



**World Meteorological Organization**

**WMO Integrated Global Observing System**

**AMDAR Workshop for the South-West Pacific Region (WMO Region V)**

**22-23 May 2017, Jakarta, Indonesia**



**WORKSHOP REPORT**

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## WORKSHOP REPORT SUMMARY

### 1. Workshop Opening

The WMO Regional AMDAR Workshop for the South-West Pacific Region (WMO Region V) was held over 22 to 23 May 2017 at the Head Quarters of the Badan Meteorologi, Klimatologi, dan Geofisika (BMKG, the Agency for Meteorology, Climatology and Geophysics of Indonesia) in Jakarta, Indonesia, at the kind invitation of the Agency.

The opening ceremony started with a special welcome dance, the Sekar Jagat dance, performed by four female dancers. The Sekar Jagat dance is used as an opening dance at many occasions when attended by governmental officials. Sekar means "flower", and Jagat means "the world". Sekar Jagat means "beautiful flowers adore the world, giving beautiful color to the world".

The workshop was opened by Dr Andi Eka Sakya, Director-General of BMKG, PR of the Republic of Indonesia with WMO and President of RA-V. Dr Sakya welcomed all participants to the workshop and to Jakarta. With reference to Captain Mark Holey (General Management Operational Policy, Cathay Pacific Airways), Dr Sakya quoted that *modern technology is expected to deliver faultless forecasts and accurate and consistent forecasting is required*. It was a well-known fact that safety is aviation's No.1 Priority and that weather is the second biggest threat to flight safety. This (safety) has become an increasing issue since air traffic is doubling every 15 years. Automation of observations was therefore one of the most relevant developments for the air transport industry. In line with that, and according to new ICAO directives (39<sup>th</sup> Triennial Assembly, 2016), *meteorology is an enabling or supporting function for multiple threads of ASBU<sup>1</sup> in the GANP<sup>2</sup>*. In this respect, Dr Sakya referred to recently proposed amendments to Annex 3 (ICAO Doc. 8896), regarding requirements for (General and Routine) Aircraft Reports. Dr Sakya further stated that requirements for Aircraft Reports were not currently being met and ATMs were currently not able to fully utilise and realise the benefits of Aircraft Reports in their operations, but that NextGen and SESAR were establishing the under-laying requirements for a more efficient ATM in the future. Meanwhile, because meteorological services were not receiving the high-resolution data required to support modern NWP systems, the WMO AMDAR Observing System was therefore well placed to fill these gaps. He acknowledged the appreciation of the WMO AMDAR observing system by a variety of stakeholders, in particular WMO Member countries in RA-II and RA-V, airlines and a diversity of user groups. In conclusion, Dr Sakya wished all participants a successful and instructive workshop.

Mr Dean Lockett of the WMO Secretariat also welcomed all participants to the workshop on behalf of the WMO Secretary-General, thanking in particular BMKG for hosting the event, all speakers and presenters, and, in particular, Mr Zulkarnain and his colleagues, for their excellent support, coordination and management of the event in Jakarta. Mr Lockett emphasised the importance of this workshop given that the region was currently a data-sparse area for aircraft-based observations and that the Air Transport Industry would be expected to benefit considerably from the development of new AMDAR programs with national and regional partner airlines.

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

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<sup>1</sup> Aviation System Block Upgrades

<sup>2</sup> Global Air Navigation Plan

## 2. Workshop Programme

The workshop programme consisted of a series of presentations by representatives of WMO Member States and other experts interspersed with periods for questions and answers, and for open discussions. In particular:

