO RA VI). The EUMETNET area requirements also cover the northern region of Africa (RA I), which is also considered as data sparse. Efforts are continuing in trying to find solutions (e.g. new airlines) for closing these gaps. EDR turbulence monitoring is also a target for implementation under the E-AMDAR programme.

Since AMDAR is not the only available upper-air data source in Europe, Mr Stringer told the audience that it was planned to take advantage of all other new opportunities and developments, like ICAO and ATM<sup>7</sup> regulated systems and 3<sup>rd</sup> party initiatives.

Mr Stringer ended his talk with the statement that the partnership between WMO and IATA would be key to the development of global AMDAR.

## **Session 5**

Mr Dean Lockett (WMO) informed the participants on the "*Development of the IATA-WMO Collaboration on AMDAR*" and Ms Katya Vashchankova (IATA) on the "*Business and funding models with cost compensation for airlines*".

Mr Lockett provided the background on the collaboration between the two organizations, noting that at the second session of the ET-ABO (December 2015), the CBS Expert Team on Aircraft-Based Observing Systems had expressed an intention to seek collaboration with IATA on AMDAR. However, after having carried out a study on

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<sup>6</sup> National Oceanic and Atmospheric Administration/Earth System Research Laboratory/Global Systems Division (USA)

<sup>7</sup> Air Traffic Management

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AMDAR and turbulence, it was IATA that approached WMO in 2016 with regard to the outcomes and recommendations and offered to collaborate on AMDAR extension, enhancement and operation. This potential collaboration had also been suggested by some IATA member airlines as a means for enhancing the benefits of the programme to aviation, in addition to providing an opportunity to ensure more uniform and secure licensing arrangements for access to and use of the data by WMO member NMHSs and other data users.

Following a decision by the WMO Executive Council in May 2017 and agreement by the IATA Secretariat to proceed, the two organisations entered into a Working Arrangement in July 2017 which has defined the scope and terms under which the two organizations have been working together on developing the concepts and framework for the future potential collaboration.

Mr Lockett presented a likely time schedule for the development and finalisation of the collaborative framework, which was being supported by a joint IATA-WMO sub-group. It was expected that this might lead to a formal agreement on the IATA-WMO Collaboration on AMDAR following a decision by the 19th Session of the WMO Congress and the IATA General Assembly in 2019.

One of the key aspects of this work has been the development of a Concept of Operations (CONOPS) for the IATA-WMO Collaborative AMDAR Programme (IWCAP), which is based on achieving 9 goals to improve and enhance the existing programme.

Ms Vashchankova explained to the audience that one of the important aspects of the IATA-WMO collaboration will be the potential funding sources for AMDAR programme expansion. Revenues from potential commercialisation of existing AMDAR data by IATA, and supplemental contributions from external funding agencies and other stakeholders would be kept in two funds, one for covering the operational activities in the AMDAR programme, and a second fund to the programme's further development, taking into account additional support that might be required to assist participation in the programme by least developed and developing countries. Based on an IATA market study, Ms Vashchankova informed the participants that many private companies had expressed interest in receiving AMDAR data in real-time.

Mr Steve Stringer (E-AMDAR) provided a presentation to the workshop participants on "*Regional collaboration, planning and development strategies, WMO regional Association role*".

Mr Stringer described the operation of the E-AMDAR programme, which provides an excellent example of a regional collaboration that started in 2000 when all national AMDAR programmes operated by EUMETNET members were brought together under a single programme, coordinated by EUMETNET. The target was to pool and share resources and standardise AMDAR reporting for Europe, taking advantage of best practice across the various programmes. An example of how such international collaboration can lead to programme efficiency is the development and operation of the E-AMDAR data optimisation system. This ground-based system that controls AMDAR data reporting of individual aircraft in real-time, allows the programme to operate at much greater efficiency by eliminating redundant data, while taking advantage of the international nature of air transport to maximise data coverage, both spatially and temporally.

It was highlighted that, in collaboration with WMO, the E-AMDAR programme was assisting in the planned expansion of the AMDAR programme to the whole of WMO Region VI, with a particular emphasis on improving coverage over the data-sparse areas of Eastern Europe.

