

**WORLD METEOROLOGICAL ORGANIZATION**

**Joint Meeting of  
WMO AMDAR Panel  
(14<sup>th</sup> Session)  
and  
WMO CBS/Expert Team on Aircraft Observations  
(3<sup>rd</sup> Session)**

**Quebec City, Canada, 2 – 4 November 2011**

**FINAL REPORT**



## **EXECUTIVE SUMMARY**

The Fourteenth AMDAR Panel Meeting (AMDAR-14), and the Third Session of the CBS Expert Team on Aircraft-based Observations (ET-AIR), was conjointly held at the Fairmont, le Chateau Frontenac, Quebec City, Canada, over November 2-4 November 2011.

The Joint Meeting was very successful, incorporating a large agenda with an emphasis on the development of an invigorated work programme that seeks to align the work of the Panel and the Expert Team with the Implementation Plan for the Evolution of the Global Observing System over the longer term, and the work of the WMO Technical Commissions over the medium and shorter terms.

The progress made by the Panel and the ET over the past 12 months in implementing the AMDAR Programme was presented with highlights including: the expansion and improvement of AMDAR data coverage over key areas including Alaska, Africa, the Southwest Pacific and Antarctica; continued progress on the WIGOS Pilot Project; near completion of a new BUFR template for AMDAR; significant progress on an update to the ARINC 620 software specification; further progress on operational implementation and final validation of water vapor sensing technology; and, several developments associated with AMDAR software.

The Panel and the ET continued discussions on the repercussions of the changing governance structure of the AMDAR Programme as it becomes more integrated into WMO as a component of the GOS and also with the new arrangement for technical support to the Panel in which, from January 2012, it will be funded by WMO under the Regular Budget as an outcome of Cg-XVI.

The Joint Meeting was presented with the current status and development plans of the national and regional AMDAR Programmes and discussed the means by which the Panel and the ET can address the development of new and potential programmes in the future. A key outcome was that the work programme will in the future place more emphasis on strategically focused assistance for developments that have both a high chance of success and will have an impact on improving global AMDAR data coverage, rather than attempting to administer large regional projects for which it is difficult to find and resource leaders. An example of such assistance that can and will be delivered is the Regional AMDAR Workshop to be held in Mexico City in November 2011.

The activities of the AMDAR Panel Science and Technical Sub-group and the Training and Outreach Sub-group were reported on by the respective Sub-group leaders.

The Joint Meeting identified that the final validation and the commencement of the global implementation of water vapor sensing as a component of AMDAR will become a high priority within the work programme and there was discussion towards the reinvigoration of an internationally coordinated approach. Also identified was the need to develop strong business cases for both WMO Members and the Aviation Industry to ensure support for wider operational implementation.

Another high priority activity identified as requiring greater support is the internationalization of the turbulence and Eddy Dissipation Rate monitoring programme that has been under development in the USA for many years. The Panel has strengthened ties with the relevant

bodies under which this development is managed and plans have been made to commence trials and implementation outside of the USA.

The work underway in relation to the WIGOS Pilot Project for AMDAR contributing to improvement to the AMDAR Quality Management System will continue and be expanded in the future.

Other topics covered included: the production of a quarterly AMDAR Programme newsletter; various AMDAR software developments, AMDAR application to climate monitoring, data quality issues and revision of AMDAR regulatory material and the WMO Aircraft Observations website.

A work programme incorporating long, medium and 12-month plans was drafted that will be reviewed and finalized by the AMDAR Panel Management Group (APMG), which was expected to meet twice throughout 2012. A report on the status of the AMDAR Trust Fund was presented and, in line with the plans made through the planning process conducted during the meeting, a draft budget for the coming year was approved and will also be finalized by the APMG.

The Expert Team for Aircraft-based Observations reviewed its Terms of Reference and work programme and a review of the draft Implementation Plan for the Evolution of Global Observing Systems was conducted.

The Chairman of the AMDAR Panel and ET-AIR on behalf of the meeting expressed gratitude to Environment Canada for their generous hospitality and the provision of such excellent facilities in support of the meeting.

## **MEETING AGENDA**

- 1 OPENING OF THE MEETING
- 2 ORGANIZATION OF THE MEETING
  - 2.1 Adoption of the agenda
  - 2.2 Working arrangements and other organizational matters
- 3 AMDAR PROGRAMME STATUS
  - 3.1 Status of technical support to the AMDAR Panel
  - 3.2 Report on the status of the AMDAR
  - 3.3 Reports on activities by the Panel sub-groups
  - 3.4 Status reports on national and regional programmes
    - 3.4.1 Established AMDAR programmes
    - 3.4.2 New, emerging and potential AMDAR programmes
- 4 PROJECTS, PLANNING AND WORK PROGRAMME
  - 4.1 WIGOS Pilot Project – Review and Planning Update
  - 4.2 Global AMDAR Programme Development
  - 4.3 AMDAR Software Development
  - 4.4 AMDAR Quality Management System
  - 4.5 AMDAR documentation, training and outreach
  - 4.6 AMDAR Science and Technical Development
  - 4.7 AMDAR Planning
- 5 FINANCIAL AND ADMINISTRATIVE MATTERS
  - 5.1 Status of the AMDAR Trust Fund
  - 5.2 Budget for 2011-2012
  - 5.3 Future Governance of the AMDAR Programme
  - 5.4 Review of Rules and Procedures
  - 5.5 Election of officers
- 6 ET-AIR ADMINISTRATIVE MATTERS AND REPORTING TO CBS
- 7 ANY OTHER BUSINESS
- 8 DATE AND PLACE OF THE NEXT MEETING OF THE AMDAR PANEL
- 9 CLOSURE OF THE MEETING

## **LIST OF APPENDICES**

1. List of Participants
2. AMDAR Panel Session 14 and ET-AIR Session 3 Actions
3. AMDAR Panel and ET-AIR Draft Work Plan
4. Purpose and Terms of Reference for the WMO Panel on Aircraft Data Meteorological Relay
5. Commission for Basic Systems, OPAG IOS, Expert Team on Aircraft-based Observations, Proposed Terms of Reference
6. AMDAR Panel Trust Fund Budget Projection for 2012

## **GENERAL SUMMARY OF THE WORK OF THE SESSION**

### **1 OPENING OF THE MEETING**

- 1.1 The Fourteenth AMDAR Panel Meeting (AMDAR-14), conjointly organized with the Third Session of the CBS Expert Team on Aircraft Based Observations (ET-AIR), was opened by the Chairman, Mr Frank Grooters at 9:00am on Tuesday, 2 November 2011, at the Fairmont, le Chateau Frontenac, Quebec City, Canada.
- 1.2 The Participants of the Joint Meeting were addressed and welcomed by Mr Philippe Morel, Quebec Regional Director General for Environment Canada. Mr Morel affirmed Canada's commitment to the AMDAR Programme through the updating of Environment Canada's strategy for the sustainability and further development of AMDAR as a component of the broader Canadian Upper Air Monitoring Strategy.
- 1.3 The Joint Meeting was also addressed and welcomed by Mr Dean Lockett on behalf of WMO and the WMO Secretariat, who outlined the need and reasons for a focus for the meeting on the planning process and work programme development for both the AMDAR Panel and the ET-AIR as the further and full integration of the AMDAR Observing System into WMO under the WMO Integrated Global Observing System and the World Weather Watch Programme.
- 1.4 Both the Chairman and Mr Lockett expressed their thanks and gratitude to Environment Canada for hosting the meeting and for the in-kind contribution of the meeting facilities provided.

### **2 ORGANIZATION OF THE MEETING**

#### **2.1 Adoption of the agenda**

- 2.1.1 The Provisional Agenda was adopted with some minor alterations to the order proposed by the Chairman.

### **3 AMDAR IMPLEMENTATION**

#### **3.1 Status of technical support to the AMDAR Panel**

- 3.1.1 The Joint Meeting was informed that subsequent to the agreement between WMO and the AMDAR Panel at the joint meeting in October 2010, Geneva, the AMDAR Technical Coordinator (TC) role had been jointly funded by the AMDAR TF and the WMO Regular Budget and fulfilled through the allocation of a Scientific Officer position within the Observing Systems Division of the Secretariat. Additionally and also as agreed, the Panel and the Secretariat had sought approval from CBS and Congress for full funding of the position from the WMO Regular Budget (RB). CBS-Ext (2010) and Cg-XVI, fully supported the proposed integration of AMDAR into WMO structures and subsequently Cg-XVI agreed on the additional resources to be allocated for this purpose. Therefore, as of 1 January 2012, the position of the Scientific Officer - Aircraft and Remote Sensing Observations will be fully funded from the WMO RB.

- 3.1.2 In November 2010, WMO advertised for the position of Scientific Officer, Aircraft-based and Remotely-sensed Observations (SO/ARO) and conducted interviews in March 2011. Mr Dean Lockett was appointed to the position at the P4 level and commenced work in the Secretariat in June 2011.
- 3.1.3 As a result, the AMDAR Panel will therefore, from January 2012, cease funding of the 50% of the AMDAR Programme TC functions and role and, whilst this arrangement means that the AMDAR Panel effectively has no responsibility for the funding of a TC position, it also means that the Panel continues to have access to the services and support of SO/ARO in the TC role at only 50% work capacity, as decided at the joint meeting in October 2010.
- 3.1.4 The Joint Meeting was invited to consider how best to handle these new arrangements and in particular how best to manage the reduced TC capacity available to the AMDAR Panel. It was pointed out that, in order to maintain the same level of technical work capacity expected and delivered in the past, several options were available including:
- The contracting of technical expertise through the use of funds from the Trust Fund;
  - More of the technical work of the Panel to be carried out by Members as time and national priorities allow; and,
  - A reduction in the frequency of meetings to biennial so that as to reduce the workload of SO/ARO in their organization and coordination.
- 3.1.5 Three recommendations were made to the Joint Meeting:
- 3.1.6 **Recommendation 1:** To ensure that AMDAR Panel Member NMHSs understand this situation and continue to support the work programme of the Panel through contributions to the Panel Trust Fund, it is recommended that the Panel adopts a more rigorous and detailed approach to the planning and coordination of its work programme.
- 3.1.7 **Recommendation 2:** It is recommended that the Panel works towards the establishment of a more detailed planning process with documentation that encompasses the compilation and maintenance of long, medium and short term plans and clearly establishes an annual work programme taking into account availability of financial and other resources. The planning activity and work programme should take into account: WMO programme outcomes; the terms of reference and work programme of OPAG IOS; and, the over-arching planning associated with the evolution of the Global Observing System under the leadership and coordination of OPAG-IOS/ET-EGOS.
- 3.1.8 **Recommendation 3:** Joint AMDAR Panel and ET-AIR meetings to be conducted biennially from and subsequent to AMDAR Session 15 and ET-AIR Session 4 (2012).
- 3.1.9 Recommendations 1 and 2 were supported by the Joint Meeting.
- 3.1.10 Whilst considered by the Joint Meeting, recommendation 3 was not adopted at this time and the decision on biennial meetings was deferred until the next joint meeting, which is expected to be held in 2012 (see item 7 below).

3.1.11 The recommendations prompted considerable discussion on the governance of the AMDAR programme and its transition from the AMDAR Panel to the World Weather Watch Programme under CBS and CIMO. In particular, concern was expressed regarding whether or not the work programme of The Panel can be accommodated under the Terms of Reference of an expert team. Additionally, concern was expressed regarding the future of the Trust Fund and the authority for its use and operation. This is addressed further under item 5.3.

3.1.12 It was recognized that consideration must be given to finding ways to provide supplementary support for technical coordination activities, given the 50%-only capacity of the SO/ARO position to support AMDAR technical coordination. This would likely include funding from the Trust Fund for the contracting of an additional temporary support role as needed and approved by the AMDAR Panel Management Group (APMG).

### **3.2 Report on the status of the AMDAR programme**

3.2.1 A report was presented to the Joint Meeting providing an overview of the progress achieved in implementing the work programme of the AMDAR Panel over the previous 12 months.

3.2.2 The AMDAR Panel continued to operate as a WMO affiliated body made up of Members of WMO operating under the Terms of Reference that have been put in place and maintained by the Panel Membership. AMDAR Panel Members contribute on an annual basis to the AMDAR Panel Trust Fund, which is managed and overseen by WMO and supports the coordination, activities and work programme of the Panel and the AMDAR Programme.

3.2.3 The AMDAR Panel in cooperation with the CBS Expert Team on Aircraft Observations (ET-AIR) and the CIMO Theme Leaders on Aircraft Measurements had continued to work towards further development of the Aircraft Observing system and its full integration into the WMO Integrated Global Observing System (WIGOS) under the WMO World Weather Watch Programme.

3.2.4 The following countries and organisations maintained operational AMDAR programmes as subprogrammes of the global WMO AMDAR Programme: Australia, Canada, China, E-AMDAR, Hong Kong China, Japan, New Zealand, Republic of Korea, South Africa and the United States of America.

3.2.5 At the time of writing of the status report, the programme was comprised of 31 airlines and over 2800 aircraft, although national status reports reveal growth in the Chinese programme of 8 additional airlines over the past year and the addition of an aircraft from Air Vanuatu.

3.2.6 The list of airlines participating in the programme, not including the new Chinese airlines are: Qantas Airways and SkyTraders (Australia), Air Canada Jazz (Canada), Air China, China Southern Airlines and Shandong Airlines (China), Air France, KLM, Lufthansa Passage, Lufthansa Regional, Lufthansa Cargo, British Airways, Finnair, Scandinavian Airlines, Blue1, EasyJet Airline, Novair, Thomas Cook Scandinavia

(EAMDAR), Cathay Pacific (Hong Kong China), Air Nippon Airways and Japan Airlines (Japan), Air New Zealand (New Zealand), Korean Air and Asiana Airlines (Korea), South African Airways (South Africa), Alaska Airlines, American Airlines, Delta Air Lines (including Northwest Airlines), FederalExpress, United Airlines, United Parcel Service (UPS), Southwest Airlines (USA) and Air Vanuatu (Vanuatu).

- 3.2.7 Although the AMDAR Programme output, as measured in terms of the number of observations transmitted on the GTS has fluctuated markedly in recent years, developments over 2011 have meant that the Programme now provided an average of between 250,000 and 300,000 upper air observations per day in support of the WMO World Weather Watch Programme.
- 3.2.8 A recent sharp rise in aircraft observations was chiefly associated with the addition of 110 Alaska Airlines B737 aircraft as a new component of the USA AMDAR (MDCRS) Programme over March – June 2011. There was also a marked rise in observations available on the GTS as a result of increased output from the ICAO Automatic Dependent Surveillance (ADS) programme over February to April 2011, predominantly over the northern Atlantic area.

### ***Programme Highlights***

- 3.2.9 The Work Programme of the Panel and the ET-AIR had focused on progress on the WIGOS Pilot Project for AMDAR, which has included: the continued development and finalization of a BUFR template for AMDAR; the development of a metadata specification; further work on a strategy for the development of a data management framework for AMDAR; and the validation of the WVSS-II water vapor sensor. More detail on progress made is provided below.
- 3.2.10 The following activities were also identified as highlights:
- 3.2.11 In cooperation with the Mexican meteorological service (CONAGUA), the USA National Weather Service and WMO, the AMDAR Panel had organized and would conduct the Mexican Regional AMDAR Workshop, to be held in Mexico City from 8-10 November 2011.
- 3.2.12 Descriptions of Work have been developed towards the progressing of projects including the Compilation of a Generic Specification of Functional Requirements for AMDAR Software and, the Study on AMDAR Coverage and Targeting for Future Airline Recruitment.
- 3.2.13 Work had progressed on the update of the ARINC 620 Meteorological Report specification towards a Version 5, incorporating many necessary improvements.
- 3.2.14 The AMDAR Programme had worked towards the specification and implementation of AMDAR software for Honeywell avionics for Boeing 777 aircraft.
- 3.2.15 The AMDAR Programme had worked towards the establishment of a quarterly AMDAR Programme Newsletter to be published on a quarterly (every 3 months) basis.

- 3.2.16 With the assistance of the Canadian Meteorological Centre, statistics on programme output on the GTS had been revised and published on the WMO Aircraft Observations website.

### ***National Programme Developments***

- 3.2.17 The following National Programme developments were highlighted:
- 3.2.18 The USA National Weather Service, in cooperation with Aeronautical Radio Incorporated (ARINC) and the USA Federal Aviation Administration (FAA) had implemented an AMDAR programme with Alaska Airlines, incorporating the equipping of 110 Boeing 737 aircraft and providing a significant improvement to global AMDAR data coverage over Northern America.
- 3.2.19 The South African Weather Service (SAWS) was assisted by the Australian Bureau of Meteorology and the USA NOAA National Center for Environmental Prediction (NCEP) in completing the update of the SAWS AMDAR AAA V3 (AMDAR3) data processing module and the South African Airways (SAA) airline completed the update of the SAA AMDAR fleet to AAA V3 software, which has resulted in the South African AMDAR data quality and GTS output improving significantly and to full potential.
- 3.2.20 The Australian AMDAR Programme had been assisted in the development of a specification for the development of AMDAR software for Honeywell Avionics for the Embraer 190 aircraft.
- 3.2.21 The Australian AMDAR Programme had commenced receiving AMDAR data from an Airbus A319 aircraft that is operated on behalf of the Australian Antarctic Division by SkyTraders airline and flying inter-continental services between Australia and Antarctica over the Southern hemisphere summer. The first AMDAR data for this aircraft was transmitted on the GTS in early 2011.
- 3.2.22 The Australian AMDAR Programme in a cooperative project with Meteo France, Air Vanuatu and Qantas had commenced flight testing of AMDAR AAA v3 software on a B737 Air Vanuatu aircraft, which has led to the implementation of the first AMDAR Programme in the Southwest Pacific.