- Mr Frank Grooters presented a brief history of aircraft-based observations, starting in the early 1019s with the registration of atmospheric parameters leading to the development of the automated WMO AMDAR observing system in the late 1980s. Mr Grooters then described the basic operation and current status of the AMDAR observing system and the WMO programme under which it was managed and maintained at the international level.
- Mr Dean Lockett made a presentation to the workshop outlining the various requirements and best practices for the implementation and operation of a national or regional AMDAR programme. This included the requirements for upper-air data as described in the WMO Rolling Review of Requirements (RRR) and the Observing Systems Capability Analysis and Review Tool (OSCAR), programme planning and design, interactions with partner national airlines and the management, quality monitoring and control of the data. Participants were informed about existing related WMO AMDAR Observing System Resources<sup>3</sup> such as WIGOS Technical Reports and other regulatory and guidance information.
- Mr Curtis Marshall, Chairman of the Expert Team on Aircraft-Based Observing Systems, made a presentation on the benefits and impacts of the use of AMDAR data. This presentation was accompanied by a variety of examples, supporting the benefits of AMDAR data to a diverse number of applications, including climatology, meteorology and the airline operations. Also the positive impact on the results of several (global and regional) NWP models was presented.
- Mr Carl Weiss, ET-ABO Training and Outreach Coordinator, informed the workshop about AMDAR data display and gave examples of operational data usage. Participants were in particular demonstrated how to use of the NOAA Global Systems Division (GSD) AMDAR data web site for AMDAR data display. Examples of data use included comparison of observations to verify suspicious radiosonde and NWP model moisture observations, employing AMDAR winds to upgrade a wind advisory to a high wind warning and using AMDAR winds and moisture to update a terminal forecast of ceilings and visibilities, among others.
- Ms Tammy Farrar (FAA) informed the audience about the current status in the United States Eddy Dissipation Rate (EDR) Turbulence and Prediction programme. As part of the NextGen initiative, the motivations for the implementation of EDR are that turbulence impacts (sometimes heavily) on airline operations, which is a safety related concern of airlines and passengers, and to provide a solution for the shortfalls in turbulence reporting through manual (subjective) turbulence PIREP reports. EDR is an automated in-situ reporting system developed by the US National Center for Atmospheric Research (NCAR). Global expansion of the EDR implementation is expected in the near future. Additional development for providing EDR Turbulence forecasts by using Graphical Turbulence Guidance (GDG) and GDG "Nowcast" (GDG-N) was also presented. It was noted that, in cooperation with a US carrier, turbulence information was presented to the pilot on a Cockpit Flight Weather Viewer. EDR is one of the parameters able to be reported in an AMDAR message.

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<sup>3</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)

- Mr Chris Hill (NOAA National Centers for Environmental Prediction, NCEP) made a presentation on the Assimilation of AMDAR Observations for Numerical Weather Prediction (NWP). Starting with the current state of aircraft-based data assimilation at NCEP, Mr Hill further showed the global distribution of AMDAR data utilized at the four main hour assimilation cycles (important for the impact on NWP output), the value of the aircraft-based observations (compared to the conventional observations types), and highlighted briefly the updates made in the NCEP data assimilation to improve the systems output. A result of the assimilation of aircraft-based observations is, that these observations have provided the greatest reduction of NWP forecast error due to their large number, wide special distribution, and good quality. If based on consideration of the impact per observation, singular aircraft data are highly impactful due to their unique placement in time and space.  
Significant revisions (mainly 3-D Var to 4-D Var) of the NOAA Global Data Assimilation System (GDAS) were completed in May 2016, allowing more effective assimilation of time- and space-variant aircraft data.
- Dr Doug Body (Australian AMDAR Programme), Mr Kevin Alder (New Zealand AMDAR Programme), Mr Curtis Marshall (US MDCRS/AMDAR Programme) and Mr Stewart Taylor (E-AMDAR) each briefly presented a description of the developmental and operational aspects of their respective national/regional programmes. The workshop participants were informed that these programmes were potentially able to provide a limited amount of AMDAR observations for some countries (at flight level and profiles at visiting airports) outside of the normal operational domains of the programmes. Such provision of supplementary AMDAR data was usually derived through a bilateral arrangement between the programme and the recipient country.
- Mr Bryce Ford (HMEI/SpectraSensors) gave an introduction to the Water Vapour Sensing Instrument (WVSS-II). This instrument is increasingly installed into US aircraft (140+) and European aircraft (9). Water Vapour Measurement (WVM) provides important atmospheric information to the meteorological users as well as to the airlines, and can be included in the AMDAR message. Studies have shown, that the NWP benefits significantly from the assimilation of WVM data through AMDAR.

Mr Ford also informed the workshop participants that in addition to cooperating with the airline industry, the WMO AMDAR Programme has a very fruitful relationship with other areas of private industry. Many of these industries are members of the Hydro-Meteorological Equipment Industry (HMEI) organisation, which is co-located at WMO. HMEI members are often represented on WMO Expert Teams, such as the ET-ABO.

- Ms Jeannine Hendricks (HMEI/Rockwell Collins-Information Management Services) briefed the participants on the data services and support for airline interaction that Rockwell Collins/IMS is able to provide to new and existing AMDAR programmes. IMS operates a global VHF and satellite communications network with extensive coverage, used by many airlines for the transmission of operational aircraft data and also for the transmission of meteorological and air traffic information, including AMDAR and ADS-C. Aviation hardware is also maintained by IMS, allowing the company to install AMDAR applications and related infrastructure when agreed with the airline. Further services can be provided through the availability of an IMS Optimization Solution (currently in use by the E-AMDAR programme). Recent implementations with the support of IMS are the Mexico AMDAR programme (WMO Region IV) and the South-American AMDAR programme with the LATAM Airlines Group S.A. (WMO Region III).