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Mr Stringer explained that the WMO Aircraft-Based Observations Programme (ABOP) was developing Regional Implementation Plans (A-RIPs) for each of the six WMO Regions and that the E-AMDAR Programme Manager was requested to take the lead for the development of the A-RIP for RA VI (Europe). IATA and the WMO Regional Association will be requested to assist in that development, aiming at the incorporation of the A-RIP into the regional WIGOS Implementation Plan (WIP). The establishment of a coordinating work group under the WMO Regional Association VI was expected to be an important aspect of the future development of AMDAR in the region and would also be a critical element of the framework being developed for the IATA-WMO collaboration on AMDAR.

Mr Stringer ended his talk with the offer that WMO and E-AMDAR were ready to assist NMHSs and airlines in the further expansion of the AMDAR programme in Europe.

### **Session 6**

Mr Stewart Taylor summarised the *“Technical aspects of programme development – AMDAR software, data service providers, water vapour measurement, turbulence”*.

With reference to the available documentation and other regular material (i.e. WIGOS Technical Report No. 2014-02, Requirements for the Implementation and Operation of an AMDAR Programme), Mr Taylor focussed his talk on the requirements, development and implementation of AMDAR onboard software, the relevant stakeholders and the necessary data processing, quality management and optimization. The importance of water vapour measurement and turbulence reporting was also emphasized.

Mr Taylor explained how the right type of software for AMDAR reporting could be identified by referring to a table of the type(s) of avionics capable of reporting AMDAR and available to airlines. An airline selected for integration to an AMDAR Programme – national or regional – would complete a specific questionnaire requesting information on their avionics and a cross-check against the AMDAR compatible software. The information received by the questionnaire provides the information on whether an aircraft type is AMDAR capable and the level of software development that might be needed.

On the stakeholder’s side, Mr Taylor emphasized that, in addition to the airlines and the NMHSs, good contacts with the Data Service Providers and the Avionics Vendors would be necessary.

Data processing and quality management are crucial for getting reliable AMDAR information and that is an important role for the NMHSs. If a large aircraft fleet is involved or a regional programme (with several airlines participating), data optimization could be considered in order to realize efficient coverage at the lowest cost.

In finalizing his talk, Mr Taylor showed the audience the technical details and the status of certification of the Water Vapour Sensing System (WVSS-II) and the current global coverage of turbulence information (EDR and DEVG).

### **Session 4**

*National /regional level discussions on AMDAR development and how airlines can join the programme*

In a special session, the participants from the NMHSs and the airline industry were asked to discuss the potential of initiating a national or regional AMDAR programme, having listened to the presented information so far.

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**Israel:** Has already commenced investigating the potential to develop a national programme, possibly in collaboration with 2 airlines, but assistance will be needed. Cooperation with E-AMDAR might be an option, but the advantages of such arrangement would need to be assessed against the costs of the additional charge to the NMHS for data processing and optimization.

**Georgia:** Agreed that a possible future development was feasible, but the benefits of AMDAR would first have to be presented and discussed within the NMHS.

**Croatia:** Had tentative plans for E-AMDAR participation in the 2019-2022 timeframe.

**Turkey:** Is aware of the benefits of AMDAR and was already involved in discussions with E-AMDAR regarding participation in the regional programme. Turkish Airways had recently agreed to collaborate with the Turkish State Meteorological Service and expected to soon meet with E-AMDAR to develop plans for proceeding.

**Russian Federation:** The airline representatives attending the workshop had more questions on how to proceed in participating in the programme, but agreed that the benefits of AMDAR to airlines were clear. They requested follow-up support from WMO to connect with the relevant authorities and contacts from both the aviation and meteorological communities.

**Poland:** Suggested that a business case and encouragement would be required for the national airline to consider participating and that assistance from IATA and E-AMDAR would be appreciated.

The participants were further requested to answer 5 questions in written form. The questions and a summary of the responses are provided in Annex III – Results of the .

### 3. Issues, Outcomes and Actions

The following key issues, outcomes and actions were highlighted:

- The workshop participants expressed their appreciation of the developing IATA-WMO partnership in AMDAR.
- It was agreed that the wider installation of water vapour sensing systems should be a priority so as to benefit the meteorological and aviation user communities.
- It was agreed that E-AMDAR and WMO/ABOP should assist the Israel Meteorological Service, where needed, in the establishment of a national AMDAR programme in collaboration with the national airline.
- It was agreed that WMO should assist the airlines in the Russian Federation interested in the participation in an AMDAR programme, in contacting the Russian NMHS.
- The workshop welcomed the news that there had recently been agreement between stakeholders in Turkey to develop a national AMDAR programme. It was agreed that E-AMDAR would offer advice and assistance in this endeavour with the possibility to establish a programme either at the national level or to participate as a partner within the E-AMDAR regional programme.