### ***Meetings and Assistance***

- 3.2.23 The Joint Meeting was informed on the numerous meetings that had been attended by the AMDAR Panel Management Group throughout 2011 in support of various aspects of the AMDAR Work Programme.
- 3.2.24 The report and the Joint Meeting acknowledged many people and organizations that had contributed to the work of the programme over the past 12 months, including:
- AMDAR Panel and ET-AIR Chairs and Vice-chairs;
  - Those AMDAR Panel Member NMHSs providing financial and in-kind contributions to the AMDAR Panel Trust Fund;
  - Aviation industry partners including the airlines operating AMDAR programmes;

- The Panel Members for Germany and USA for leading the Science and Technical and Training and Outreach Sub-Groups respectively;
- The E-AMDAR Technical Coordinator for leading the Improvement in Data Exchange and Quality Control project;
- CIMO Theme Leader on Aircraft Measurements, Dr Jitze van der Meulen, for leading the WIGOS sub-project on the Development of Standardised Procedure for Quality Management of AMDAR data and in the development of a strategy for establishment of a Quality Management System for AMDAR;
- The Royal Netherlands Meteorological Institute (KNMI) for administrative assistance and support to the AMDAR Panel and ET-AIR Chairman;
- The E-AMDAR Programme for provision of targeted data over various parts of the globe, assistance and technical support associated with several ongoing projects, including the ARINC 620 Meteorological Report update, the BUFR template and coordination of continued testing and verification of the WVSS-II system;
- The E-AMDAR Technical Coordinator for leading the work on the update of the ARINC 620 Meteorological Report while the post of the AMDAR Technical Coordinator was vacant.
- The Canadian Meteorological Centre of Environment Canada and the USA NOAA National Center for Environmental Prediction (NCEP) for provision of monitoring and statistical information on the AMDAR Programme;
- The Bureau of Meteorology for provision of AMDAR data over New Zealand and South Africa and assistance in resolving the South African AMDAR Programme data processing issue related to AAA software;

3.2.25 Appreciation was also expressed to the United States for supporting the development of the AMDAR programme with Alaska Airlines, preliminary collaborative work with the Mexican meteorological service, SMN towards development of an AMDAR programme with AeroMexico and assistance and coordination in organizing the Mexico Regional AMDAR Workshop.

### **3.3 Reports on activities by the Panel sub-groups**

#### **3.3.1 Science and Technical Sub-Group**

3.3.1.1 The investigation of Gelaro et al. (2010) about the worldwide impact of several observation system groups on numeric models shows that AMDAR plays a significant role in the reduction of forecast errors. One of the final conclusions is to look for strategies in targeting measurement activities. Especially E-AMDAR has some tools for activating aircraft on certain regions and flight phases.

3.3.1.2 In an NCEP presentation Bradley Ballish shows the intercomparison of biases and root mean square deviations of different instrument groups by use of referencing to the background of numerical models. In the North American area in August 2011 the AMDAR data turn out to have smaller biases than the radiosondes.

3.3.1.3 A special paper of Clemens Drüe, 2011 gives an insight into a method to reconstruct the flight trajectories of aircraft just by use of AMDAR data reports. The process finally yields the true airspeed vector for each report. This gives the possibility to retrace the

wind error vector in the aircraft fixed coordinate system. The chance is open for identifying systematic wind error features individually for each aircraft.

- 3.3.1.4 Similar to the infrastructure's concept of AMDAR the project IAGOS (In-service Aircraft for a Global Observing System) is intended to use commercial aircraft for atmospheric measurements. The instrumentation is focusing on air chemistry and aerosols. In summer this year the first aircraft (Lufthansa fleet) started the operation of IAGOS equipment. Other aircraft of other fleets in Europe and later on even in the USA will follow. Meanwhile IAGOS took the leading role in the plannings about an aircraft equipment for volcanic ash detection. In the frame of a cooperation with EUMETNET-AMDAR the data transfer between the IAGOS aircraft and GTS is organized.

### ***Icing***

- 3.3.1.5 There appears to have been little development over the year regarding: the elements and methods for automatically reporting conditions for ice accretion from aircraft; the methods and systems for the operational use of ice conditions; and the impact of icing data.

- 3.3.1.6 If STSG is not in a position to direct the work for the development related to icing it must at least continue to monitor the development as it regards: the elements and methods for automatically reporting conditions for ice accretion from aircraft; the methods and systems for the operational use of ice conditions; and the impact of icing data.

### ***Impact Studies***

- 3.3.1.7 There appears to have been little progress over the year. The monitor and review of publications and activities associated with AMDAR data impact studies is an on-going activity of STSG. A milestone to report next year is the Fifth WMO Workshop on the Impact of Various Observing Systems on NWP, Sedona, AZ, United States, 22 to 25 May 2012.

## **3.3.2 Training and Outreach Sub-Group**

### ***Outreach Activities***

- 3.3.2.1 The Coordinator of the Training and Outreach Sub-Group (TOSG) reported that, at the 2011 Experimental Aircraft Association's (EAA) AirVenture (July 24-31), the National Weather Service (NWS) again promoted AMDAR activities at its exhibit. An AMDAR poster was displayed at the NWS booth along with a WVSS-II unit and TAMDAR poster. NWS personnel engaged in AMDAR discussions with numerous visitors. Rich Mamrosh gave two 30-minute presentations on aircraft observations entitled "Weather Data From Commercial Aircraft".
- 3.3.2.2 Bryce Ford (SpectraSensors, Inc.) developed a WVSS-II poster which he exhibited at several events in the U.S. and internationally

## **Training Activities**

3.3.2.3 AMDAR data continued to play an important role in supporting forecast applications in the COMET aviation training modules. AMDAR data were used in a HYSPLIT model case study illustrating the transport of hazardous airborne chemicals. A 7-day GSD AMDAR web page animation sequence illustrates the dramatic reduction in air traffic across Europe as a result of the Eyjafjallajokull eruption in April 2010.

## **3.4 Status reports on national and regional programmes**

### **3.4.1 Established AMDAR programmes**

#### ***Australia***

3.4.1.1 The Bureau informed the Panel that the Australian AMDAR Program currently consists of a fleet of seventy two (72) aircraft contributing around 8000 AMDAR observations per day to the Global AMDAR Programme.

3.4.1.2 Since the last Panel meeting, the Bureau has: started receiving AMDAR data from Air Vanuatu international flights (737-800); begun rollout of AAA V3 AMDAR software to Qantas 747 (19 aircraft) and 767 fleet (7 aircraft); negotiated terms for a data agreement with Jetstar Asia to accompany Q4 2011 rollout to their fleet (14 A320-200);

3.4.1.3 Over the next 12 months, efforts will be made to continue to expand and enhance the Bureau's AMDAR Program by: complete upgrading Qantas fleets currently equipped with AAA V1 software to AAA V3; complete the implementation of an AMDAR Program with Jetstar Asia; negotiating the commencement of programs with Jetstar Airways and Virgin Australia; and, the commencement of a water vapour sensing program.

#### ***Canada***

3.4.1.4 Currently 27 CRJ-100/200 Jazz Air-operated aircraft, out of a fleet of 48 AMDAR-capable CRJ-100/200 aircraft, and 2 CRJ-200 NAV CANADA Flight Inspection aircraft contribute to the Canadian AMDAR Programme. A new long-term agreement with Jazz Air, expected to be effective as of April 1st, 2012, is being developed.

3.4.1.5 As the Canadian AMDAR Programme faces a number of programmatic and technical challenges it is time to assess its benefits and to establish a strategy for its future. To help with the development of such strategy a 1-day workshop with Environment Canada's internal AMDAR stakeholders, including users, network operators, and managers, will be held in mid-October. The end goal of the Workshop is the development of options and recommendations for the sustainability and further development of the programme for consideration by Senior Management of the Meteorological Service of Canada. The new strategy for AMDAR will be used in the development of a wider strategy for the Canadian Upper Air Programme.

- 3.4.1.6 Future plans will depend on both the recommendations emanating from the updated strategy for the sustainability and further development of the Canadian AMDAR Programme, and on the level of acceptance by the Senior Management of the Meteorological Service of Canada.

### **China**

- 3.4.1.7 The China AMDAR Programme has made some progress in the past year under the work and cooperation of the Civil Aviation Administration of China (CAAC) and China Meteorological Administration (CMA).
- 3.4.1.8 With the effort of CAAC, more airlines have participated in the China AMDAR Programme in the past year: 11 airlines with 111 aircraft, increased from 3 airlines with 22 aircraft over the 2009-2010 period. After being examined and evaluated by the Quality Control System, over 7000 meteorological reports per day are now disseminated via GTS.
- 3.4.1.9 A national regulation document on ADMAR data, BUFR codes of aircraft meteorological observation data, has been published by CMA.
- 3.4.1.10 An AMDAR-WXM report distribution control system has been developed and on trial in the past year by CAAC. To avoid expensive international data flux fees, the system enables: on/off switch of ADMAR relay according to airspace situation or flight number, control of observational time intervals among other functions.

### **E-AMDAR**

- 3.4.1.11 The E-AMDAR programme has performed well, fulfilled or exceeded all of its targets and produced meteorological data of high quality. In late 2010 easyJet with more than 150 Airbus was integrated in the programme. The total fleet now includes more than 800 aircraft from 13 cooperating airlines producing 40-45 000 observations daily. E-AMDAR continued to deliver hourly profiles to DWD, Météo France and the UK MetOffice as well as targeted data to SAWS and Singapore.
- 3.4.1.12 The ash cloud from the eruption of the volcano Grimsvötn in Iceland caused only minor disruption for aviation and E-AMDAR observations. The main influence was in northern UK on the 23rd-24th May and some airports in northern part of Germany were also closed for a 24 hour period.
- 3.4.1.13 Two humidity sensors WVSS-II v3 are being tested on the UK research aircraft. Preliminary results from the first test periods are very good. A final report will be available in November 2011. Another two WVSS-II v3 were tested on a Learjet in the framework of the European DENCHAR research project.
- 3.4.1.14 Negotiations are under way with Lufthansa concerning exchange of the three WVSS-II v2 sensors, in use since 2007, to the WVSS-II v3 as well as equipping six more of their Airbus A320 aircraft with the latest sensor.

### **France**

- 3.4.1.15 The French AMDAR Programme has the main objectives to: Optimise AMDAR data for national forecasting and meso scale models; Assess and validate AMDAR data produced by E-AMDAR for use by the regional model; Develop the AMDAR Programme over French overseas territories for global use; and, Prepare and deliver in real time atmospheric chemical data for use in air quality models.
- 3.4.1.16 To progress these objectives, Météo France is working cooperatively within the E-AMDAR organization to: Maintain existing contracts with Airline companies; make use of technical solutions already developed and implemented; and, facilitate the transfer from research to operations for the new measurements.
- 3.4.1.17 In order for Météo France to make better and wider use of AMDAR data by the forecasters, it believes the frequency should be enhanced. Therefore, a MoU has been signed between Météo France and E-AMDAR, to increase the temporal resolution of AMDAR profiles at a selection of airports in France.
- 3.4.1.18 Météo France continues to contribute to the E-AMDAR programme by acting as the intermediary to Air France for issues such as data dissemination and programme enhancement and expansion to overseas territories and supports the B777 AMDAR software development.
- 3.4.1.19 Météo France will be a contributing partner with the Bureau of Meteorology in the implementation of AMDAR software on an Air Vanuatu B737-800 aircraft, which will produce data from flights over the New Caledonian area.
- 3.4.1.20 Météo France is involved in the IAGOS projects (IAGOS DS and IAGOS ERI) for the design and conception of the real time transmission of atmospheric chemical data (Real Time Transmission Unit) and also facilitates coordination on IAGOS matters with the AMDAR Panel. Tests have commenced at Météo-France Operation Services for emission/reception/archive of IAGOS reports in BUFR format.

### **Germany**

- 3.4.1.21 The Fleet's Status: The German part of the EUMETNET-AMDAR fleet currently consists of aircraft operated by Lufthansa Passage, Lufthansa Cargo and, Lufthansa CityLine. The total number of aircraft has been increased from 292 to 313.
- 3.4.1.22 During the last 12 months no changes have been done to the 3 existing humidity aircraft of the Lufthansa fleet.
- 3.4.1.23 In order to save data transmission costs the system E-ADOS (E-AMDAR Data Optimisation System) ensures an equally distributed data coverage in time and space without redundancies. The AMDAR activity of aircraft within a pool of Lufthansa, Finnair and KLM is structured by configurable priorities of aircraft, airports and regions.
- 3.4.1.24 Test Flights with New Generation Humidity Instruments on Research Aircraft: Of the new WVSS-II generation (year 2009) two units each have been flown on the test beds of FAAM (Facility for Airborne Atmospheric Measurements) and EUFAR (European Facility for Airborne Research). First quick views show a consistency of the instrument's

performance with the good climate chamber results of one year before. Detailed evaluation is in progress. The piggy-back operation on the FAAM aircraft will be continued.

- 3.4.1.25 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 the next 2 years, a number of at least 6 additional aircraft of the Lufthansa fleet will be equipped with humidity instruments.

### ***Hong Kong, China***

- 3.4.1.26 Six aircraft of the Cathay Pacific Airways continued to contribute to Hong Kong, China's AMDAR programme. On average around 1,000 AMDAR observations are received at the Hong Kong International Airport (HKIA) per day.

- 3.4.1.27 Apart from supporting aviation weather forecasting and near real-time wind shear detection and reporting, AMDAR data are used in the mesoscale non-hydrostatic model of Hong Kong, China to improve the initial condition.

- 3.4.1.28 The monitoring of AMDAR data quality will be enhanced. Hong Kong, China also plans to expand its AMDAR programme to include other aircraft types over the next few years with a view to increasing the data availability near HKIA to support development of new aviation-specific MET services, e.g. meteorological services for terminal area.

### ***Japan***

- 3.4.1.29 The Japan Meteorological Agency (JMA) has been receiving AMDAR weather data from the two airlines of Japan, All Nippon Airways (ANA) and Japan Airlines (JAL). Approximately 16,000 reports are collected from 200 aircraft per day over Japan via VHF data link. JMA has been disseminating AMDAR data in BUFR format since December 2006.

- 3.4.1.30 The AMDAR data is used in the data assimilation system for the Global model with a horizontal resolution of 20km and Mesoscale model with that of 5km. JMA is also developing the Local Forecast Model with a horizontal resolution of 2km. The AMDAR data is also used in the data assimilation system for the Local Forecast Model.

### ***New Zealand***

- 3.4.1.31 AMDARs are received from 20 Air New Zealand aircraft flying over New Zealand and across to Australia. At present only 7 of these aircraft are transmitting regularly, however NZ MetService intends to increase the number of regularly reporting aircraft during the next year. NZ MetService pays some of the cost of AMDARs from Qantas aircraft flying across the Tasman Sea. New Zealand are in favour of both water vapour sensing and uplink software but do not have plans to progress either of these in the near future.

### ***Republic of Korea***

3.4.1.32 The Korea Meteorological Administration (KMA) is in charge of the AMDAR programme in Republic of Korea, and currently receiving AMDAR weather data from 19 Korean aircrafts (14; Korean Air, 5; Asiana Airlines). And KMA is transmitting 19 aircrafts' data via Global Telecommunication System (GTS).

3.4.1.33 KMA has been assimilating AMDAR data into global NWP model and also utilized AMDAR observation for the initial field of very short range forecast systems. KMA continues to upgrade its AMDAR data processing system in order to increase the amount of transmitted data via GTS, and plans to increase the number of data providers in the near future.

### **South Africa**

3.4.1.34 The South African Airways (SAA) is the regional airline providing AMDAR data. At present 31 aircraft (domestic, regional and international) are fitted with the necessary software. However, South African Airways (SAA) has indicated its plans to expand the AMDAR Programme by adding A320 Airbus aircraft to the existing fleet (ACMS system configuration permitting). The final Airbus A330-200 will join the fleet during December 2011. This will bring the number of participating aircraft to 32. The airline has recently replaced its seven B747-400 aircraft with six airbus A330-200's, all having the AAA V3 software on board.

3.4.1.35 European airlines, through the E-AMDAR programme, have also been contracted to augment AMDAR data in those regions where SAA has few or no flights. Under ideal situations, the South African programme contributes over 3000 observations per month to the Global AMDAR Programme.

3.4.1.36 Since the last Panel meeting, the mentioned data transmission problems, which led to data loss, had continued to recur. This was due to delays in software upgrades from AAA V2 to AAA V3, which have now been successfully completed. The recorded data reports on the GTS reflected on the NOAA monitoring website indicate improvement following the upgraded software.

3.4.1.37 SAWS would like to bring to the attention of the Panel its interest in the acquisition of Water Vapour Sensors and the Data Optimisation System. SAWS would like to urge the AMDAR Panel to encourage development partners and participating airlines to cooperate with member States in mobilising funding to acquire Water Vapour Sensors.