## **ABO and AMDAR Opportunities in the South-West Pacific Region**

During Day 1/Session 3 of the workshop, Mr Grooters provided the workshop participants with a presentation on the opportunities and potential within the South-West Pacific Region to further expand the AMDAR coverage and increase the availability of aircraft-based observations in support of both the meteorological and aviation communities. Mr Grooters outlined the key target airlines for recruitment in the region that had been highlighted by the [WMO study on AMDAR Coverage & Targeting for Future Airline Recruitment](#) and showed examples of current regular flights operated by several national airlines in the Region, which were potentially capable of providing AMDAR data and would cover a large part of the data sparse area in this region. Mr Grooters urged Member participants to collaborate with their national airlines towards the development of new AMDAR programmes in the region and, if possible, to work together in the region to realise efficiencies through international collaboration and cooperation. Mr Grooters also urged Member participants to assist WMO in the coordination of the Aircraft-Based Observations Programme (ABOP), through endeavours to foster regional collaboration through the WMO Regional Association V.

## **Airline and NMHS perspectives on the implementation of AMDAR**

- Mr S.E. Budiyanto presented the airline perspective regarding the implementation of AMDAR as considered by Garuda Indonesia. Demonstrated by a number of examples, Mr Budiyanto showed that, on several occasions per year, Garuda flights are delayed or have to be cancelled due to severe weather conditions, e.g. as a result of typhoons, where other airlines had been able to continue their services. The Garuda management was informed by the Flight Dispatch Center that improved operational information, including better weather service information, would be needed in the future in order both to increase the level of safety for their flights and to allow improved and more efficient operations in severe weather situations. In particular, more accurate weather information was required for better defining and forecasting the wind field (e.g. Jetstream location), the location and intensity of turbulence and the presence of wind shear. Additionally, it was recognised that better knowledge of the atmospheric temperature profile was important for convective weather forecasting, such as the presence and intensity of thunderstorms. Currently the weather information received from the weather service provider is based on PIREPS and (sometimes) AMDAR and plotted on (wind) charts, but was not always provided for the required altitudes. More frequent updates of the meteorological situation was needed. Mr Budiyanto also suggested that an important product that was required was one that could provide a cross section of the relevant meteorological parameters (wind, turbulence, icing, convection) at each flight level.

Mr Budiyanto concluded with the statement that AMDAR implementation was important to aviation, and that (regular) updates of the meteorological products based on ABO/AMDAR would be able to assist the forecaster to produce a more accurate service to the airline.

- Mr Zulkarnain presented the AMDAR Programme Development perspective for Indonesia seen from the BMKG point of view. The current BMKG national meteorological observation network includes surface observations (synoptically and METAR oriented), upper-air observations (pilot balloons, radiosondes), special aircraft observations (PIREPS, AMDAR, special ICAO observations related to volcanic ash) and remote sensing observations (radar, Mode-S/ADS-B). Mr Zulkarnain suggested to the workshop that the chief challenges for BMKG included: gaining technical knowledge and experience in AMDAR technology, increasing airlines' awareness of the benefits of the

AMDAR programme and perhaps establishing the provision of AMDAR data as national requirement under the civil aviation authority. The fact that many airlines in the Region operate aircraft with ACARS capability (including Garuda Indonesia and Indonesia AirAsia), means there is great potential to further develop and expand AMDAR in the South Pacific region.

Mr Zulkarnain concluded his presentation by making the following recommendations/requests of WMO and its technical commissions:

- To provide technical assistance to Indonesia on AMDAR programme development;
- To provide assistance and support for further collaboration with potential AMDAR partner airlines; and
- To continuously promote the standardisation and the establishment and expansion of AMDAR with organisation and industry partners such as ICAO and IATA.

The Workshop Programme is provided within [Annex I](#).

### **3. Issues, Outcomes and Actions**

The following key issues, outcomes and actions were highlighted:

- It was agreed that development of a national AMDAR programmes in Indonesia should be a priority for BMKG.
- It was agreed that BMKG would firstly internally agree on how to initiate an AMDAR programme (based on the development of a business case) before approaching the airline.
- The workshop agreed that BMKG would be supported by the ET-ABO in the promotion of the development of AMDAR in the region.
- BMKG would nominate Mr Zulkarnain as the successor of the retired Indonesian member in the Task Team for the development of the Aircraft-Based Observations Program Regional Implementation Plan (A-RIP) for Region V.