#### Actions

WIGOS/AMDAR Workshop for West Asia WMO Region VI, Workshop, Report, p. 13

1. The workshop Member participants agreed to increase efforts to collaborate with their national airlines towards the development of new AMDAR programmes in the eastern and south-eastern parts of WMO Region VI.
2. WMO/ABOP will investigate the opportunities and benefits of the implementation of AMDAR software in Electronic Flight Bags (EFBs).
3. WMO and IATA will consider the possibility to jointly write to aircraft manufacturers and avionics vendors and applications developers, encouraging them to consider the future provision of AMDAR software and related infrastructure (e.g. water vapour sensor) as standard or optional available items with new aircraft.
4. WMO/ABOP to inform the Russian Federation airlines on the alternatives in the provision of aircraft-based observations when no ACARS is available.
5. WMO/ABOP and E-AMDAR, in collaboration with workshop participants and regional members to continue to work towards the expansion of AMDAR over WMO Region VI.

#### **4. Close of the Workshop**

Following the completion of the workshop programme of presentations and discussions, Mr Dean Lockett thanked all presenters and participants for their input to the workshop and also thanked OMSZ for hosting the event and for their generous hospitality to all participants.

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**ANNEX I - WORKSHOP PROGRAMME**

7 December			
Session	Time	Topic or Item	Presenter/Chair
Session 1	0830	<b>Workshop Registration</b>	
	0900	<b>Workshop Opening</b>	1. Dr Kornélia Radics, Director OMSZ 2. Mr Dean Lockett, WMO
	0910	<b>Workshop Schedule &amp; Practical Arrangements</b>	Chair, Host
	0915 25 min	<b>What is AMDAR and why we need more meteorological services and airlines to participate</b> <ul style="list-style-type: none"> <li>Description of AMDAR and its operation and current status</li> <li>The importance of airline participation in the real-time reporting of aircraft-based observations</li> <li>The role of meteorological services and their partnership with airlines</li> </ul>	Mr Dean Lockett, WMO
	0940 25 min	<b>Use and benefits of AMDAR to airlines and the wider aviation and meteorological community</b> <ul style="list-style-type: none"> <li>Impact of AMDAR data:</li> <li>More accurate forecasts and improved meteorological services</li> <li>Improved flight safety and fuel efficiency for airlines</li> </ul>	Mr Curtis Marshall, NOAA
	1005 25 min	<b>IATA and airlines role in the AMDAR program</b> <ul style="list-style-type: none"> <li>How airlines can potentially benefit from WMO-IATA funding to adopt the technology.</li> </ul>	Mr Brent King, IATA, Ms Katya Vashchankova, IATA
Break	1030	Coffee/Tea Break	
Session 2	1100 30 min	<b>AMDAR data use in OMSZ</b> <ul style="list-style-type: none"> <li>AMDAR data assimilation in OMSZ NWP</li> <li>Impact of AMDAR data in OMSZ forecasting</li> </ul>	Mr Máté Mile, OMSZ
	1130 60 min	<b>Importance of AMDAR to airlines</b> <ol style="list-style-type: none"> <li>Benefits of AMDAR-A Pilot's Perspective</li> <li>Benefits of AMDAR to airline operations</li> <li>Benefits of AMDAR to terminal forecasting and ATM</li> </ol>	Mr Vincent Boschat, Air France Mr Bjorn Syren, Rockwell Collins Mr James Shapland, Met Office
	1230 15 min	Visit to OMSZ Forecasters Room (AMDAR data visualization and use in aeronautical forecasting)	All
Break	1245	Lunch break	

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Session 3	1345	Q&A and Discussion of the Morning Presentations (20 mins)	Participants, Presenters
	1405	<b>IATA role in the development of turbulence monitoring and its use in airline operations (Pilot's view)</b>	Mr Brent King, IATA
	1430	<b>AMDAR data use and visualization</b>	Mr Frank Grooters, WMO
	1500	<b>Current European AMDAR programme and potential for further AMDAR Expansion and new development in Europe</b>	Mr Steve Stringer, EUMETNET
Break	1530	Coffee/Tea break	
Session 4	1600	Discussion Session for National/regional level AMDAR development and how airlines can join the program, 5 questions to the participants	
	1645	Feed-back/ Summary/ Q&A	Panel
End	1730	End Day 1	