### **USA**

#### *GSD Activities*

3.4.1.38 The addition of Alaska Airlines data resulted in a 25% increase in the volume of aircraft observations assimilated into the hourly Rapid Refresh (RR) model. As many as 15,000 aircraft observations per hour are assimilated into some RR cycles. For the overnight hours, no less than 2,000 reports per hour are entered. The number of WVSS-II observations averages 500 per hour.

#### *TAMDAR Activities*

3.4.1.39 Besides some minor tweaking for contractual obligations, the TAMDAR data coverage continued across Alaska and the eastern half of the CONUS.

3.4.1.40 In support of forecast activities for Hurricane Irene, NWS purchased all available TAMDAR data during the period from August 25, 2011 at 21:20UTC to August 29, 2011 at 20:10UTC. It was during this period that the storm had its greatest impact on the U.S. eastern seaboard.

#### *MDCRS Activities*

3.4.1.41 In late September, the FAA and ARINC signed a new MDCRS contract. The base period is for one year with four option years to follow.

3.4.1.42 110 Alaska Airline (AS) B737 aircraft were added to the USA AMDAR fleet in April 2011. These data made the largest increase in USA AMDAR observations (40%) in the last 10 years (noting a substantial increase in 2007 with the entry of 50 B737 Southwest Airlines aircraft into the USA AMDAR fleet).

#### *WVSS-II Evaluation Activities*

3.4.1.43 The Cooperative Institute for Meteorological Satellite Studies (CIMSS) University of Wisconsin-Madison (UW) continued intercomparison analyses of the co-located rawinsonde and WVSS-II data taken on evenings during fall 2009, spring 2010 and summer 2010 at Rockford, IL (RFD).

3.4.1.44 In general, the re-engineered WVSS-II systems appear to meet WMO observing requirements across all specific humidity ranges and in both ascent and descent. Overall, the WVSS-II specific humidity observations match the rawinsonde data very closely, with random differences ranging from 0.2 to 0.7 g/kg at all levels, well within WMO recommendations. A slight moist bias in the observations should be correctable in post-processing of the data. Evaluations of observations made within 15 minutes, 60 km distance and 55 m altitude showed variability of less than 0.18 g/kg, exceeding the performance of most, if not all, other operation data sets.

#### *WVSS-II Contract Activities*

3.4.1.45 To date, WVSS-II installations have been completed on 29 Southwest Airlines (SWA) aircraft and the existing 25 units flying on UPS aircraft are operating normally. Of the initial 31 units in the first SWA WVSS-II allotment, the remaining 2 systems are scheduled for installation in December 2011. Installation of the second lot of 36 SWA WVSS-II units will begin early next year and is expected to be completed within 18 months.

#### *AMDAR Data Monitoring / QC*

3.4.1.46 Repeated NCEP and South African efforts plus actions by Dean Lockett have resulted in a fix to the prolonged problem of groups of AMDAR reports at incorrect locations.

3.4.1.47 Diagnostic reports from NCEP to Stewart Taylor led to fixes of different E-AMDAR aircraft regarding the following issues: reported aircraft locations appearing to be reflected off the equator; and, reported aircraft temperatures that were one tenth the correct value

#### *Turbulence and Icing Activities*

3.4.1.48 The following Eddy Dissipation Rate (EDR) deployments were made:

- United Airlines B-757s - ~100 aircraft
- Delta Air Lines (DAL) B-737s - ~80 aircraft
- Southwest Airlines B737s - ~10 aircraft

3.4.1.49 Deployment of EDR onto Delta Airlines (DAL) B-767s began in 2011 and is scheduled for completion in FY12. This will give additional CONUS coverage, as well as some transoceanic/trans-equatorial flights.

3.4.1.50 Forecast Icing Product (FIP) Severity with probabilities became operational in ADDS in FY2011. Current Icing Product (CIP) and FIP software are to be updated from Rapid Updated Cycle (RUC) model to WRF-Research Applications Program (RAP) model in FY2012.

#### ***Finland***

3.4.1.51 In autumn 2009 BLUE1 signed an agreement to produce AMDAR observations. After that in spring 2010 FINNAIR signed a similar agreement. BLUE1 fleet consists of 5 and FINNAIR fleet of 30 aircrafts (A320) producing AMDAR data.

3.4.1.52 Via the international data delivery network, FMI receives AMDAR data and routes the data into the numerical weather prediction model (HIRLAM) and into workstations for forecasters and other users at FMI. Display systems allow the simultaneous plotting of various sounding profiles together. Such display systems have identified data quality issues and a need to develop feedback mechanisms for fault reporting and rectification.

3.4.1.53 Currently, profiles from 5 airports are supported by E-AMDAR and the status of 6 other airports is unclear. Some financial support and optimization will be needed to expand the programme. There is potential to expand the AMDAR reporting of Finnair to include 15 wide body A330/340 and 16 EMB170/190 aircraft.

#### ***3.4.2 New, emerging and potential AMDAR programmes***

3.4.2.1 A report was submitted by the AMDAR focal point for Kenya providing information on efforts in recent years to implement an AMDAR Programme with Kenya Airways.

3.4.2.2 Kenya Meteorological Department (KMD) started negotiation with Kenya Airways (KA) about four years ago, visiting the chief Pilot twice, who indicated a willingness to support an AMDAR programme development. KMD has been given a contact to liaise with regarding the development. Recently at a half day meeting at KMD headquarters a

presentation on the importance of AMDAR in support of Meteorological Aviation operations was made to several representatives from Kenya Airways Operations Centre. KA requested specific details regarding software, which was sent by the AMDAR Panel Chairman. No further meetings or actions have taken place since.

- 3.4.2.3 The report suggested that the AMDAR Panel might identify one or two representatives to visit Kenya and Kenya Airways with KMD acting as the liaison to emphasise the importance of the AMDAR programme development.
- 3.4.2.4 A recommendation was made that the Joint Meeting discuss ways in which Kenya can be assisted in further endeavours to commence an AMDAR programme in Kenya.
- 3.4.2.5 The report also recommended that the Joint Meeting consider the possibility of provision of targeted AMDAR data for Kenya.
- 3.4.2.6 The Joint Meeting undertook to consider both recommendations in developing its 2012 work programme.

#### **4 PROJECTS, PLANNING AND WORK PROGRAMME**

The Joint meeting was informed about the status of the various projects and tasks within the AMDAR Panel work programme.

##### **4.1 WIGOS Pilot Project – Review and Planning Update**

- 4.1.1 In July 2008, the AMDAR Panel was given the task of managing the WIGOS Pilot Project for AMDAR: Integration of AMDAR into WIGOS (WIGOS-PP-AMDAR). The overview of this project is: *This Project will focus on the practices impacting AMDAR data collection, processing, archiving and dissemination. The standard practices used in observing the atmosphere need to be well documented to ensure sufficient detail accompany the observations so that users can interpret measurements correctly. In addition new methods and procedures will be required in preparation for the deployment of new operational instruments, such WVSSII water vapour sensor.*
- 4.1.2 The project plan focuses on a set of six short-term (4) and long-term (2) aims and tasks:

Short-term:

- (1) Development of a standardised BUFR Template for AMDAR;
- (2) Application of WMO Metadata relevant to AMDAR;
- (3) Development of a standardised Quality Management Framework for AMDAR data; and
- (4) Validation and preparation for intercomparison of available Water Vapour sensor performance.

Long-term:

- (5) Update of the AMDAR Reference Manual WMO-No.958; and
- (6) Development of the framework for generic software specification for AMDAR.

- 4.1.3 The Joint Meeting was informed about the current status of each of the WIGOS-PP-AMDAR tasks and recommendations were made and considered for advancing the project.

#### ***Development of a BUFR Template for AMDAR***

- 4.1.4 Eva Červená from the Expert Team on Data Representation and Codes (IPETDRC) has undertaken preliminary testing of the AMDAR BUFR Template Version 5 and reflected the requirements for higher precision of relative humidity in the AMDAR BUFR Template Version 6 that was submitted to the 3rd session of the Inter-Programme Expert Team on Data Representation and Codes (20-23 September, Melbourne). The relevant new descriptors were approved for fasttrack, the template for validation.
- 4.1.5 The AMDAR Panel has been offered the help of the ECMWF (Enrico Fucile) and UK Met Office (Richard Weedon) in carrying out the validation process. The AMDAR Panel was notified by Eva Červená that, if the validation was not completed by November 2011 in time for approval at the CBS session, then the BUFR template would not be able to be approved for use until November 2013 using this approval process. However, Ms Červená notified that the template could be approved before then using the procedure for approval of amendments between sessions.
- 4.1.6 The Joint Meeting agreed that the AMDAR Panel and ET-AIR should continue to coordinate the validation of the AMDAR Panel BUFR Template Version 7 by ECMWF and the UK MetOffice. The AMDAR Panel and ET-AIR should seek to ensure that the validation process is completed in time to submit the proposal for approval of the template through the procedure for the adoption of amendments between CBS sessions and submission to Chair of the IPET-DRC and Mr Atsushi Shimazaki of WMO Secretariat by the end of November 2011.
- 4.1.7 The Joint Meeting expressed appreciation and thanks to Dr Červená for her assistance and advice on the approval process for the AMDAR template.

#### ***Application of WMO Metadata relevant to AMDAR***

- 4.1.8 Stewart Taylor, E-AMDAR has provided the proposed aircraft metadata requirements to E-AMDAR contacts in British Airways to ascertain the viability of obtaining the metadata from airlines.
- 4.1.9 The Joint Meeting accepted recommendations that the metadata sets that have been compiled and tabled at WIGOS-PP-AMDAR-5 should undergo a review and refinement process coordinated by the Panel. The AMDAR Panel and ET-AIR, through the Project Leader Improvement in Data Exchange and Quality Control, would consider the definition and specification of categories of metadata including:
- 1) AMDAR metadata set for Global AMDAR Data Management;
  - 2) Complete AMDAR metadata set for Programme Management; and,
  - 3) Minimum AMDAR metadata set for Programme Management.

- 4.1.10 The AMDAR Panel and ET-AIR will then seek to incorporate the final metadata set definitions into appropriate regulatory material and the AMDAR Panel and ET-AIR to develop a strategy, in consultation with WMO Information Systems, for the collection and maintenance of the metadata set for Global AMDAR Data Management as a component of the AMDAR Quality Management Framework.
- 4.1.11 Mr Neil Halsey suggested that ICAO should be involved in the metadata review process and undertook to be a member of the review team.

***Development of standardised procedure for Quality Management of AMDAR data***

- 4.1.12 Dr Jitze van der Meulen made a presentation on the Strategy for Development of a Data Management Framework (DMF) for AMDAR. Dr Meulen identified that for a DMF to be successful, it must be adopted universally and uniformly and that the DMF must deal with the issue of Level 1 data (those pre-processed measurements made on the aircraft platform) quality management being largely in the hands the airlines, whilst Level 2 data (processed meteorological parameters) quality the responsibility of both airlines and GTS-hub data managers. The conversion of Level 1 to Level 2 data should be an area for uniform practices to be defined and implemented.
- 4.1.13 For effective management of AMDAR data streams, they must be monitored and subject to quality control (QC) with feedback and preventive strategies in place at the 3 levels of data management: where data is generated, where QC is carried out and where monitoring take place. Standards and procedures for each of these levels should be defined and standardized.
- 4.1.14 The Joint Meeting discussed the possibility and benefits of holding a meeting or workshop of AMDAR data management experts for the purpose of assisting the development of a strategy for standardizing practice in relation to AMDAR data quality management, particularly focusing on those aspects relating to global data management. It was agreed that this activity should be supported by the Panel and organized by the APMG in consultation with WMO and Dr. Van der Meulen. The APMG should be responsible for determining the aims and goals for the workshop and the list of proposed attendees. The aim should be to hold the workshop in the first half of 2012.

***Validation and preparation for inter-comparison of available Water Vapour sensor performance***

- 4.1.15 Dr Axel Hoff made a presentation on the two flight testing programs that are currently underway, with 2 WVSS-II Version 3 (WVSS-II-v3) sensors being tested on the Facility for Airborne Atmospheric Measurements, UK (FAAM) research aircraft and 2 also being tested on the DENCHAR (Development and Evaluation of New Compact Hygrometers for Airborne Research) Learjet aircraft. Results from these flight tests are expected to provide further information regarding the operational capabilities of the sensor. The functionality of the humidity measurement on commercial aircraft potentially provides the opportunity to also utilise the equipment for icing warning, deicing efficiency and as an input to indication of contrail generation, Such developments would have implications for flight safety, fuel saving and environmental protection and could

therefore strengthen the airline industry business case for AMDAR and water vapor measurement participation.

- 4.1.16 A draft preliminary report on the comparisons made with the 2 WVSS-II-v3 systems on the FAAM research aircraft had been received by E-AMDAR and the final version was expected to be available by November 2011.
- 4.1.17 Mr David Helms and other presenters provided a presentation entitled, Water Vapor Sensing System (WVSS) Assessment Synopsis 2011 providing the current status of WVSS-II-v3 deployment in the USA, a summary of maintenance issues over the past 2 years, NOAA assessment of the moisture data based on comparison with the North American Model background, CMC comparison results, long-term sensor monitoring carried out by SpectraSensors using comparison with the RUC model and results of stability tests underway and continuing on two sensors at SpectraSensors factory in California.
- 4.1.18 The Joint Meeting also received a remote presentation by Dr Seth Gutman on comparison of WVSS-II-v3 water vapour profiles with total precipitable water quantities produced by GPS/GNSS observations. The research concludes that: the comparison technique can be used to identify changes in the characteristics of aircraft moisture sensors with time, and identify (i.e. flag) questionable observations in near-real-time. It also clearly demonstrates the advantages of adopting an integrated upper-air observing system strategy to improve global weather & climate services.
- 4.1.19 Mr Yuri Varakin made a presentation on the Russian Aircraft Humidity Sensor that utilizes a chilled mirror technique and suggested that the next generation sensor may be suitable for operational AMDAR deployment.
- 4.1.20 The Secretariat provided a document that summarized the development, evolution and testing of the WVSS-II system over the past decade as well as the more recent tests and comparisons completed and still being undertaken on the WVSS-II Version 3 (WVSS-II-v3) system. In addition to the two research aircraft deployments mentioned above, this included the analysis and assessment of the WVSS-II-v3 / Rawinsonde (RS-92) comparison carried out at Rockford, IL, USA during 2009-2010 being undertaken by the Cooperative Institute for Meteorological Satellite Studies (CIMSS), University of Wisconsin, Madison. The most recent comparison analysis results suggest that:
- The WVSS-II-v3 systems appear to meet WMO observing requirements across all specific humidity ranges in both ascent and descent.
  - The engineering changes made to the WVSS-II since 2008 seem to have alleviated the problems with data taken during descent observed in earlier tests.
  - Overall, the WVSS-II SH observations match the rawinsonde data very closely, with random differences ranging from 0.2 to 0.7 g/kg at all levels, well within WMO recommendations.
- 4.1.21 The Joint Meeting agreed that, based on the various comparisons and testing that had been undertaken by various groups and monitored by the Panel, the latest version of the sensor, WVSS-II-v3, appeared to be meeting both the operational performance and

metrological standards required to be fully sanctioned by the Panel as an operationally useable and deployable component of the AMDAR system.

- 4.1.22 Additionally, it was agreed that the wider deployment of a water vapor sensing capability on AMDAR aircraft offers the potential for significant improvement to the global coverage of upper air profiling of atmospheric water vapor content, both spatially and temporally and would likely have a large and significant impact on many meteorological application areas including numerical weather prediction systems, aeronautical and public weather forecasting and climate monitoring. Such deployment also would offer the opportunity for NMHSs to consider significant changes to the configuration of their operational upper air measurement networks leading to improvements in upper air network efficiency and optimization.
- 4.1.23 The Joint Meeting discussed the need to develop a suitable course of action for advancing and finalizing the WVSS-II-v3 validation process and it was agreed that several activities should be undertaken by the Panel and ET-AIR to this end.
- 4.1.24 It is expected that E-AMDAR will be able to provide the final report from the FAAM WVSS-II comparison tests to the AMDAR Panel before the end of 2011. If results from the trial are favorable and the sensor shown to meet prescribed WMO and CIMO requirements, the Coordinator of the STSG should oversee the development and implementation of a process for the measurement technique employed by the WVSS-II-v3 to be formally approved by the Panel and subsequently by CIMO, CBS and WMO.
- 4.1.25 It was considered that this process might include the compilation of a paper that outlines and summarises all results and testing of the WVSS-II-v3 sensor and formally states the scientific case for the sensor and measurement technique meeting operational, metrological and meteorological requirements for implementation as a component of the AMDAR Programme. The AMDAR Panel Management Group undertook to consider developing a Description of Work for the commissioning of such a paper.
- 4.1.26 The Panel and ET-AIR undertook to review the status of the WVSS-II sensor measurement technique within CIMO and CBS regulatory material and ascertain requirements for its update.
- 4.1.27 Given the expected benefits to meteorological applications of a wider deployment of water vapour sensing within the AMDAR Programme, the Joint Meeting also considered activities that might advance the sensor's implementation by operational AMDAR programmes. It was agreed that the Panel needs to oversee the development of business cases for both NMHSs and the aviation industry that outlines the benefits and impacts that have either already been demonstrated or are likely.
- 4.1.28 The Joint Meeting considered whether operational implementation of water vapour measurement might be pursued through a joint international approach as had been previously planned when the first version of the WVSS-II system was being trialed. There was general agreement that this approach was worthwhile trying as it allowed for a unified and more efficient approach to difficult issues such as sensor certification, business cases and justification, maintenance issues and possibly bulk and forward

ordering of sensors. It was agreed that the AMDAR Panel Management Group would consider how to approach this aspect at the next APMG Meeting.

