

WORLD METEOROLOGICAL ORGANIZATION

CIMO/MG-2/Doc.2.2(3)
(20.IV.2005)

COMMISSION FOR INSTRUMENTS AND METHODS
OF OBSERVATION

ITEM: 2.2

CIMO MANAGEMENT GROUP
Second session

Original: ENGLISH ONLY

Bucharest, Romania 2 – 3 May 2005

**REPORT ON THE OPAG-UPPER AIR AND ON THE
ET ON UPGRADING THE GLOBAL RADIOSONDE NETWORK (ET-UGRN)**

(Submitted by the Mr. Rainer Dombrowsky,
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Summary and purpose of document

This document summarizes activities of the Expert Team on Upgrading the Global Radiosonde Network

Action proposed

The management group is invited to review the activities of the ET and to comment on its future plan.

Report of the Chairman of the Expert Team on Upgrading the Global Radiosonde Network

1. Work Plan of the Expert Team on Upgrading the Global Radiosonde Network

1. Based on the CIMO-XIII decisions, the CIMO Management Group (CIMO-MG) decided on a Milestone Plan to provide basic guidance for planning of CIMO activities. The Milestone Plan is based on CIMO OPAGs structure and their respective Terms of Reference. The Plan assists the OPAG co-char persons and leaders of ETs in preparing their work Plan.

2. The Work Plan of the Expert Team, as presented in the Annex to this document, takes into account the tasks to be undertaken by the CIMO OPAGs, the Terms of Reference of Expert Teams and the CIMO-MG Milestone Plan.

3. To date many deliverables remain behind schedule. New deadlines are being discussed and the membership believes that it can still meet the milestones set by the ET.

1a. Develop techniques and report annually on the performance of radiosonde types in the GOS

4. The WMO Radiosonde Catalogue was updated in October 2004 and is available on the WMO website. The requirement for this activity is annual updates and Mr. Oakley is currently working on the 2005 update. The goal is to have the update ready for posting by October 2005.

5. Due to on-going national projects the ET members responsible for conducting a survey on current techniques used to monitor the performance of upper-wind and humidity measurements has been delayed.

6. The Upper-Air ECMWF monitoring statistics for 2004 have been completed, including plot summaries.) These tables have been provided to the Secretariat, CIMO, for posting on the CIMO website. AT present these simply reflect the compiled statistics, with no analysis, interpretation, or recommendations. The analysis will be prepared and presented at CIMOXIV.

7. Mr. Okley has been providing summaries to the Secretariat, CIMO, on the use of RS-80 radiosondes worldwide and sites that have equipment not easily upgraded to use the RS-92 to determine any impact.

8. A review of radiosonde types and the associated table used in the TEMP code. A report was presented to the CBS ET in November 2003.

1b. In Coordination with HMEI solicit agreement on BUFR code table and descriptors for international use.

9. The delay due to not having a completed survey has delayed in the development of an Implementation Plan for new monitoring techniques.

10. The team members have been working with HMEI and Members to determine the best approach to soliciting approval for a BUFR code table and descriptors. We have not received a response from the CBS ET/DRC approving the recommendation presented by the ET.

11. A survey document was prepared for determining measures needed to reduce the cost of operating upper-air networks. To date ET members have not been able to finalize a report due to the limited response to the survey. The ET is considering another call for information so a report can be prepared for CIMO XIV.

1c. Migration Strategy toward binary codes

12. This remains a work in progress.

1d. Investigate measures for reducing the cost of upper-air operation costs

13. This remains a work in progress.

2. Coordination between CIMO and AMDAR Panel

2a. Coordination between CIMO and AMDAR Panel

14. Major met centers including ECMWF, Met Office, NCEP, CMC and Meteo France now collect and store all AMDAR reports provided on the GTS. It is known that some centers do not see all the US data and vice versa. Many other centers store regional and national sub-sets of data from the GTS. Up to 180,000 observations are exchanged daily on the GTS with additional data, about 50,000 observations from the US, are not yet exchanged, but stored either by NCEP or FSL.

Mature Programs:

15. The following countries continue AMDAR operations and their operations are expanding and becoming more mature; Australia, New Zealand, South Africa, the E-AMDAR group (UK, Netherlands, Germany, France, Sweden) and the US. South Africa is configuring up to 60 new aircraft that will commence reporting in the Southern Africa region.

AMDAR Expansion: Since the last ET-UGRN meeting, 5 new national programs have commenced routine operational reporting:

- Feb 2004 - Saudi Arabia - 29 aircraft configured - 4 currently reporting nationally producing some 700 high quality observations per day.
- April 2004 - Hong Kong China - 1 aircraft configured producing 180 high quality observations per day over the west and north Pacific. Additional aircraft will be introduced in 2005.
- August 2004 - Japan - Around 220 aircraft report on most days but data quality is patchy with some aircraft reporting a mixture of data quality. The system is not a standard AMDAR system but this will change in time as work continues to develop the system and to improve data quality.