#### **Actions**

1. The workshop Member participants agreed to increase efforts to collaborate with their national airlines towards the development of new AMDAR programmes in the South-West Pacific Region.
2. The workshop Member participants agreed to provide support for the development of the Aircraft-Based Observations Program Regional Implementation Plan for Region V through the WMO Regional Association V.
3. The Vanuatu Meteorological Services (through Mr Antfalo) to investigate the possibility to implement AMDAR into the new Air Vanuatu B737-800.
4. ET-ABO (through Mr Lockett) to request BMKG for feed-back on progress.

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

Following the completion of the programme of presentations and discussions, Mr Grooters thanked the Agency for Meteorology, Climatology and Geophysics of Indonesia for hosting the event and for the generous hospitality provided to all participants. Mrs Nurhayati, Head of the Center for Public Weather, provided the closing address to the workshop on behalf of the Director-General of BMKG, thanking all participants and presenters. Mrs Nurhayati summarized the outcome of the workshop in looking forward to collaboration in the development of a national AMDAR programme and in assisting BMKG in increasing the awareness of the benefits of AMDAR to the airlines.

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**ANNEX I – WORKSHOP PROGRAMME**

Day 1, 22 May			
Session	Time	Topic or Item	Presenter/Chair
Day 1 Session 1	0830	Workshop Registration	
	0900	Workshop Opening	1. Dr Andi Eka Sakya, Director General BMKG 2. Mr Dean Lockett, WMO
	0930	Workshop Schedule & Practical Arrangements	Chair, Host
	0940	History of Aircraft-Based Observations & AMDAR	Mr Frank Grooters
	1000	Current Status of the Aircraft-Based Observations and the AMDAR Observing System	Mr Frank Grooters
Break	1030	Coffee/Tea Break	
Day 1 Session 2	1050	Operational Requirements of AMDAR Data (including Quality Monitoring and Control)	Mr Dean Lockett
	1130	AMDAR Benefits (Applications)	Mr Curtis Marshall
	1200	Q&A and Discussion of the Morning Presentations	Participants, ET-ABO, Presenters
Break	1230	Lunch break	
Day 1 Session 3	1345	AMDAR Data Display & Data Use	Mr Carl Weiss
	1430	Airline Perspective of AMDAR Implementation	Mr SE Budiyanto (Garuda Indonesia)
	1500	ABO&AMDAR Opportunities in the South-West Pacific Region	Mr Frank Grooters
Break	1530	Coffee/Tea Break	
Day 1 Session 4	1550	Water Vapour Measurement	Mr Bryce Ford (HMEI/SpectraSensors)
	1610	Communications and Data Service Provision	Ms Jeannine Hendricks (HMEI/Rockwell Collins)
	1630	Panel discussion and feedback from participants	Participants, ET-ABO, Presenters
	1730	End Day Sessions	
Evening Event	1900	Dinner hosted by BMKG	

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Day 2, 23 May			
Session	Time	Topic or Item	Presenter/Chair
Day 2 Session 1	0900	Recap (issues, questions/comments) Day 1	Participants (ET-ABO, Presenters)
	0930	EDR Turbulence Reporting & Prediction	Ms Tammy Farrar
	1000	NWP Assimilation	Mr Chris Hill
Break	1030	Coffee/Tea Break	
Day 2 Session 2	Operational Regional and National Programs, Status, Potential Coverage (Targeting) in RA-V and Regional Development:		
	1050	European E-AMDAR Programme	Mr Stewart Taylor
	1115	Australia/New Zealand AMDAR Programme	Dr Douglas Body/ Mr Kevin Alder
	1145	US MDCRS/AMDAR Programme	Mr Curtis Marshall
	1210	Regional Association (RA-V) Collaboration for AMDAR Implementation	Dr Douglas Body
Lunch	1245	Lunch Break	
ay 2 Session 3	1415	Indonesia AMDAR Programme Development Perspective	Mr Zulkarnain
	1440	Final Panel discussion and feedback from participants	Participants, ET-ABO, Presenters
Day 2 Session 4	1500	Closing Ceremony	
	1515	Workshop Close	
	1530 to 1700	The conference venue will be available for meetings and discussion among meteorological service representatives and national airline representatives. The Task Team on ABO* will also have the opportunity to meet and discuss further progress in the development of the ABOP Regional Implementation Plan (A-RIP) for RA-V.	

**ANNEX II – LIST OF PARTICIPANTS****WMO Invited Experts**

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