- 4.1.29 The Joint Meeting also considered that a draft Statement of Support for the implementation of a water vapour measurement capability by NMHSs and may give this further consideration upon finalization of a formal validation of the sensor being accepted by WMO Technical Commissions.

#### ***Integration of AMDAR Regulatory Material***

- 4.1.30 The Integration of AMDAR Regulatory Material is designated as a long-term WIGOS-PP-AMDAR task and has not yet been commenced. The task incorporates the review of the AMDAR Reference Manual and the guides and manuals of the WMO Technical Commissions to ensure they are up-to-date in relation to all aspects of AMDAR and the Aircraft Observing System. The Joint Meeting agreed that this task should now be incorporated into the work programme with the APMG to specify a Description of Work and seek a contractor to undertake and complete the work over 2012.

#### ***Development of the framework for generic software specification for AMDAR***

- 4.1.31 The Joint Meeting was informed that the WIGOS-PP-AMDAR task, Development of the framework for generic software specification for AMDAR, was discussed at the AMDAR Planning and Preparatory Meeting in De Bilt, July 2011, where it was recommended that a Description of Work (DoW) should be compiled for this task to determine if it could be carried out under the terms of a WMO Special Service Agreement (SSA) if a suitable contractor could be found.
- 4.1.32 The DoW was compiled by the Secretariat and reviewed by the AMDAR Panel Management Group (APMG) over the 2<sup>nd</sup> half of 2011. Two potential contractors had been approached and subsequently provided expressions of interest and quotations for the work. Upon consideration and assessment of the submissions made, the APMG determined that Mr Frank Tamis, AirDatec, was the most suitable candidate to undertake the work. The SSA for this work was currently being processed within WMO with an expected commencement of November 2011 and completion of May 2012.
- 4.1.33 The Joint Meeting endorsed the action that had been taken by the APMG and also nominated a team to be responsible for the review processes associated with the development and finalization of the deliverables from the SSA.

### **4.2 Global AMDAR Programme Development**

#### ***Mexico AMDAR Regional Workshop***

- 4.2.1 The Joint Meeting was informed that the upcoming WMO AMDAR Regional Workshop was to be held in Mexico City over 6 to 8 November, with several Panel Members participating as presenters. The provisional agenda for the workshop was presented.

#### ***International AMDAR Programme Development, Including Regional Programme Development Projects***

- 4.2.2 The Chairman presented a document on the status of the AMDAR Panel High Priority Pilot Projects that the Panel had been maintaining, namely, the Coordination of National and Regional Programmes, Improvement in Data Exchange and Quality Control, North Africa and Western Asia Pilot Project and the South-west Pacific Pilot Project. It was pointed out that the Panel had struggled to find leaders for most of the projects the Panel had defined and it was understood that there was a reluctance to take on such roles given the time and resources required to be dedicated to them. At the current time, only the project for Improvement in Data Exchange and Quality Control had a leader, Mr Stewart Taylor. Experience of the Panel has shown that the most successful AMDAR programme developments had arisen out of focused and shorter-term efforts on specific and well-defined smaller projects and tasks where the prospects for success were evident in a willingness to proceed and make progress by both a NMHS and a prospective airline.
- 4.2.3 The Panel accepted three recommendations made by the Chairman: that all High Priority Pilot Projects would be closed, apart from the Improvement in Data Exchange and Quality Control, which would continue under the work programme of ET-AIR and as a component of the WIGOS Pilot Project for AMDAR and, that the Panel would continue to support international AMDAR Programme developments on an individual basis according to prospects and need and in line with future global development plans that are established by the Panel and the ET through studies and consultation with WMO Members and as defined in the work programme.
- 4.2.4 It was agreed that the Terms of Reference of the Panel should be amended to reflect the closure of the projects and the modified approach to the work of the Panel.

#### ***Data Targeting Over Africa***

- 4.2.5 Mr Stig Carlberg, Sweden, presented a document outlining the current status of the agreements for the provision of targeted AMDAR data over Africa via the E-AMDAR Programme. The E-AMDAR Programme has an agreement with the South African Weather Service (SAWS) for the provision of targeted data for several South African airports, which has been in place for several years. Currently the long haul fleet of British Airways provides en route observations and profiles at Dar es Salaam, Entebbe (only profiles) and Lusaka and the long haul fleet of Lufthansa provides profiles at Nairobi. This agreement will terminate at the end of 2011 with discussion currently underway towards either extending the agreement or negotiating a new agreement between SAWS and EUMETNET.
- 4.2.6 The Joint Meeting had discussion on the capability of the existing global AMDAR programme to provide targeted data more widely and it was agreed that there was a need to determine the potential available coverage, whilst noting that the prospects for extending the available coverage was dependent on the ability of operational national program managers to modify their individual programmes to extend coverage, either through the use of optimization systems or more manual processes. It was agreed that prospects for the provision of targeted data and an improved global AMDAR coverage would be greatly improved with the wider implementation of optimization systems.

- 4.2.7 The APMG undertook to investigate ways to determine the potential for extending targeted data provision.

### **4.3 AMDAR Software Development**

#### ***AAA Software Issues in South Africa***

- 4.3.1 The South African Weather Service acknowledge that the new software development in implementing AMDAR version 3 took longer than expected due circumstances outside of its control. The South African Weather Service would like to acknowledge the help provided by the World Meteorological Organisation and the Australian Bureau of Meteorology during the development of the AMDAR version 3 decoding software.
- 4.3.2 The SAWS request that the any changes in the AMDAR software decoding and encoding should be handle better in the future. All interested parties and stakeholders should be aware of changes and a plan for implementation made and circulated.

#### ***Australian AAA v3 Software Development***

- 4.3.3 A document was submitted by Australia outlining the various AMDAR software developments underway in Australia, which include porting of the AAA v3 software developed for Qantas 737-800 to the B747 and B767 fleets, the finalization of software development for the Jetstar A320 and the potential development of software with Virgin airlines for their Embraer E-190 fleet. The Bureau also submitted a draft specification for AAA v3 D2, which might be utilized in the process of developing the generic AMDAR software specification.

#### ***ARINC620 Software Specification Update***

- 4.3.4 The Joint Meeting was informed about the Panel project underway to update the ARINC 620 Meteorological Report specification from version 4 to version 5, incorporating at least 10 additional requirements or changes.
- 4.3.5 The APMG had deliberated over the proposed requirements to incorporate the reporting of IAGOS chemistry and volcanic ash parameters within the AMDAR downlink message structure but after consultation with IAGOS representatives had determined that it was not appropriate for a range of reasons and that a more appropriate approach to any such requirements would be to develop a separate ARINC 620 downlink message format.
- 4.3.6 In order to finalise the update process and procedure, it would be necessary to complete the draft specification and provide it to ARINC for AEEC approval by the end of 2011. The AEEC DataLink Systems Sub-Committed would then assess the submission of the proposed modification to ARINC 620 at the next meeting in the first quarter of 2012. The Panel appointed a review team of four people to review the completed draft, with the finalization and review process to be coordinated by the Secretariat (SO/ARO).

#### ***B777 Software Development***

- 4.3.7 Météo-France and E-AMDAR have coordinated the development of a specification for AMDAR software development for the Air France B777 fleet. As this development is likely to be of wider interest to other AMDAR Programmes, the Panel Chairman has taken a role in further development and coordination on behalf of the Panel and requested that Air France provide a quotation for completion of the work on behalf of all stakeholders. The quotation has been provided and the Panel agreed that the AMDAR Panel Trust fund should be utilized to support this development in cooperation with other contributors.
- 4.3.8 The ownership of the software was discussed and it was suggested that the contract for software development by Air France should ensure that the Panel retains ownership and IP rights over the software. The APMG will discuss this and the issue of financing the development at the next meeting of the APMG in 2012.
- 4.3.9 The Panel also agreed that any future request for participation and/or cost-sharing in a specific AMDAR software development project will be individually reviewed by the APMG on a case-by-case basis.

#### **4.4 AMDAR Quality Management System**

##### ***Quality Management Framework Requirements for Observational Data***

- 4.4.1 Dr Jitze van der Meulen made a presentation to the meeting on the subject of the development and implementation of a Quality Management Framework (QMF) for AMDAR. Dr van der Meulen recommended a 3-level approach to establishment and documentation of a QMF consisting of QM work processes, QM business processes and a QM manual that describe the tasks and activities, processes and organizational structure respectively. Such a model will be developed in line with the WMO policy on QMF to guarantee and improve the quality of AMDAR data. Whilst a data quality management framework for AMDAR data is well established and documented there are areas and aspects of quality control procedures that can be further standardized across programmes. One practical aspect that the Panel might address in relation to quality management is the introduction of a data flagging system that codifies the data according to its recommended use based on real-time assessment by the originating data programme and transmitted with the data as quality management metadata.
- 4.4.2 Dr Van der Meulen also presented a number of particular data quality issues that have been studied and characterized based on comparison with the HIRLAM model, including air temperature bias, the validity of high resolution data recently produced by the E-AMDAR Programme, pressure altitude anomalies and the variation in quality with aircraft type.

##### ***AMDAR Data Temperature Bias and NWP Correction***

- 4.4.3 The Joint Meeting discussed the issue of air temperature bias and noted that ECMWF had recently announced an intention to integrate an aircraft observations bias correction module within the next release of the assimilation and forecasting system. Whilst the Panel has been aware that there have been studies and comparisons with NWP

systems that have demonstrated an air temperature bias, it was suggested that its nature and universality had not been rigorously established. It was decided that this should be a topic that should be addressed at the proposed AMDAR Data Management Workshop and suitable experts from the NWP community should be invited to attend.

### ***ADS Data Management and Quality***

- 4.4.4 Several issues relating to the quality and format of Automatic Dependent Surveillance (ADS) data have been directed to the Panel and the Aircraft Observing Programme. For some time there has been an outstanding request from members to be provided with direction on how aircraft data generated by ICAO programs should be transmitted on the GTS. At the current time data appears to be being transmitted in AIREP and PIREP format by a number of sources and, when quality issues arise, data managers are not always aware of whom to contact to rectify errors. Additionally, there are cases where the data, as received on the GTS, does not contain the aircraft identity.
- 4.4.5 Mr Neil Halsey representing ICAO at the Joint Meeting reminded the Panel that ADS-C reports are ICAO generated and owned reports, for which there is an understanding that the weather information contained within them can be utilized for meteorological purposes. This understanding is formalized in ICAO Annex 3, Chapter 5 and Appendix 4, with the message format contained in ICAO PANS-ATM (Doc 4444, 4.11.4). It should be noted that these data should be transmitted via the AFS (ICAO Aeronautical Fixed Service) from the Air Traffic Services (ATS) unit concerned to the responsible Meteorological Watch Office and to the World Area Forecast Centres (WAFC) only. The WAFCs are then responsible for transmitting this information on to the GTS as basic data. ICAOs main concern is that ADS meteorological data should not be changed, “corrupted” in any way, or, be re-transmitted on the AFS. Responsibility for quality control of meteorological data generated by the ADS programme immediately before and after GTS transmission belongs to WMO and its members and not ICAO. Whilst the issue of aircraft identity is a concern, Mr Halsey suggested that if this originates from the aircraft, the ATS, or the WAFC, ICAO should be notified and this will be rectified.
- 4.4.6 The Joint Meeting agreed that the issues associated with ADS data transmission on the GTS need to be resolved with a quality management practice developed and implemented by WMO. The QM system must ensure that data quality issues can be directed to the originators of the data, which means that there must be a line of communication that goes back to the airline and this can possibly be developed in consultation with ICAO. It was agreed that this should be one of the issues that the proposed Data Management Workshop should deal with.

## **4.5 AMDAR Documentation, Training and Outreach**

### ***WMO Aircraft Observations Website***

- 4.5.1 The Secretariat presented a document that provided the current status of the Aircraft Observations website that is published under the Global Observing System and World Weather Watch sites at: <http://www.wmo.int/amdar/> . It was identified that there were some issues with the site that required rectification including: many areas are still listed as “under construction”, many areas are not up to date, there is duplication throughout

many pages, the site does not accurately reflect the current status of the Aircraft Observations programme and its relationship with the AMDAR Panel and AMDAR Programme and the site does not adequately cater for all stakeholder interests and requirements. It was agreed that the site is not well structured and lacks the necessary information on the index page to guide the reader to their topic of interest.

- 4.5.2 The Joint Meeting accepted a recommendation to elect a committee from the Members to review the website and make recommendations to the APMG for its update based on a recommended set of criteria and aspects. The committee would also make a recommendation to the APMG on how the update process might be carried out and resourced including the consideration of the contracting of a technical resource to undertake the work.

### ***AMDAR Benefits Material for Airlines and NMHSs***

- 4.5.3 The Joint Meeting was informed that the Special Service Agreement (SSA) that had been put in place for the production of the AMDAR Manual on Benefits [of AMDAR] to the Airline Industry had been terminated in July 2011 due to the ill health of the contractor and, as a result, his inability to undertake and complete the work. Several possibilities for progressing this work were discussed and it was agreed that the need to compile benefits material for both the aviation industry and NMHSs on the benefits of involvement in the AMDAR Programme and its extension for water vapor measurement was a high priority. The APMG would seek to determine a way forward on this issue in consideration of several proposed options including seeking a new contractor to undertake the compilation of the AMDAR benefits manual, attending and promoting AMDAR at the Airlines Association meeting in South Africa in 2012, seeking endorsement of AMDAR by appropriate aviation bodies including the Air Line Pilots Association and holding a workshop or conference of aviation industry representatives on AMDAR and its relationship weather impacts on aviation. Mr Bryce Ford volunteered to provide support and guidance in the adoption of these initiatives.

### ***Aviation Industry Interaction***

- 4.5.4 The Secretariat presented a document that provided a summary of the aviation industry bodies and organizations that the Panel has or has had an interest in maintaining a relationship and interaction with, including the Aeronautical Electronic Engineering Committee (AEEC), the USA Federal Aviation Authority, airframe manufacturers Boeing and Airbus, the Radio Technical Commission for Aeronautics (RTCA), ICAO, EuroControl and IATA. The Joint Meeting reaffirmed the need to maintain associations with these various organizations. In particular, given the requirement to maintain the AMDAR ARINC 620 Meteorological Report specification, the AEEC association should have a high priority. Mr Neil Halsey would continue to hold associate membership to the Panel and represent the interests of the Panel to ICAO.
- 4.5.5 The meeting discussed the interactions with Airbus that had culminated in Airbus providing a quotation to the Panel for integration of AMDAR software and water vapor sensors into the Airbus airframe manufacturing process and led to the Panel, through WMO, contacting Panel Members to seek support to meet the costs (early 2007). The results of this were that the Panel was unable to secure commitment of the necessary

capital to meet the costs of one or both of the software and WVSS integration options within Airbus. It was agreed that the Panel and the ET might consider a new strategy and other options for obtaining the necessary funding to reengage Airbus with a view to seeking an updated quotation, particularly in light of the improvements in the WVSS-II performance characteristics. It was also agreed that approaches to avionics manufacturers that do and can support AMDAR software applications should be considered.

- 4.5.6 It was suggested that the Panel should make an assessment of the requirement to be more closely involved in the work of the RTCA in light of their role in guiding the development of some aspects of the FAA NextGen project in the USA.

### ***Volcanic Ash Training Course***

- 4.5.7 Mr Carl Weiss made a presentation on the new NWS Volcanic Ash Training module for forecasters, which led to discussions on the possibility of the Panel seeking discussions with COMET regarding the possible production of a training module on the AMDAR Programme, the production and existence of AMDAR data and its use in forecasting applications.

### ***Quarterly Newsletter***

- 4.5.8 The Joint Meeting discussed the concept of the production by the Panel of a quarterly newsletter, initially to keep Members and Focal Points aware of developments associated with the AMDAR Programme but later to be developed into a tool for outreach to the wider meteorological and aviation communities. SO/ARO presented a template that had been developed for the newsletter and an example newsletter “mock-up”. The meeting participants agree that the newsletter should be instigated and the Coordinator of the Training and Outreach Sub-group should coordinate its production with the assistance of the Secretariat. It was agreed that for the newsletter to be successful, all Panel and ET members need to offer support for its production. The first newsletter should be produced in January 2012 and cover the preceding quarter.

### ***KNMI / KLM AMDAR Business Case***

- 4.5.9 Mr Frank Grooters presented a document that outlined and summarized the results of an analysis of the benefits of the KNMI and KLM joint initiative to extend the Netherlands AMDAR Programme KLM's B737NG fleet, thus increasing the availability of AMDAR data in support of weather and aviation operations at and around Schiphol International Airport, Amsterdam. The study was based on the business case that was developed in support of the AMDAR programme extension and the availability and use of AMDAR data generally. KLM requested the development of a business case as, although KLM is interested in being an AMDAR partner airline, it would like to have a clearer idea of the return (“added value”) from using AMDAR data before making further investments in financial and human resources. The business case addresses translating the meteorological improvements in quality into the economic value gained from using AMDAR.