- October 2004 – China, 15 aircraft reporting routinely producing around 1000 observations per day. Data quality is good but some problems still exist. The AMDAR program will expand during 2005.
- January 2005 - Canada had 45 aircraft reporting on most days producing high quality data. Some profile data is generated over the high latitudes. The program scheduled for continued expansion.

Additional Programs:

- E-AMDAR continues to increase the number of operational aircraft but data volume and coverage are closely controlled through the optimization and targeting systems.
- Finland is producing data as part of an operational trial and is expected to go operational later this year.
- Chile continues to develop its program with a focus on national and long distance air routes. No data is being produced at this time.
- The Republic of Korea will recommence development in 2006.
- Argentina, United Arab Emirates and the Russian Federation continue planning and will commence development in the near future.
- A number of countries have confirmed in the past 12 months that they are interested in developing or will develop programs; these include the following nations: Oman, Egypt, Romania, Austria, Hungary, Czech Republic, Bulgaria, Ukraine, Spain, Iceland, Ireland, Brazil, India, Pakistan, Malaysia, Mauritius (still operating 1 ASDAR unit).

Data Targeting:

16. Work continues to expand and develop data targeting programs into data sparse regions. E-AMDAR is working with the ASECNA group of countries in Central and West Africa and Madagascar to configure French aircraft operating in most of the 15 countries. Some data is being provided for 2 non-ASECNA countries Ghana and Nigeria. Additional data will also be provided over the southern Africa by E-AMDAR under special arrangement. E-AMDAR has provides targeted data for short periods or in some cases on an ongoing basis for India, the Asian Tsunami region, Hong Kong China, the Central Atlantic Ocean, South America, Mexico, Canada, Central and Eastern Europe and the Middle East. Kenya has commenced discussions with E-AMDAR to provide additional targeted data in a formalized arrangement. Australia has begun to investigate ways to provide targeted data in RAV including the South West Pacific area and Indonesia and to assist with program planning and development.

New AMDAR Rapporteur

Dr. Jochen Dibbern (Germany) has been appointed as the AMDAR Rapporteur to CBS through OPAG IOS. One of his most important tasks is to work with various agencies and WMO Commissions in development of awareness training programs.

Technical Training:

17. The AMDAR Panel has provided a number of technical training programs since the last ET-UGRN meeting:

- 17 May 2004 - United Arab Emirates Met Service
- 18 May 2004 - Emirates Airlines
- 14 December 2004 - Romanian Met Service - Romanian Civil Aviation Administration
- 15-17 December 2004 - Central and Eastern European Regional workshop for 14 countries
- 24 October 2004 – Technical Workshop, CMA Beijing China

Visual Display System:

18. The AMDAR Panel is working to develop an independent PC-based interactive AMDAR data display system in response to requests from a number of countries and in particular from the ASECNA group of countries in Africa. All existing AMDAR data providers have developed their own in-house display systems tailored to suit their domestic operational systems and are not suitable or readily adaptable for use as an independent system required by developing countries. The project is in the early stage of development but through international cooperation the system will be completed in early 2006.

Codes:

19. Work will commence soon to test the exchange of AMDAR data via CREX code on the GTS, in particular data that can provide a radiosonde profile when plotted. These modifications to CREX have been requested by developing countries because they do not have the capability of operating BUFR decoders.

2b. Monitor and Assist in the Introduction of Humidity Measurements in AMDAR Systems

20. A big step has been taken with the commencement of an operational trial of the US WVSSII humidity/water vapor sensor. Ten sensors are now reporting as part of the initial trial in the U.S.

The number of aircraft equipped with the U.S. WVSSII will increase to 25 sensors by the end of 2005. Although a few technical problems have been uncovered, data quality is very good and much better than previous sensors. WVSSII data is available through the FSL website and access to routine operational data is available. It is now possible to run simple intercomparisons in 3 different ways:

1. Testing for consistency with other aircraft carrying the sensors;
2. Testing against near-by radiosonde profiles;
3. Testing against models such as NOAA's Rapid Update Cycle.

An independent system evaluation is being conducted by NWS through Dr. Ralph Petersen using RUC model output as the initial reference and as data become available, against radiosondes.

Although a very early initial evaluation report has been prepared, it was based on a small data sample. A second report, based on at least one month's data from the 10 aircraft is being finalized. It is interesting to note the impact that a bias of about 2 degrees in the temperature probe has on the derived humidity and dew point results. The system also

measures and reports mixing ratio. Other quantities are derived on the ground using temperature and pressure reported by the aircraft and compared.

21. The WMO AMDAR Panel is coordinating a project where a group of other countries are planning to purchase and evaluate the WVSSII sensor. E-AMDAR will purchase about 5 sensors for ground-based and airborne evaluation trials as part of a sensor certification process on the A320 family. Australia (2), South Africa (2) and New Zealand (1) are also planning to purchase sensors for installation and evaluation on their own aircraft of the A320 family in 2006.