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Day 2, 8 December			
Session	Time	Topic or Item	Presenter/Chair
Session 5	0900	Summary Day 1, Questions, Introduction to today's programme	Mr Dean Lockett, WMO
	0915	<b>Development of the IATA-WMO Collaboration on AMDAR</b> <b>Business and funding models with cost compensation for airlines</b> <b>Discussion</b>	Mr Dean Lockett, WMO Ms Katya Vashchankova, IATA
	1000	<b>Regional collaboration, planning and development strategies, WMO Regional Association role</b>	Mr Steve Stringer, EUMETNET
Break	1030	Coffee/tea break	
Session 6	1100	<b>Technical aspects of programme development - AMDAR software, data service providers, water vapour measurement, turbulence</b>	Mr Stewart Taylor, EUMETNET/WMO
	1130	<b>Plenary discussions on national/regional AMDAR programme development</b>	Mr Steve Stringer, Mr Dean Lockett
	1215	<b>Review Workshop Results &amp; Recommendations, Plans for follow-up, Final Summary</b>	Mr Dean Lockett, Mr Frank Grooters
End	1245	Workshop End	

**ANNEX II - LIST OF PARTICIPANTS**

Name	Country	Organization	Role	Email Contact
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Mr Stewart Taylor	UK	EUMETNET, WMO	Presenter	<a href="mailto:stewart.taylor@metoffice.gov.uk">stewart.taylor@metoffice.gov.uk</a> <a href="mailto:staylor@wmo.int">staylor@wmo.int</a>
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Mrs Kornélia Radics	Hungary	OMSZ	Host, NMHS Participant	
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## ANNEX III - RESULTS OF THE QUESTIONNAIRE

In **Session 4** of the Workshop Programme, 5 questions were presented to the participants with the request for written answers. This Annex reflects a compilation of the answers.

### 1. About AMDAR

#### a. Do you now understand how it operates and the benefits?

All participants declared to understand the AMDAR system and the benefits provided by the AMDAR data.

#### b. Is there any additional information you would like/require?

Most participants did not require additional data; some had read in advance the AMDAR information available on the AMDAR web site.

The representatives from the Russian Federation asked a technical question related to the AMDAR transmission from the aircraft to the ground and wondered whether another system than ACARS could be used.

Questions related to support to airline(s) will be asked to IATA via e-mail.

### 2. In relation to your organisation:

#### a. Is it relevant and, if so, how? If not, why not?

All participants considered AMDAR as relevant to their organisations, for various reasons:

- i. the production of new data sets in coordination with the national airline, preferably in a regional programme (E-AMDAR);
- ii. not only relevant for the NMHS but also for ATM;
- iii. relevant for the NMHS and for the airline to become part of the AMDAR programme;
- iv. relevant but the problem is the lack of (forecasting? Technical?) specialists;
- v. relevant in producing better quality meteorological products;
- vi. relevant because the assimilated AMDAR data to the models can improve the skills of the organisation;
- vii. relevant in relation to global coverage and airline operations, but having problems because of old aircraft fleet for retrofitting.

#### b. How might your organisation become involved and what might be the process?

A variety of answers were provided by the participants to this question:

- i. the NMHS should be represented in a (regional) programme, good collaboration and coordination with the national airline, processing the relevant meteorological products;
- ii. good presentation (of the system and its benefits) to the top management, providing guidance documentation (describing the system and requirements);
- iii. bringing the information from this workshop up to the higher internal level;
- iv. starting a wider cooperation with the national airline;

- v. from an airline perspective, starting a meeting with the NMHS with the aim to start the process.

In two cases (Israel and Turkey) actions have been started and plans are in an early state.

**c. Do you need any assistance?**

The organisations (NMHSs and airlines) already in contact in relation to a potential development of AMDAR did not need any assistance at this moment.

Others however preferred to start an internal discussion first before requesting additional support or assistance.

If deemed to be required, WMO, IATA and E-AMDAR will be contacted either for providing guidance how to contact the NMHS or the airline, or for further programme related (operations or technical issues and training) information.

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