- 4.5.10 The results of the business case show that the current AMDAR profiles have become an important source of information for forecasters but, based on the model studies conducted to date, the extra AMDAR data does not make a major contribution to the model forecast during the summer season. Positive impact was seen during the winter season, but has still to be confirmed through a model study. However, KLM has stated that they see demonstrable added value in AMDAR in two key areas, namely improved safety and reduced costs. The recommendations and outcomes from the study are that: the current approach and use of the AMDAR Boeing 737 NG aircraft should continue; if possible, more aircraft should be equipped with the AAA version 3 AMDAR software; that further model studies of the impact of AMDAR measurements are completed; and, reliable measurements of humidity are considered for extension of the programme.

#### **4.6 AMDAR Science and Technical Development**

- 4.6.1 In relation to the water vapor sensing programme, both the developmental and planning issues and aspects were discussed and are covered under items 4.1 and 4.7.

##### ***AMDAR and Climate***

- 4.6.2 The Chairman briefly discussed a draft paper by Boer and Van der Meulen that was submitted to the meeting as an information document. The paper demonstrates that water vapour sensor implementation on the aircraft platform is likely to have an impact and be of interest to climate application areas. The paper outlines the advantages that the AMDAR programme provides to climate studies and its extension to water vapour measurement (currently not well covered by the conventional observing programmes) including: AMDAR measurements already meet the measurement uncertainty thresholds for climate, including the water vapour measurements being made with the laser diode measurement system being used operationally in the USA and Europe; aircraft provide measurements en-route at the pressure levels of interest and relevance to the study and monitoring of the variability and change in water vapour that are key to our understanding of climate change; the sensor system being used operationally has demonstrated processes and procedures to ensure the necessary quality standards; the AMDAR programme provides a coverage that is already global in nature as required for studies on the impact of water vapour on climate; and the programme is multi-purpose, in that it serves more than just a single meteorological application area.
- 4.6.3 The Joint Meeting agreed that, whilst the focus on the justification for AMDAR Programme development in the past has been primarily on use of the data for real-time and near-real-time forecasting applications, the extension of the justification and resulting business cases developed should in the future also encompass other areas including climate.

##### ***Turbulence and EDR Global Implementation***

- 4.6.4 A presentation was made by Dr Tammy Farrar from the USA Federal Aviation Administration on the status and future plans for the aviation industry use of turbulence Eddy Dissipation Rate (EDR) data derived from several cooperative programmes with airlines in the USA.

- 4.6.5 Around 200 aircraft from 3 airlines have been equipped with software and algorithms for the real-time reporting of EDR under the US Turbulence Program administered by the FAA. This is expected to be expanded to around 450 aircraft over 2012. Under the program, EDR is monitored continuously and reported at approximately 15-minute intervals, with either all 1-minute peak and mean EDR values reported or else, under the new Delta AirLines (DAL) program, a routine 15-minute “heartbeat” report is made along with flight beginning and end reports and a set of peak and mean values reported when EDR exceeds a defined threshold. At this time, EDR data generated by the program is available only on the web-based Experimental Aviation Digital Data Service (ADDS) maintained at the National Center for Atmospheric Research (NCAR)
- 4.6.6 The EDR data is used within the Graphical Turbulence Guidance GTG product that has been developed by NCAR utilizing input from the NWS Rapid Update Cycle (RUC) forecast model (20km) and made available under ADDS. This product is expected to be updated to include higher resolution Rapid Refresh NWP data (13km) and incorporating more EDR in early 2012 followed by an update to GTG version 3 in late 2013 which will incorporate enhanced turbulence forecasting capability at improved altitude range and temporal resolution.
- 4.6.7 Dr Farrar also outlined the FAA efforts to integrate the GTG product into airline operations and assess the impact based on a proof of concept program with DAL Flight Operations Centre over 2009 to 2011. This program provided (inconclusive) evidence that use of and integration of the product into flight operations resulted in better decision making by dispatchers, in turn resulting in fuel burn savings, reduced emissions, improved safety, and increased National Airspace System (NAS) capacity, but follow-up studies and simulations were required.
- 4.6.8 The Joint Meeting agreed that an international approach to turbulence monitoring and reporting was an important aspect of the AMDAR work programme and that the work done in the USA to provide observations for both model assimilation and verification should be built upon and extended to the global AMDAR programme. The AMDAR Panel should work together with the USA NWS, FAA and the relevant research bodies to ensure that the turbulence algorithms and metrics become standardized within AMDAR software specifications so that the next generation of AMDAR software incorporates them.
- 4.6.9 It was agreed that the Panel should make a formal request to the FAA through Dr Farrar to provide the finalized and approved EDR reporting algorithm that might be implemented globally as a standard within AMDAR Programmes.

#### **4.7 AMDAR Planning**

##### ***AMDAR and Evolution of the GOS - Including review of the draft Implementation Plan for the Evolution of Global Observing Systems***

- 4.7.1 The Joint Meeting reviewed the draft Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP), with particular attention paid to those sections relevant to and referencing aircraft observations. Some significant updates and modifications to the text were suggested and it was agreed that these should be incorporated into an

update to the EGOS-IP by SO/ARO, which would be reviewed and finalized by the AMDAR Panel Management Group before submission to ET-EGOS.

### **Work Plan Development**

- 4.7.2 The Secretariat presented a document that proposed a methodology for the development of a planning process for the Aircraft Observing System programme and incorporating the work of both the AMDAR Panel and ET-AIR. This is important and pertinent, particularly in light of the new arrangement for the funding and resourcing of technical coordination support, which now means that the AMDAR Trust Fund can be more readily utilized for AMDAR programme development activities and initiatives.
- 4.7.3 The methodology involves the specification of a long-term plan, from which the derivation of medium and shorter-term plans and activities can be developed and made under the authority of both the Panel and CBS. The long-term plan would be most closely aligned with the Evolution of the Global Observing System Implementation Plan, EGOS-IP, whereas the medium-term activities should be more aligned with the CBS inter-sessional activities, goals and requirements. The short-term plan would effectively be the work programme of the Panel and the ET over the coming year.
- 4.7.4 The Joint Meeting agreed to such an approach to the planning process and that the first draft of these plans should be developed based on the templates proposed by the Secretariat and taking into account the current ongoing work programme of both the Panel and the ET and new initiatives and activities proposed by the Joint Meeting.
- 4.7.5 It was agreed that the long-term plan should essentially consist of a simple list of key goals and activities. The 6 key core activities are:
1. Enhancement of AMDAR Observing System Coverage.
  2. Extension of the AMDAR System.
  3. Research and Development of New Aircraft Observations Technologies.
  4. Development and Maintenance of the Aircraft Observing System Quality Management System.
  5. Aircraft Observing System Training and Outreach.
  6. Management and administration of the Aircraft Observing System Programme.
- 4.7.6 A set of long-term activities associated with the core activities was also agreed upon. The draft plan, including the medium-term activities and the 2012 work programme is provided as Appendix 4 and is to be refined and approved by the APMG.

## **5 FINANCIAL AND ADMINISTRATIVE MATTERS**

### **5.1 Status of the AMDAR Trust Fund**

- 5.1.1 The current status of the AMDAR Trust Fund (TF) was presented to the Joint Meeting and it was noted that, as of October 2011, the TF balance stood at 1,029,505.97 CHF. Contributions made by members in 2010 had totaled 163,159.72 CHF and pledges of contributions for 2011 had been received totaling 177,183.94 CHF.

## **5.2 Budget for 2011-2012**

- 5.2.1 Based on commitments made prior to the current meeting, there was an expected expenditure of approximately 42,500 CHF only.
- 5.2.2 It was agreed that the healthy current and projected state of the TF provides an opportunity and the potential to pursue and accomplish some important AMDAR Programme initiatives and developments, which should be addressed and defined within the context of a sound and well-reasoned work plan.
- 5.2.3 It was proposed and accepted that the expenditures included and agreed within the draft work programme would be used to develop a draft projected budget for 2012 to be finalized and approved by the APMG. The draft budget is provided within Appendix 6.

## **5.3 Future Governance of the AMDAR Programme**

- 5.3.1 The Secretariat presented a document on the Future Governance of the AMDAR Programme that summarized the progress that had been made to date in realizing the agreed plan to integrate the AMDAR Observing System into the WMO Integrated GOS (WIGOS) under the World Weather Watch Programme.
- 5.3.2 With the technical coordinator role of the AMDAR Programme now integrated into the WMO Secretariat under the Aircraft Observations programme and funded from the WMO Regular Budget, the only remaining item in the agree list of six steps to be completed is for full support for AMDAR activities to be funded under the WMO Regular Budget for 2015 – 2018, if this is agreed to by Congress.
- 5.3.3 The Joint Meeting considered and discussed what the final step might mean in terms of the AMDAR Panel existence, its ongoing work programme and the maintenance of the AMDAR Panel Trust Fund. Whilst the Secretariat has proposed that, under the previously agreed evolution of the governance structure, the AMDAR Panel would eventually cease to exist and that the ongoing work of the Panel would be taken over by the WMO Technical Commissions under the WWW Programme, the Panel Members expressed a desire to seek an assurance that the unique work of the Panel could and would indeed be continued under the terms of reference and the work programme of a WMO Technical Commission Expert Team or a similar body identified and appointed by WMO procedure and process.
- 5.3.4 The Joint Meeting reaffirmed that ideally the roles and responsibilities of the AMDAR Panel and the ET-AIR would eventually become unified under a single team within the CBS framework. It was noted however that, the membership, terms of reference and work programme of this team would need to be carefully constructed to ensure that the work done by both the Panel and the ET is carried forward into the future. In particular it must be recognized that the relationship the AMDAR system has with the aviation industry has to be continually monitored and nurtured.
- 5.3.5 It was agreed that any decision and further discussion on the future of the Panel should be withheld until the Chairman obtains advice and clarification from CBS MG regarding these issues.

#### **5.4 Review of Rules and Procedures**

- 5.4.1 The Panel Chairman presented a document that provided an update of the AMDAR Panel governance document, which is now entitled, Purpose and Terms of Reference for the WMO Panel on Aircraft Meteorological Data Relay (AMDAR Panel). The update incorporates all the changes agreed upon at the last Joint Meeting and a small number of changes that includes minor alterations to the definitions of the AMDAR Panel Management Group and the Panel Sub-groups and Coordinators; and, the addition of an Associate category of Panel membership.
- 5.4.2 The AMDAR Panel members agreed to these changes and adopted the document as proposed. The document is provided within Appendix 4.

#### **5.5 Election of officers**

- 5.5.1 All AMDAR Panel official positions were declared vacant and an election of officers was conducted. Mr Frank Grooters was reelected as Chairman of the AMDAR Panel. Mr Carl Weiss was reelected as Vice-Chair. Dr Axel Hoff agreed to continue in the role of Coordinator of the Science and Technical Sub-group. Mr Carl Weiss agreed to continue in the role of Coordinator of the Training and Outreach Sub-group.

### **6 ET-AIR ADMINISTRATIVE MATTERS AND REPORTING TO CBS**

#### **6.1 Proposal of the TOR of ET-AIR for 2013-2016**

- 6.1.1 The Chairman of ET-AIR and the Secretariat proposed a new Terms of Reference of the ET-AIR to be considered by the Joint Meeting for submission by the Chairman to CBS-XV. These ToR were endorsed by the meeting and are provided as Appendix 5.

#### **6.2 Proposal of the Work Plan of ET-AIR for 2013-2016**

- 6.2.1 The Joint Meeting agreed that the AMDAR Panel Management Group (APMG), taking into account the Work Programme drafted and to be finalized and approved by the APMG, should be responsible for compiling a proposed Work Plan for ET-AIR for submission to CBS-XV in 2012.

#### **6.3 AMDAR Panel and ET-AIR report to CBS**

- 6.3.1 The Joint Meeting agreed that the APMG should assist in compiling the report of the Chairman of ET-AIR to CBS-XV in 2012. The achievement, issues and recommendations within the report are to be based on the final reports of AMDAR Panel and ET-AIR joint meetings.

### **7 ANY OTHER BUSINESS**

7.1 No additional business was raised for consideration.

**8 DATE AND PLACE OF THE NEXT MEETING OF THE AMDAR PANEL**

8.1 The Joint Meeting was informed by the Member for the United States that the USA had offered to host the next meeting in Boulder, Colorado with the meeting provisionally scheduled for the week commencing Monday 29 October 2012 or, alternatively, the week commencing Monday 5 November 2012.

**9 CLOSURE OF THE MEETING**

9.1 The Meeting closed at 5pm on 4 November 2011.

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## APPENDIX 1 – List of Participants

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## APPENDIX 1 – List of Participants

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## APPENDIX 1 – List of Participants

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**APPENDIX 2**  
**AMDAR Panel Session 14 and ET-AIR Session 3 Actions**

Agenda Item	Action	Responsibility	Deadline
3.4	<ol style="list-style-type: none"> <li>1. Consult with appropriate managers on the future support of the ESRL/GSD AMDAR Display system;</li> <li>2. Ascertain the possibility of an update to the system to allow national aircraft IDs to be used.</li> </ol>	Mr David Helms	Q1 2012 (AMDAR Management Group Session 4)
4.2	<ol style="list-style-type: none"> <li>1. Emirates Airline to be approached regarding the development of an AMDAR Programme.</li> <li>2. Investigate the possibility of Bahrain or Oman taking responsibility for Middle East AMDAR Programme development</li> </ol>	Chairman	Q4 2012
4.2	<ol style="list-style-type: none"> <li>1. Investigate methods for determining the potential for targeted data provision.</li> <li>2. Investigate resource options for funding targeted data programmes.</li> </ol>	AMDAR Panel Management Group	Q4 2012
4.2	Update the ToR to reflect closure of High Priority Pilot Projects.	Chairman	Q1 2012
4.3	Letter to Météo France and E-AMDAR requesting financial support for B777 software development.	Chairman	Q2 2012
4.3	Address issue of B777 software ownership and ensure that Panel has all necessary rights to make use of it (ownership).	AMDAR Panel Management Group	Q1 2012
4.5	Approach COMET re possibility of development of training modules for AMDAR.	SO/ARO	Q1 2012
4.5	<ol style="list-style-type: none"> <li>1. Newsletter Template and Submissions Form to be sent to Coordinator TOSG;</li> <li>2. Investigate editorial expertise and assistance that might be available to the Panel from within WMO.</li> </ol>	SO/ARO	Q1 2012
4.6	Review the status of WMO guidance material relating to water vapour sensing on Aircraft Meteorological Stations	AMDAR Panel Management Group	Q4 2012
4.6	Consider case and processes necessary for an international collaborative approach to water vapor sensing implementation	AMDAR Panel Management Group	Q1 2012
4.6	Formal approach to FAA to be made through Dr Tammy Farrar for provision to the Panel of the standard EDR algorithm and, if possible a software package or specification.	SO/ARO	Q2 2012

**APPENDIX 2**  
**AMDAR Panel Session 14 and ET-AIR Session 3 Actions**

Agenda Item	Action	Responsibility	Deadline
4.7	Incorporate suggested and discussed changes to the EGOS-IP and submit to the APMG for review.	SO/ARO	Q1 2012
4.7	Review and finalise update to EGOS-IP and submit to ET-EGOS.	APMG	Q1 2012
4.7	Review and finalise Aircraft Observations Programme Work Plan	APMG	Q1 2012
4.7	Review and finalise 2012 Budget	APMG	Q1 2012
5.3	Contact CBS to determine options and issues associated with the amalgamation of the Panel with the ET, particularly taking into account maintenance of the Panel work programme and the authority for use of the Trust Fund.	AMDAR Panel Chairman	Q4 2012

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

**WMO AMDAR PANEL AND CBS/ET-AIR  
AIRCRAFT OBSERVING SYSTEM PROGRAMME PLAN**

**2012 Work Programme and Medium-term Plan**

**Long-term Plan to 2025**

<b>VERSION</b>	0.2
<b>DATE</b>	16 January 2012
<b>STATUS</b>	Draft

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

**WMO AIRCRAFT OBSERVING SYSTEM WORK PROGRAMME 2012 AND MEDIUM-TERM PLAN**

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
1.1 (Enhancement of AMDAR Observing System Coverage - Extend global AMDAR coverage)	1.1.1	Study on data coverage and airline capabilities	1	1. Award SSA	1. AP-MG	Q1 2012	Q4 2012	TBC	SSA in place	40K
				2. Manage SSA	2. SO/ARO	Q4 2011	Q4 2012	TBC	Nil	
				3. Review deliverables.	3. SO/ARO, A-FPs, (AP-MG)	Q1 2012	Q4 2012	TBC	1. Study on Coverage; 2. Study on airlines; 3. Report.	
	1.1.2	Development of AMDAR Programmes for: <ul style="list-style-type: none"> <li>• Northern Africa;</li> <li>• South and Central America;</li> <li>• Southwest Pacific</li> <li>• Eastern Europe;</li> <li>• Middle East</li> <li>• Central Africa.</li> </ul>	1	1. Organise finance for AeroMexico programme.	1. AP-MG, SO/ARO	Q4 2011	Q2 2012	Commenced	1. Contract with AeroMexico	50K
			2	2. Determine potential for data targeting over Africa	2. AP-MG	Q1 2012	Q3 2012	TBC	1. Report to MG-4	
			2	3. Determine what capacity there is to use targeted data in Africa	3. AP-MG	Q1 2012	Q3 2012	TBC	1. Report to MG-4	
			2	4. 1 or 2 members of the Panel to undertake fact-finding mission to Africa re programme potential	4. AP-MG	Q1 2012	Q3 2012	TBC	1. Report to Panel-15	10K
			3	5. Investigate approach for Emirates AMDAR Programme commencement – assess possibilities for Bahrain, Oman.	5. F.Grooters	Q1 2012	Q3 2012	TBC	1. Report to MG-4	
	1.1.3	Improve and extend Targeted Data Activities	2	1. All programmes to identify potential for data targeting within their programs.	1. A-FPs (Operational)	Q1 2012	Q3 2012	TBC	1. Report to MG-4	

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
	1.1.4	Develop guidelines for programme development	2	1. Write DoW	1. AP-MG	Q1 2012	Q3 2012	TBC	1. DoW	
1.2 (Enhancement of AMDAR Observing System Coverage - Address the requirement for national, regional and global optimization)	1.2.1	Develop optimization systems for: <ul style="list-style-type: none"> <li>• United States AMDAR Programme;</li> <li>• Asia;</li> <li>• Africa;</li> <li>• South America.</li> </ul>	2	1. Study on optimization for Sth Africa AMDAR Programme 2. Study on optimization for US AMDAR Programme (MDCRS)	2. SO/ARO, G.Khambule 3. SO/ARO D. Helms	Q2 2012	Q3 2012	TBC	1. Report to MG-4	
2.1 (Extension of the AMDAR System - Implement water vapour sensing measurement)	2.1.1	Implement water vapour sensing measurement	1	1. Investigate Panel ownership of general STC for Airbus 320 family.	1. A.Hoff	Q1 2012	Q3 2012	TBC	1. Report to MG-4	
			1	2. Investigate Panel ownership of general FAA STCs for Boeing 737 types and conversion to European EU/EASA certification.	2. A.Hoff/Y. Lemaitre	Q1 2012	Q3 2012	TBC	1. Report to MG-4	
			1	3. Write a letter to PRs seeking interest in international project for WV implementation	3. SO/ARO	Q1 2012	Q2 2012	TBC	1. Letters to PRs	
2.2 (Extension of the AMDAR System - Implement turbulence measurement)	2.2.1	Implement turbulence measurement	1	1. Obtain specification for EDR from FAA	1. SO/ARO	Q1 2012	Q3 2012	TBC	1. EDR Specification	10K
			1	2. Obtain EDR software package from FAA for use in E-AMDAR	2. SO/ARO	Q1 2012	Q3 2012	TBC	2. EDR Software	

### APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
4.1 (Development and Maintenance of the Aircraft Observing System Quality Management System - Implement a Quality Management Framework for AMDAR)	4.1.1	WIGOS Pilot Project for AMDAR	1	1. WIGOS-PP-AMDAR-1 Development of BUFR Template: <ul style="list-style-type: none"> <li>• Coordinate validation;</li> <li>• Report to Code Group</li> <li>• Report to MG-3;</li> <li>• Report to JM-4</li> </ul>	1. SO/ARO ECMWF/Met Office	Q4 2011	Q1 2012	Commenced	1. Validated template	
			1	2. WIGOS-PP-AMDAR-2 Metadata Development: <ul style="list-style-type: none"> <li>• AP-FPs and Review Group to review Metadata sets;</li> <li>• Define metadata categories;</li> </ul>	2. PL-IDEQC, SO/ARO, AP-FPs  Review Group: SO/ARO, N.Halsey, D.Helms, J.v.d.Meulen,	Q4 2011	Q3 2012	Commenced	1. Refined metadata set; 2. Categorised metadata set. 3. PL-IDEQC report to MG-4	
			1	3. WIGOS-PP-AMDAR-3 Develop AMDAR Data Management Procedures: <ul style="list-style-type: none"> <li>• Hold a workshop of AMDAR data management experts in Q1 2012 (Geneva);</li> <li>• Develop a strategy for global AMDAR data management;</li> </ul>	3. J.v.d.Meulen, AP-MG	Q1 2012	Q4 2012	TBC	1. AMDAR Data Management Workshop; 2. Global AMDAR Data Management Strategy.	15K

### APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
			1	4. WIGOS-PP-AMDAR-4 Validation and Inter-comparison of WVSS-II: <ul style="list-style-type: none"> <li>• Paper on summary of results and conclusions:                             <ul style="list-style-type: none"> <li>• DoW</li> <li>• Award SSA</li> <li>• Manage SSA</li> </ul> </li> <li>• Seek endorsement by CIMO and CBS as a candidate system for operational deployment by Members;</li> <li>• Technique employed by the WVSS-II sensor should be appropriately integrated into the CIMO Guide and CBS guides.</li> <li>• Development of AMDAR Panel Statement of Support for WV implementation leading to WMO endorsement.</li> </ul>	4. AP-MG	Q1 2012	Q4 2012	TBC	1. DoW 2. SSA 3. Paper 4. Statement of Support	30K

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
			1	5. WIGOS-PP-AMDAR-5: Update of AMDAR Reference Manual: 1. SSA to be compiled for: i) Review of WMO and AMDAR regulatory material ii). Integrate AMDAR RM into WMO regulatory material. I iii). Conduct a regulatory material review process as necessary to finalise item ii. 2. Draft of a short document describing in general terms the (implementation of an) AMDAR Programme	5. 1. AP-MG, SO/ARO 2. AP-MG	Q1 2012	Q4 2012	TBC	1. DoW for SSA. 2. AMDAR System reviewed in WMO reg. material. 3. Draft AMDAR Implementation Manual	40K
			1	6. WIGOS-PP-AMDAR-6 Generic Software Spec: 1. Manage SSA; 2. Review deliverables.	6. 1. SO/ARO; 2. Review group: SO/ARO, D.Helms, HR.Sonnabend, A.Hoff.	Q4 2011	Q3 2012	Commenced	1. Generic software specification.	40K
4.1 (Development and Maintenance of the Aircraft Observing System Quality Management System - Implement a Quality Management Framework for AMDAR)	4.1.2	Establishment of National and International Metadata	2	1. Collection of metadata on AMDAR software to be completed	1. PL-IDEQC, SO/ARO, AP-FPs	Q1 2012	Q3 2012	TBC	1. Software metadata set	

### APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
4.2 (Development and Maintenance of the Aircraft Observing System QMS - Develop a National and Global Aircraft Observations Data Management Framework)	4.2.1	Develop a National and Global Aircraft Observations Data Management Framework	2	<ol style="list-style-type: none"> <li>1. Re NOAA/ESRL/GSD AMDAR data display determine: <ul style="list-style-type: none"> <li>• Future maintenance of and for this system</li> <li>• Possible change to use of national aircraft IDs</li> </ul> </li> </ol>	1. D.Helms	Q1 2012	Q3 2012	TBC	1. Report to MG-4	
4.3 (Development and Maintenance of the Aircraft Observing System QMS - Standardise AMDAR software function across avionics systems and optional sensors across aircraft)	4.3.1	Update of ARINC 620 Meteorological Report to Version 5	1	<ol style="list-style-type: none"> <li>1. Finalise ARINC 620 Met. Report Version 5</li> </ol>	1. SO/ARO, A.Hoff, HR.Sonnabend, D.Helms	Q4 2011	Q1 2012	Commenced	1. ARINC 620 V5	
	4.3.2	Standardisation of AMDAR within Aviation	3	<ol style="list-style-type: none"> <li>1. Commence planning for an Aviation Industry event for 2013 re software implementation in new aircraft.</li> <li>2. Attend the Airlines Association AGM, South Africa</li> </ol>	<ol style="list-style-type: none"> <li>1. AP-MG</li> <li>2. AP-MG G.Khambule,</li> </ol>	Q1 2012	Q4 2012	TBC	<ol style="list-style-type: none"> <li>1. Report to Panel-15</li> <li>2. Report to Panel-15</li> </ol>	
	4.3.3	AMDAR Software Development	2	<p>B777 Software Development:</p> <ol style="list-style-type: none"> <li>1. Proposal of B777 software development to be made to Meteo-France and E-AMDAR</li> <li>2. Ownership issues to be addressed</li> </ol>	<ol style="list-style-type: none"> <li>1. F.Grooters</li> <li>2. AP-MG</li> </ol>	Q1 2012	Q2 2012	TBC	Letter to M-France and E-AMDAR	20K
4.4 (Development and Maintenance of the Aircraft Observing System QMS - Manage the data processing and quality assurance for other sources of aircraft data)	4.4.1	Develop strategies for the management of ADS and Mode S data	2	Ensure item is addressed under 4.1.1(3): AMDAR Data Management Workshop	SO/ARO, J.v.d.Meulen	Q1 2012	Q3 2012	TBC	Report to MG-4	

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
5.1 (Aircraft Observing System Training and Outreach - Develop methods and material for promoting Aircraft Observations)	5.1.1	Aircraft Observations System Website Maintenance	2	1. Review website.	2. C.Weiss, SO/ARO, Y.Lemaitre, J.v.d.Meulen	Q1 2012	Q1 2012	TBC	1. Review report to MG-3	
			3	2. Technical contractor to update website.	3. SO/ARO	Q2 2012	Q4 2012	TBC	1. SSA 2. Website update plan 3. Website update commenced	40K
	5.1.2	Impacts and Benefits Document for Aviation	2	1. Identify contractors and obtain Eols and quotations 2. Award and manage SSA 3. Review deliverables	1. AP-MG 2. SO/ARO, B.Ford 3. AP-MG	Q1 2012	Q4 2012	Commenced	1. SSA 2. Aviation 3. Impacts and Benefits document	40K
	5.1.3	AMDAR COMET Training Module	3	Contact COMET re development of a AMDAR course.	AP-MG(C. Weiss), SO/ARO	Q1 2012	Q1 2012	TBC	Report to MG-3	
	5.1.4	Impact Studies Assessment	3	Commission a paper summarizing results of AMDAR Impact studies including NWP and other Data Users	AP-MG, (ESRL, ECMWF, ABoM, MF, CMA,SAWS)	(Q2 2012)	(Q4 2012)	TBC	Paper	25K
5.2 (Aircraft Observing System Training and Outreach - Conduct training and outreach activities)	5.2..1	Aircraft Observations Newsletter production	2	Newsletters Q1, Q2, Q3, Q4	C-TOSG, SO/ARO,AP-MG, AP-FPs.	Q1 2012	Q4 2012	TBC	Newsletters Q1, Q2, Q3, Q4	
6.1 (Management and administration of the Aircraft Observing System Programme - Conduct meetings of members)	6.1.1	Organization of Panel Meetings	1	1. Confirm meeting location and date	AP-MG	Q1 2012	Q1 2012	Commenced	Location, dates	5K
				2. Venue and meeting logistics	Host	Q2 2012	Q2 2012	TBC	Venue	
				3. Info for participants	Host	Q3 2012	Q3 2012	TBC	Info for participants	
				4. Doc Plan draft	AP-MG	Q3 2012	Q3 2012	TBC	Doc Plan Draft	
				5. Doc Plan	AP-MG, SO/ARO, A-FPs	Q3 2012	Q3 2012	TBC	Doc Plan	

### APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

Core and L-T Activity	M-T Activity	Description	Pty (1-3)	2012 Activities	Responsibility	Commence	Complete	Status	Outputs / Deliverables	Budget Estimate
				6. 2012 Panel Meeting	SO/ARO, (AP-MG)	Q4 2012	Q4 2012	TBC	2012 Meeting Report	
	6.1.2	Organization of AMDAR Panel Management Group Meetings	1	Organise and hold AP-MG Session 3	AP-MG, SO/ARO	Q1 2012	Q1 2012	TBC	MG-3 Report	10K
				Organise and hold AP-MG Session 4	AP-MG, SO/ARO	Q2 2012	Q3 2012	TBC	MG-4 Report	5K
6.2 (Management and administration of the Aircraft Observing System Programme - Coordinate planning activities)	6.2.1	Reporting and planning associated with ICT-IOS, CBS and ET-AIR	1	1. Finalisation of ET-Work Plan 2013 - 2016 2. ET-AIR Report to CBS	1. AP-MG 2. ET-AIR Chair	Q1 2012	Q3 2012	TBC	1. ET-AIR Work Plan 2. Report to CBS	
			1	3. Review of EGOS IP	3. AP-MG	Q4 2011	Q4 2011	TBC	3. Revision provided to ET-EGOS Chair-	

## APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

### WMO AIRCRAFT OBSERVING SYSTEM CORE AND LONG-TERM ACTIVITIES

- 1 Enhancement of AMDAR Observing System Coverage.
  - 1.1 Extend global AMDAR coverage, particularly over upper air data sparse and developing areas.
  - 1.2 Address the requirement for national, regional and global optimization
  - 1.3 Extend AMDAR Programme to GA aircraft and coverage of regional airports.
- 2 Extension of the AMDAR System.
  - 2.1 Implement water vapour sensing measurement.
  - 2.2 Implement turbulence measurement.
  - 2.3 Implement icing indication.
- 3 Research and Development of New Aircraft Observations Technologies.
  - 3.1 Manage risks and opportunities associated with new and developing technologies in avionics, communications and metrology.
- 4 Development and Maintenance of the Aircraft Observing System Quality Management System.
  - 4.1 Implement a Quality Management Framework for AMDAR that incorporates standardization across national programmes, taking into account:
    - 1) Data management;
    - 2) Metadata management;
    - 3) Quality control for metrological systems;
    - 4) Systems and data monitoring and evaluation.
  - 4.2 Develop a National and Global Aircraft Observations Data Management Framework.
  - 4.3 Standardise AMDAR software function across avionics systems and optional sensors (e.g. water vapour) across aircraft.
  - 4.4 Manage the data processing and quality assurance for other sources of aircraft data transmitted on the GTS including data provided through ICAO.
- 5 Aircraft Observing System Training and Outreach.
  - 5.1 Develop methods and material for promoting Aircraft Observations and the AMDAR Programme.
  - 5.2 Conduct training and outreach activities in support of Core Activities.
- 6 Management and administration of the Aircraft Observing System Programme
  - 6.1 Conduct meetings of members and stakeholders.
  - 6.2 Coordinate planning activities.
  - 6.3 Monitor and evaluate the Aircraft Observations Programme.

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

**WMO AIRCRAFT OBSERVING SYSTEM CORE AND LONG-TERM ACTIVITIES**

<b>Core Activity</b>	<b>Long-term Activity</b>	<b>Description</b>	<b>Activities</b>	<b>Outputs</b>	<b>Outcomes/Impacts</b>	<b>Justification</b>	<b>Priority (1-3)</b>	<b>Timeframe</b>
1	1.1	Extend global AMDAR coverage, particularly over upper air data sparse and developing areas.	<ol style="list-style-type: none"> <li>1. Regional and national workshops;</li> <li>2. Training and Outreach;</li> <li>3. Liaison with NMHSs, Airlines and Avionics service providers;</li> <li>4. Liaison with stakeholders and data users;</li> <li>5. Studies on data coverage and airline capabilities;</li> <li>6. Assessment and use of impact studies;</li> <li>7. Facilitate, coordinate and promote data provision among and outside AMDAR programmes.</li> </ol>	<ol style="list-style-type: none"> <li>1. AMDAR Workshops;</li> <li>2. AMDAR training materials;</li> <li>3. Extension of AMDAR expertise;</li> <li>4. Results and reports of studies;</li> <li>5. AMDAR data provided beyond national AMDAR Programme requirements.</li> </ol>	<ol style="list-style-type: none"> <li>1. More airlines recruited;</li> <li>2. More national AMDAR programmes;</li> <li>3. Better AMDAR global data coverage;</li> <li>4. Significant, positive impact on applications and for Data Users.</li> </ol>	WMO-ER-4	1	Ongoing to 2025
1	1.2	Address the requirement for national, regional and global optimization	<ol style="list-style-type: none"> <li>1. Promote the implementation and use of AMDAR Data Optimisation Systems;</li> <li>2. Specification of AMDAR data requirements;</li> <li>3. Specification of optimization requirements;</li> <li>4. Liaison with WMO/CBS/E-EGOS.</li> </ol>	<ol style="list-style-type: none"> <li>1. Studies and reports</li> <li>2. Specifications</li> <li>3. Optimised AMDAR Programmes</li> </ol>	<ol style="list-style-type: none"> <li>1. More efficient use of Member resources</li> <li>2. Improved AMDAR data coverage</li> </ol>	WMO-ER-4	1	Ongoing to 2025
1	1.3	Extend AMDAR Programme to GA aircraft and coverage of regional airports.	<ol style="list-style-type: none"> <li>1. Research, trial and study of new and developing aircraft observing systems, avionics systems, communications systems and sensors appropriate for GA aircraft application</li> <li>2. Develop standards associated with new aircraft observing systems for GA aircraft</li> <li>3. Assist Members in the implementation of proven and approved aircraft observing systems for GA aircraft.</li> </ol>	<ol style="list-style-type: none"> <li>1. Studies and reports</li> <li>2. Manuals and guides</li> <li>3. Programmes incorporating GA aircraft</li> </ol>	<ol style="list-style-type: none"> <li>1. More airlines recruited</li> <li>2. Better AMDAR global data coverage</li> <li>3. Significant, positive impact on applications and for Data Users.</li> </ol>	WMO-ER-4	3	Ongoing to 2025

**APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN**

**WMO AIRCRAFT OBSERVING SYSTEM CORE AND LONG-TERM ACTIVITIES**

<b>Core Activity</b>	<b>Long-term Activity</b>	<b>Description</b>	<b>Activities</b>	<b>Outputs</b>	<b>Outcomes/Impacts</b>	<b>Justification</b>	<b>Priority (1-3)</b>	<b>Timeframe</b>
2	2.1	Implement water vapour measurement	<ol style="list-style-type: none"> <li>1. Undertake planning and project coordination in the implementation by Members of WV measurement within the AMDAR Observing System</li> <li>2. Coordinate negotiations and interactions with sensor manufacturers</li> <li>3. Coordinate negotiations and develop agreements for standardization with aircraft and avionics manufacturers and aviation standards authorities.</li> <li>4. Promote the standardization of aircraft equipment by merging the interests of meteorology pilots, airlines, ATM, NMHSs, Environmental control for                             <ul style="list-style-type: none"> <li>- better deicing warning,</li> <li>- deicing efficiency,</li> <li>- NWP,</li> <li>- contrail warning.</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Studies and reports</li> <li>2. Business cases for NMHSs and Airlines</li> <li>3. International WV Project</li> <li>4. Certificates (STCs) for aircraft</li> <li>5. Agreements between the relevant stakeholders.</li> </ol>	<ol style="list-style-type: none"> <li>1. WV capability for AMDAR Programme</li> <li>2. Significant, positive impact on applications and for Data Users.</li> <li>3. Ex-works availability AMDAR + humidity + particles.</li> </ol>	WMO-ER-4	1	Ongoing to 2025
2	2.2	Implement turbulence measurement.	<ol style="list-style-type: none"> <li>1. Undertake planning and project coordination in the implementation by Members of turbulence measurement within the AMDAR Observing System;</li> <li>2. Coordinate negotiations and interactions with algorithm developers;</li> <li>3. Coordinate negotiations for standardisation with aircraft and avionics manufacturers and aviation standards authorities.</li> </ol>			WMO-ER-4	1	Ongoing to 2015

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**WMO AIRCRAFT OBSERVING SYSTEM CORE AND LONG-TERM ACTIVITIES**

<b>Core Activity</b>	<b>Long-term Activity</b>	<b>Description</b>	<b>Activities</b>	<b>Outputs</b>	<b>Outcomes/Impacts</b>	<b>Justification</b>	<b>Priority (1-3)</b>	<b>Timeframe</b>
2	2.3	Implement icing indication.	<ol style="list-style-type: none"> <li>1. Undertake planning and project coordination in the implementation by Members of icing measurement within the AMDAR Observing System;</li> <li>2. Coordinate negotiations for standardisation with aircraft and avionics manufacturers and aviation standards authorities.</li> </ol>			WMO-ER-4	2	Ongoing to 2020
3	3.1	Manage risks and opportunities associated with new and developing technologies in avionics, communications and metrology.	<ol style="list-style-type: none"> <li>1. Research, trial and study of new and developing aircraft observing systems, avionics systems, communications systems and sensors appropriate for aircraft application;</li> <li>2. Attend and report on appropriate aviation meetings and forums that develop and define standards relating to avionics and communications</li> <li>3. Develop standards associated with new aircraft observing system technologies;</li> <li>4. Assist Members in the implementation of proven and approved technologies for aircraft observing systems.</li> </ol>			WMO-ER-4	1	Ongoing to 2025

## APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

### WMO AIRCRAFT OBSERVING SYSTEM CORE AND LONG-TERM ACTIVITIES

Core Activity	Long-term Activity	Description	Activities	Outputs	Outcomes/Impacts	Justification	Priority (1-3)	Timeframe
4	4.1	Implement a Quality Management Framework for AMDAR that incorporates standardization across national programmes, taking into account: 1. Data management; 2. Metadata management; 3. Quality control for metrological systems; 4. Systems and data monitoring and evaluation.	<ol style="list-style-type: none"> <li>1. Coordinate (expert) meetings, projects and tasks related to the development of standards;</li> <li>2. Approve and document standards;</li> <li>3. Coordinate the implementation of standards by Members.</li> </ol>			WMO-ER-4	1	Ongoing to 2025
4	4.2	Develop a National and Global Aircraft Observations Data Management Framework.	<ol style="list-style-type: none"> <li>1. Coordinate (expert) meetings, projects and tasks related to the development of a DMF;</li> <li>2. Approve and document the DMF;</li> <li>3. Coordinate the implementation of the DMF by Members.</li> </ol>			WMO-ER-4	1	Ongoing to 2015
4	4.3	Standardise AMDAR software function across avionics systems and optional sensors (e.g. water vapour) across aircraft.	<ol style="list-style-type: none"> <li>1. Coordinate with and attend meetings with representatives of airlines, avionics manufacturers, and other aviation bodies as appropriate;</li> <li>2. Coordinate implementation of the establishment of software and sensor standards.</li> </ol>			WMO-ER-4	2	Ongoing to 2020
4	4.4	Manage the data processing and quality assurance for other sources of aircraft data transmitted on the GTS including data provided through ICAO.	<ol style="list-style-type: none"> <li>1. Coordinate with and attend meetings with representatives of data providers (e.g. ICAO);</li> <li>2. Coordinate the establishment of standards for aircraft data other than AMDAR (ADS, Mode-S).</li> </ol>			WMO-ER-4	2	Ongoing to 2025

## APPENDIX 3 AMDAR PANEL AND ET-AIR DRAFT WORK PLAN

### WMO AIRCRAFT OBSERVING SYSTEM CORE AND LONG-TERM ACTIVITIES

Core Activity	Long-term Activity	Description	Activities	Outputs	Outcomes/Impacts	Justification	Priority (1-3)	Timeframe
5	5.1	Develop methods and material for promoting and developing Aircraft Observations and the AMDAR Programme.	<ol style="list-style-type: none"> <li>1. Define, develop and manage the content of the Aircraft Observing System WMO website;</li> <li>2. Specify and coordinate the development of promotional material, e.g. flyers, papers, posters, etc;</li> <li>3. Specify and coordinate the development of training material for Members.</li> </ol>			WMO-ER-4	2	Ongoing to 2025
5	5.2	Conduct training and outreach activities in support of Core Activities.	<ol style="list-style-type: none"> <li>1. Conduct technical workshops for Members;</li> <li>2. Coordinate and conduct meetings, workshops and conferences with appropriate stakeholders.</li> </ol>			WMO-ER-4	2	Ongoing to 2025
6	6.1	Conduct meetings of members and stakeholders.	<ol style="list-style-type: none"> <li>1. Coordinate meetings of the AMDAR Panel;</li> <li>2. Coordinate meetings of ET-AIR;</li> <li>3. Coordinate meetings of the Aircraft Observations Programme Management Group (AP-MG).</li> </ol>			WMO-ER-4	1	Ongoing to 2025
6	6.2	Coordinate planning activities.	<ol style="list-style-type: none"> <li>1. Develop plans for extension and enhancement of the AMDAR Observing System.</li> </ol>			WMO-ER-4	1	Ongoing to 2025
6	6.3	Monitor and evaluate the Aircraft Observations Programme.	<ol style="list-style-type: none"> <li>1. Develop and maintain diagnostics and tools for monitoring and evaluating progress of the development of the Aircraft Observations Programme.</li> </ol>			WMO-ER-4	2	Ongoing to 2025

### APPENDIX 3 AMDAR Panel and ET-AIR Draft Work Plan

Version	Date	Author	Changes
0.1	21 December 2011	Dean Lockett	Original draft incorporating plans made at AMDAR Panel Session 14, December 2011.
0.2	16 January 2012	Dean Lockett	Update to draft 0.2: 1. Incorporate comments for review carried out by AP-MG and AMDAR Focal points 2. Added Version Control section.

## APPENDIX 4

# PURPOSE AND TERMS OF REFERENCE FOR THE WMO PANEL ON AIRCRAFT METEOROLOGICAL DATA RELAY (AMDAR PANEL)

## I. GENERAL

The purpose of the Panel shall be to enhance the upper-air component of the Global Observing System of the World Weather Watch through cooperation among Members in the acquisition, exchange and quality control of meteorological observations from aircraft using automated reporting systems.

Recognizing a fundamental principle of WMO to broaden and enhance the free and unrestricted international exchange of data and noting the increasing availability of aircraft platforms with suitable sensors, avionics and communication systems, the Panel is established to take advantage of the opportunity to use these new cost-effective global data sources to better respond to the needs of WMO, WMO-sponsored programmes such as the WWW, WCRP, GCOS and GOOS, other global programmes such as GEOSS, and to bring potential benefits to end-users in aviation and other communities. The Panel is considered necessary to ensure a coordinated approach to the development of AMDAR as an operational global programme with particular benefits in data-sparse areas of the world.

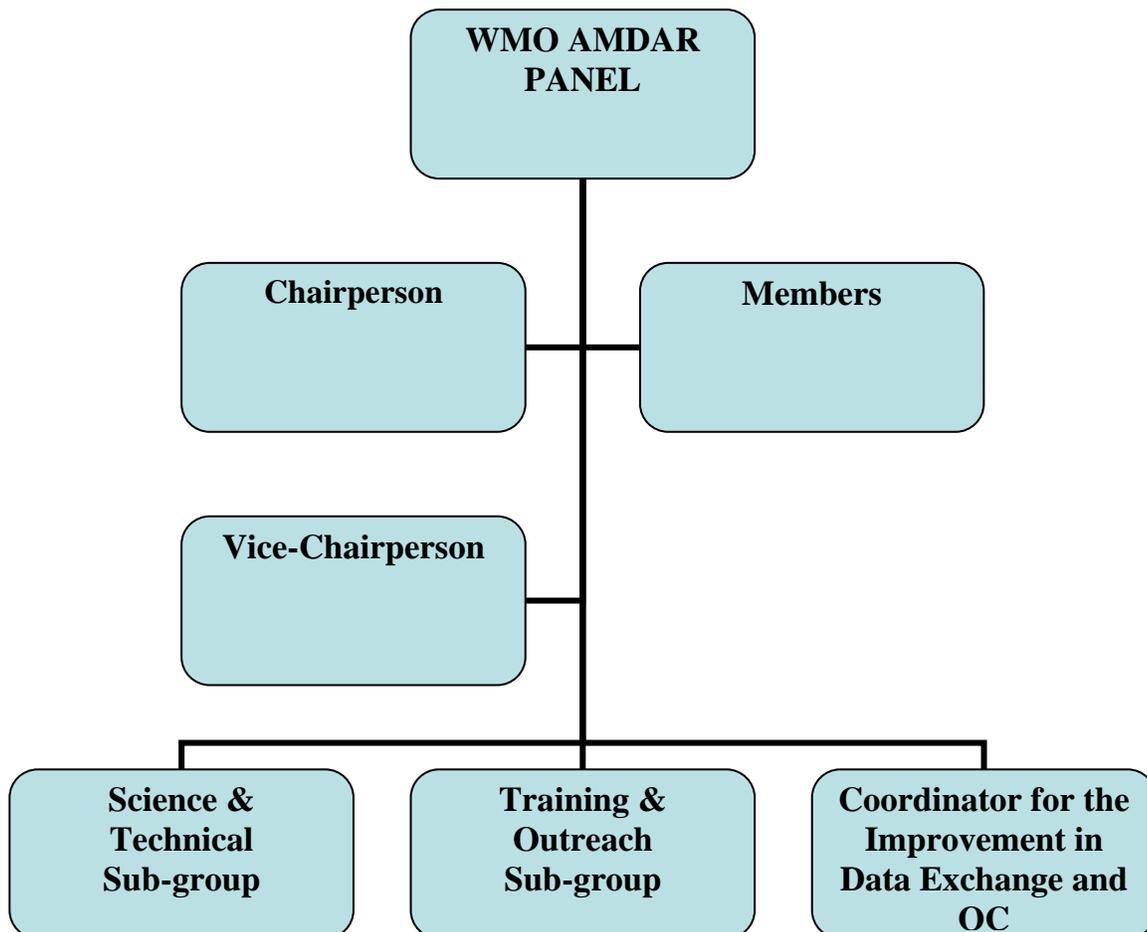
To achieve the purpose, the Panel on Aircraft Meteorological Data Relay shall:

1. Consider the expressed needs of the international meteorological and climatological communities for data from automated meteorological reports from aircraft and initiate action from its members, or others as appropriate, to meet these needs;
2. Facilitate the coordination of existing national and international programmes of automated meteorological reporting from aircraft so as to optimize the provision and timely exchange of high-quality data at minimum cost;
3. Propose, organize and implement through the coordination of national and regional efforts, the expansion of the current and future Aircraft Meteorological Data Relay (AMDAR) Programme, to obtain such data particularly in data-sparse areas of the world;
4. Promote the exchange and dissemination of all appropriate automated meteorological reports from aircraft through the Global Telecommunication System and other systems as appropriate;
5. Promote the dissemination, exchange and use of information on AMDAR data availability and quality among Members and data providers with a view to initiating appropriate corrective action;
6. Promote the exchange of information on AMDAR and encourage the development and transfer of appropriate technology;
7. Ensure that other bodies actively involved in automated meteorological reporting from aircraft are informed of the workings of the Panel and encourage, as appropriate, their participation in the Panel's deliberations;
8. Make and regularly review administrative arrangements as necessary, including securing the services of a Technical Coordinator when necessary;

#### APPENDIX 4

9. Promote joint funding arrangements, as appropriate, for the development, implementation and operation of the AMDAR Programme;
10. Liaise and interact with the Commission for Basic Systems (CBS) regarding further integration of AMDAR into GOS and WMO Integrated Global Observing System (WIGOS);
11. Liaise and interact as appropriate with the relevant sections of the aviation community on issues of common concern such as data acquisition, data management, communications and costs; and
12. Submit annual progress reports to the relevant WMO constituent body sessions and/or their subsidiary bodies.

#### II. WORKING STRUCTURE OF THE AMDAR PANEL



## APPENDIX 4

### III. MANAGEMENT GROUP:

1. The Management Group is created to steer the AMDAR Panel activities between AMDAR Panel sessions.
2. The Management Group is composed of:
  - a. AMDAR Panel Chairperson
  - b. Vice-Chairperson of the AMDAR Panel
  - c. Science and Technical Subgroup Coordinator
  - d. Training and Outreach Sub-Group Coordinator
  - e. Coordinator for the Improvement in Data Exchange and Quality Control
  - f. Representative from CBS ET-AIR
3. The AMDAR Panel Management Group may call representatives of national and/or regional AMDAR programs for specific agenda items.
4. The work of the AMDAR Panel Management Group is supported by the WMO Secretariat.
5. The AMDAR Panel Management Group will normally meet once per year.

### IV. SUB\_GROUP AND COORDINATORS:

1. Sub-groups have been established to deal with specific issues related to scientific, technical, training, Outreach and the improvement in data exchange and quality control activities of the Panel.
2. The Panel agreed on terms of reference for the sub-groups and coordinators.

### V. MEMBERSHIP FOR THE WMO PANEL ON AIRCRAFT METEOROLOGICAL DATA RELAY (AMDAR PANEL)

The Panel is recognized as a body within the WMO structure, with the endorsement of the WMO Executive Council and anchored to the Commission for Basic Systems (CBS), fostering active cooperation among Members in the implementation and operation of AMDAR as a component of the WWW Composite Observing System.

Because industry organizations are not eligible for Panel membership, their representation can be addressed either by associate membership, or as an observer.

#### Members:

Panel members shall be Members of WMO that operate or intend to operate AMDAR programs and are willing to contribute to the Panel's activities or the AMDAR Panel Trust Fund.

#### Associate Members:

Representatives of any international organization or programme actively involved in the use, development, collection, provision or standardization of avionics and communication

## APPENDIX 4

practices related to automated meteorological reporting from aircraft, or organizations which specifically require such data may be invited by or apply to the AMDAR Panel to participate in Panel Meetings and activities. Associate Members will not have voting rights for AMDAR Panel decisions and may be excluded from AMDAR Panel discussions and activities appropriate to Members only.

### Observers:

Representatives of any organization or programme actively interested in automated meteorological observations from aircraft, or which specifically require such data, may be invited to participate as Observers in AMDAR Panel Meetings. Observers will not have voting rights for AMDAR Panel decisions and may be excluded from AMDAR Panel activities appropriate to Members only.

## VI. OPERATING PROCEDURES FOR THE WMO AMDAR PANEL

1. The Panel will normally meet annually. The Panel will elect a Chairperson and Vice-chairperson, from among the representatives of the Panel members by a simple majority of the participating Panel Members. Also, the AMDAR Panel will appoint coordinators of its sub-groups as necessary to carry out the agreed work programme of the Panel between sessions. The Chairperson will prepare reports for WMO, as required;
2. The Chairperson may call on representatives of individual Panel members for assistance in matters such as the representation of the Panel at meetings of other bodies, the preparation of reports on specific topics, etc.;
3. A position in the WMO Secretariat (Scientific Officer-Aircraft and Remote Sensing Observations) also covers the duties of the AMDAR Technical Coordinator to support the work of the AMDAR Panel. The cost for this position is shared between the WMO Secretariat and the AMDAR Panel Trust Fund.
4. The Panel's budget and associated income and expenditures will be reviewed and approved at the annual meetings of the Panel;
5. The WMO Secretary-General will provide appropriate support to the Panel and manage any trust funds established;
6. The working language of the Panel shall be English; and
7. The Panel's terms of reference, membership and operating procedures shall be reviewed and revised as necessary at the annual meetings. The Chairperson shall prepare recommendations to be distributed before the meeting.

## APPENDIX 4

### VII. TERMS OF REFERENCE FOR THE WMO AMDAR TRUST FUND

1. The purpose of the AMDAR Fund is to support the AMDAR Programme and the activities of the Panel on Aircraft Meteorological Data Relay (AMDAR Panel).
2. The AMDAR Fund is a Trust Fund within the provisions of Articles 9.7, 9.8 and 9.9 of the WMO Financial Regulations (1991 edition).
3. The Fund shall be managed according to the budget adopted by the AMDAR Panel.
4. The budget will be constructed according to a format agreed by the Panel, in which all income and expenditures will be identified in general articles and specific chapters. The format of the budget may be revised by the Panel as necessary. The budget may take note of other monies and resources made available for support of the operational AMDAR Programme, but which are not included as part of the Fund. These might include, for example, meeting support provided by WMO VCP contributions, support of conditioned and agreed activities or support in kind. Only those monies placed in the Fund, however, shall be subject to these terms of reference.
5. The unit of account shall be the Swiss Franc. When commitments are made, the appropriate funds will be converted, as necessary, to the currency of commitment in at least the amount of the commitment.
6. The income of the Fund will include:
  - (i) Annual voluntary contributions;
  - (ii) Funds deposited for specific purposes, hereafter referred to as deposits;
  - (iii) Other contributions;
  - (iv) Interest on investments as may be made by the Secretary-General in accordance with the provisions of Financial Regulation 12.2; and
  - (v) Miscellaneous income.
7. The fund will be used as agreed by the AMDAR Panel:
  - (i) To finance technical and operational support services for AMDAR, including the proportional part of the cost associated with the position of the Scientific Officer (Aircraft and Remote Sensing Observations);
  - (ii) To assist in the establishment and operation of programmes of automated meteorological reporting from aircraft;
  - (iii) To meet appropriate administrative costs incurred by WMO in providing support to AMDAR Panel activities;
  - (iv) To meet other administrative costs including such items as meetings and consultants;

#### APPENDIX 4

- (v) To purchase specified items of equipment and software; and
  - (vi) To support other activities required to meet the basic goal of the AMDAR Panel.
8. Authority for the disbursement of funds, in respect of contracts and agreements properly concluded, will be delegated to the Chairperson of the AMDAR Panel, together with the Secretary-General of WMO, or his representative. The Chairperson of the AMDAR Panel will authorize the Secretary-General of WMO, or his representative to disburse the funds by means of a written communication to the WMO Secretariat.
  9. Where required by their internal regulations, individual contributors to the AMDAR Fund may wish to negotiate additional conditions governing the application, conditions of deposit and disbursement of funds. Such additional conditions shall not inhibit the efficient and proper use of the Fund nor modify the intent of the Fund. They shall require the acceptance in writing by the Chairperson of the AMDAR Panel and the Secretary-General of WMO or his representative.
  10. The Fund shall be maintained on a continuous basis and amounts standing to the credit of the Fund at the end of any annual period shall remain in the Fund for use in the subsequent period.
  11. All funds credited to the AMDAR Fund, including those for VCP purposes, shall be subject to these terms of reference and to the terms of reference of the AMDAR Panel.
  12. Following cessation of AMDAR Panel activities the Trust Fund will be closed.
  13. The Trust Fund will be closed when all remaining funds are exhausted.

**VIII. TERMS OF REFERENCE FOR THE WMO AMDAR PANEL SCIENCE AND TECHNICAL SUB-GROUP (STSG)**

**1. The Purpose of the Sub-Group**

The purpose of the AMDAR Panel Science and Technical Sub-Group (STSG) shall be to coordinate and provide information on scientific and technical matters relating to AMDAR for Panel members and the wider meteorological and aeronautical communities. It shall coordinate and where appropriate, undertake activities and investigations into specific matters of scientific and technical value to improve data quality and extend the range of reported meteorological elements. The Sub-Group will also assist with expansion of the operational use of AMDAR data.

**2. Membership**

- 2.1 The members of the Sub-Group shall be elected by the AMDAR Panel.
- 2.2 The AMDAR Panel shall select a Coordinator with the responsibility for:
  - (a) Leading and coordinating the activities of the STSG; and
  - (b) Reporting back to the AMDAR Panel on the STSG's activities and achievements.
- 2.3 The Panel will review the membership on an annual basis taking into consideration the recommendations of the STSG.

**3. Activities**

The Science and Technical Sub-Group in collaboration with CBS ET-AIR and CIMO Theme Leader Aircraft Measurements shall:

- 3.1 Review and exchange information on scientific and technical matters of relevance to AMDAR.
- 3.2 Coordinate and facilitate studies or experiments related to AMDAR science and technical activities.
- 3.3 Advise the AMDAR Panel on scientific and technical aspects of the AMDAR programme.
- 3.4 Provide guidance and information to agencies undertaking activities in the development of AMDAR sensors and operational systems.
- 3.5 Provide documentation relevant to AMDAR science and technical activities for publication on the WMO AMDAR Website and other fora where appropriate.
- 3.6 Provide advice and input to the organization of AMDAR Panel Science and Technology workshops.
- 3.7 Provide advice, input and coordination to other AMDAR Panel Sub-Groups and Coordinators.
- 3.8 Provide progress reports to the AMDAR Panel Meetings and seek review and approval.
- 3.9 Coordinate STSG's activities with the WMO Secretariat Scientific Officer (Aircraft and Remote Sensing Observations).

## APPENDIX 4

- 3.10 Provide support to the Panel regarding the AMDAR standardization related to the WMO Integrated Global Observing System (WIGOS).

### IX. TERMS OF REFERENCE FOR THE WMO AMDAR PANEL TRAINING AND OUTREACH SUB-GROUP (TOSG)

#### 1. The Purpose of the Sub-group

The AMDAR Panel is recognized as a body fostering active co-operation among members in the implementation and operation of AMDAR as a component of the WWW Global Observing System. The purposes of the Training and Outreach Sub-group (TOSG) shall be:

- (i) To support technical training and outreach activities of the AMDAR Panel. It shall coordinate and where appropriate, support training workshops organized by the Panel for the implementation and operation of AMDAR. It shall, where appropriate, support participation in outreach activities for the purpose of promoting AMDAR. Also, it shall seek new outreach opportunities for the benefit of the AMDAR program; and
- (ii) To support the CBS-OPAG-IOS activities to set up an implementation plan for training relevant to AMDAR including familiarization and awareness for the global meteorological community of the availability and use of AMDAR data, its benefits and limitations as a form of basic upper air data in operational meteorology.

#### 2. Membership and Responsibilities

- 2.1 The members of the Sub-Group shall be elected by the AMDAR Panel.
- 2.2 The AMDAR Panel shall select a Coordinator with the responsibility for
  - a) Leading and coordinating the activities of the TOSG; and
  - b) Reporting back to the AMDAR Panel on the activities and achievements of the TOSG.
- 2.3 The Panel will review the membership of the Sub-Group on an annual basis taking into consideration the recommendations of the TOSG.
- 2.4 Meetings of the Sub-Group will be held in conjunction with AMDAR Panel meetings, otherwise the group works by correspondence.

#### 3. Activities

The Training and Outreach Sub-Group shall:

- 3.1. Identify existing training material and programmes, and assess its suitability for technical training activities and for posting or cross-referencing on the WMO AMDAR website. Identify, support and participate in appropriate outreach activities and assess their suitability for posting on the WMO AMDAR website.
- 3.2. Support technical training workshops and outreach activities organized by the Panel.
- 3.3. Support the CBS-OPAG-IOS activities to set up a training implementation plan.

#### APPENDIX 4

- 3.4. Liaise with and support WMO Members and other appropriate agencies by providing expert information and advice relevant to national and regional training activities.
- 3.5. Co-ordinate TOSG's activities with the Science and Technical Sub-Group.
- 3.6. Coordinate TOSG's activities with the WMO Secretariat Scientific Officer (Aircraft and Remote Sensing Observations).
- 3.7. Provide support to the Panel regarding the capacity building and training component of the WMO Integrated Global Observing System (WIGOS).
- 3.8. Provide progress reports to the AMDAR Panel and seek review and approval.

#### **X. TERMS OF REFERENCE FOR THE WMO AMDAR PANEL COORDINATOR FOR THE IMPROVEMENT IN DATA EXCHANGE AND QUALITY CONTROL**

Recognizing a fundamental principle of WMO to broaden and enhance the free and unrestricted international exchange of data and noting the increasing availability of aircraft platforms with suitable sensors, avionics and communication systems, The AMDAR Panel Coordinator shall:

1. Promote the exchange and dissemination of all appropriate automated meteorological reports from aircraft through the Global Telecommunication System (GTS)/WMO Information System (WIS) and other systems as appropriate;
2. Promote the dissemination, exchange and use of information on AMDAR data availability and quality among Members and data providers with a view to initiating appropriate corrective action;

#### **Activities**

The Coordinator for the Improvement in Data Exchange and Quality Control shall:

- Assess present data exchange among Members and end-users;
- Review requirements for exchange; and
- Develop recommendations for exchange.
- Assess present quality control activity by Members and end-users;
- Review requirements for quality control; and
- Develop recommendations for quality control in accordance with WIGOS Standardization activities

## APPENDIX 4

### **XI. DUTIES AND RESPONSIBILITIES OF THE WMO SCIENTIFIC OFFICER RESPONSIBLE TO SUPPORT WMO AMDAR PANEL ACTIVITIES**

Under the overall guidance of the Chief of the WMO Observing Systems Division, the incumbent will perform the following duties:

- a) Act as Secretariat lead for the aeronautical and in-situ remote sensing observations;
- b) Coordinate the planning and implementation of activities relevant to aircraft-based and in-situ remote sensing observational systems within the WMO Integrated Global Observing System (WIGOS), including the World Weather Watch (WWW), AMDAR and Instruments and Methods of Observation (IMOP) Programmes, on matters related to the standardization of the above observations, observing systems design, optimization and evolution, and instrument and systems evaluations. Ensure liaison with other relevant programmes, technical commissions, international organizations, aircraft and instrument manufacturers as well as aviation communication providers;
- c) Coordinate and support the work of the relevant CBS, CIMO and AMDAR Panel subordinate bodies (including pre-session and in-session documents and final reports), as well as organize and support expert meetings, technical conferences and training workshops. Assist and provide specialist support to the chairpersons of the respective CBS, CIMO and AMDAR Panel subsidiary bodies in conducting their duties, such as in coordinating and monitoring programmatic and development activities, in preparing technical and scientific analysis, budget proposals and in monitoring expenditures;
- d) Provide scientific/technical advice to technical cooperation projects and other support activities related to AMDAR and in-situ remote sensing observations as a part of CBS and CIMO responsibilities;
- e) Coordinate quality monitoring of data generated by the surface-based Global Observing System (GOS) and prepare scientific reports, studies and analyses;
- f) Promote observational data and product utilization by coordinating and supporting the generation of the observational data products, especially from the remote sensing systems, as well as by supporting the training and education activities relevant to the aircraft and remote sensing observations;
- g) Inform regularly the Members and user community of conducted activities and plans. Maintain up to date the respective components of the WMO Website;
- h) Carry out other relevant duties as required.

## XII. AMDAR WORKSHOP GUIDELINES AND PROCEDURES

1. Objective of the AMDAR workshops is to promote development and implementation of national/regional AMDAR programs by supplying technical and programmatic support. The intention of the AMDAR Workshop is to identify roles and responsibilities essential in the development and implementation of a national and/or regional AMDAR Program.
2. It is not aimed at training of weather/aviation forecasters on the use of AMDAR data, training on coding/decoding of AMDAR data or training of other operational personnel of NMHSs. Such training workshops normally would follow once the national/regional AMDAR programme is about to be implemented and shall be negotiated by Members with respective WMO Secretariat Departments, especially through the WMO Education and Training Programme.
3. Interested WMO Members or appropriate international organization related to air transport should notify officially (in writing) their desire for a workshop through AMDAR Panel chairperson, chairperson of the CBS Expert Team on Aircraft-based Observations or directly to WMO Secretariat.
4. Members' should demonstrate their intent and potential capability to develop a national AMDAR program.
  - This intent should come from all national stakeholders, i.e., national meteorological services, relevant airline operators and/or civil aviation authorities;
  - Additionally, any identified candidate airline operator must be capable of supporting an AMDAR infrastructure, e.g., avionics, communications. This will be done through completing the AMDAR compliance questionnaire, to be provided by WMO Secretariat.
5. Priority will be given to organizing one workshop in a sub-region in the case where multiple written notifications were received in that area.
6. Once the workshop is approved by AMDAR Panel and funding is available, the Permanent Representative of the requesting WMO Member should send an invitation to WMO offering their willingness to host the AMDAR workshop.
7. Workshops of about 2½ days normally would be organized conjointly with the annual AMDAR Panel meetings.
8. Host countries will be responsible for all necessary local arrangements, such as meeting room facilities, audio visual equipment (computer, projector, etc.), internet connection, hotel booking, and inviting local and/or international participants.
9. AMDAR Panel will be responsible for identification of workshop lectures, conducting workshop and providing support to lectures.
10. AMDAR Panel will provide further assistance to a Member to develop and implement a national AMDAR programme.

## APPENDIX 5

### **Commission for Basic Systems, OPAG IOS, Expert Team on Aircraft-based Observations, Proposed Terms of Reference**

- a) Coordinate with the AMDAR Panel to develop a harmonized AMDAR work plan with an appropriate transition of the AMDAR work plan to the work plan of the relevant technical commissions, namely CBS and CIMO;
- b) Cooperate with the AMDAR Panel on the continued migration of the governance of the AMDAR Programme to CBS;
- c) Coordinate with the AMDAR Panel for the migration of the management of the AMDAR Panel Trust Fund from AMDAR Panel to the WMO Secretariat and CBS;
- d) Develop a Quality Management System for the AMDAR Programme that incorporates the progress made through the WIGOS AMDAR Pilot Project and the development of standards related to metrology, data management and data monitoring;
- e) Provide input into the CBS Rolling Review of Requirements and the relevant planning activities associated with the Evolution of the GOS;
- f) Support the ICG WIGOS and its Task Teams in the implementation of the WIGOS and provide advice and support to the Chairperson of OPAG-IOS on these issues;
- g) Review the status of all aircraft-based observations relevant to WIGOS;
- h) Report to CBS on the ET-AIR activities, including the AMDAR Programme.

**APPENDIX 6**  
**AMDAR Panel Trust Fund Draft Budget Projection for 2012**

Item	Specific Item	Swiss Francs
Balance of fund at 28 October 2011		1,029,505.97
<b>Expected Expenditure to 1 Jan 2012</b>		
Consultancy		4,500.00
<b>Expected Income to 1 Jan 2012</b>		
Contributions		44,390.56
Projected Balance at 1 Jan 2012		1,069,396.53
<b>Projected Expenditure</b>		
Consultancy	1.1.1 Study on data coverage and airline capabilities SSA	40,000.00
	4.1.1 Paper on WVSS Validation Results Summary SSA	30,000.00
	4.1.1 Review of AMDAR Regulatory Material SSA	40,000.00
	4.1.1 Generic Software Specification SSA	40,000.00
	5.1.1 Consultant for update of AMDAR Website SSA	40,000.00
	5.1.2 Impacts and Benefits document for aviation SSA	40,000.00
	5.1.4 Impact of AMDAR Study SSA	25,000.00
Travel	AMDAR Panel Meeting	5,000.00
	AMDAR MG-3	10,000.00
	AMDAR MG-4	5,000.00
Projects & Activities	1.1.2 Finance for AeroMexico programme.	50,000.00
	2.2.1 Obtain EDR Specification and Software	10,000.00
	ARINC Membership	500.00
Technical Support	1.1.2 Mission for Development of African AMDAR	10,000.00
Software Development	4.3.3 B777 Software Development	20,000.00
Workshops & Training	4.1.1 Data Management Workshop	15,000.00
<b>Expenditure Total</b>		<b>380,500.00</b>
<b>Projected Contributions</b>		
Contributions Direct	Australia	12,800.00
	Austria	3,500.00
	France	26,000.00
	Hong Kong, China	3,000.00
	Netherlands	1,200.00
	New Zealand	2,500.00
	Norway	15,000.00
	Sweden	5,000.00
	Switzerland	50,000.00
	United Kingdom	15,000.00
	Canada	10,000.00
	Germany	30,000.00
	South Africa	3,600.00
Contributions VCP	United States	25,000.00
<b>Contributions Total</b>		<b>202,600.00</b>
<b>Expected Balance at 31 Dec 2012</b>		<b>891,496.53</b>