Other Related Sensor Systems

22. The operational trial over the US Great Lakes region (GLFE) of the TAMDAR system is under way with about 50 SAAB 340 aircraft equipped with the special sensor package. The package includes pressure altitude, temperature, wind speed and direction, humidity, turbulence and an icing index. A very early preliminary report on the sensor package shows the quality of wind, temperature and humidity data are not as good as had been hoped. However, a number of problems have been identified that are being worked on that should improve data quality. The trial will run for 6 months and should run to about August. The data is being made available in either raw or processed form to interested groups for their own evaluation. Independent studies of data quality are being undertaken by FSL in the US and the EUCOS group in Europe.

3. Standardize Data Processing Radiosonde Algorithms

3.a In Coordination with HMEI investigate the consistency of Radiosonde Algorithms for coding TEMP Messages

23. The ET via Dr. Kats has been coordinating with HEMI in investigating radiosonde algorithm consistency in encoding TEMP messages. Dr. Katz is the only remaining member working this issue for the ET. The goal has been to identify common approaches. In February 2004, Dr. Katz has prepared a Circular Letter for the Acting President of CIMO, encouraging NMSs and manufacturers to share information on this topic. To date only NOAA and the UK Met Office have responded. Due to the lack of response from the manufacturers The UA OPAG Chairs met HEMI representative Bruce Sumner to further engage the manufacturers in this process. The chairman will be meeting with HEMI representatives to encourage their participation while at TECO-2005.

4. Development of Technical Information for Support of Radio Frequency Sharing Policy for WRC

4.a Improve coordination of radiosonde frequency use with other users of the meteorological spectrum

24. Through input from members of the ET-UGRN, the CBS Steering Group on Radio Frequency Coordination (SG-RFC) contributed to the development of an International Telecommunications Union (ITU) recommendation that addresses the need for spectrum sharing between radiosonde and meteorological satellites in the band 1675-1710 MHz. The ITU Recommendation specifies that radiosonde operators should strive to limit their operations to the sub-band 1675-1683 MHz, and meteorological satellite operations should be conducted in 1683-1710 MHz. Following this plan, interference-causing

overlap of radiosonde and meteorological satellite signals can be avoided. The recommendation also noted the sub-band 1668.4-1675 MHz is generally no longer available for radiosonde operations due to the 2003 World Radio Communication Conference decision to place mobile-satellite operations in the sub-band 1668-1675 MHz. The final draft of the recommendation on sharing 1675-1710 between radiosondes and meteorological satellites was complete in March 2005 and it is currently passing through the ITU approval process. Formally, this item is not yet complete in the ITU, but there is no additional action required from the ET-UGRN.

4.b In coordination with HMEI, assist the SG-RFC in coordination and protection of radio frequencies for ground-based observing systems.

25. The ITU is currently updating several documents on radiosonde system characteristics, performance objectives, and operational practices. The ITU has relied on the CBS SG-RFC to provide the necessary information for completing the updates. The members of the ET-UGRN have provided input to the SG-RFC through email correspondence. This cooperative effort has been extremely valuable in getting information on system characteristics and operations from various parts of the world. This action item should continue as additional information is needed from the ET-UGRN both on radiosonde systems and other ground based observing systems.

4.c Develop, in consultation with the SG-RFC and HMEI, objectives for spectrally efficient radiosondes.

26. There are several efforts underway around the world to develop radiosonde transmitter and receiver standards. To date, there has been no attempt to develop a common standard to be used by all WMO Members. At its September 2004 meeting, the CBS SG-RFC did consider the ET-UGRN Work Plan action item on objectives for spectrally efficient radiosondes. In response to the ET action item the SG-RFC developed a guidance document that should have been sent to the ET-UGRN chairman through the WMO Secretariat. This document provides the ET-UGRN additional information on the need for spectrally efficient radiosondes, and provides the ET-UGRN additional guidance on what should be considered when developing a standard. Finally, the document suggested that a WMO workshop be planned to allow further progress on this issue. This action item is not near completion and will need to continue. Discussion between the WMO Secretariat, the ET-UGRN Chairman, and the SG-RFC Chairman may be the best way to determine how this action item is completed. A workshop that includes radio spectrum experts, radiosonde operators, and radiosonde equipment manufacturers may be the most efficient manner to complete this item.

4.d Provide guidance to Members on spectrum regulatory activities and encourage cooperation with national spectrum regulatory agencies

27. Development of a guidance document to Members on spectrum regulatory activities has been delayed pending the approval of the ITU recommendation discussed under 4 a) and the completion of spectrum efficiency standards for radiosonde systems. There is currently no threat to radiosonde spectrum allocations that would require guidance on addressing the threat. The most important issues to be addressed with Members at this time are radiosonde spectral efficiency, and ensuring compatibility between radiosonde and meteorological satellite operations. Once the ITU recommendation and the

radiosonde transmitter/receiver standard are complete, guidance can be provided to members on those matters.

No information has been requested or provided for Radiosonde Training Workshops. If requested, information can be provided for future workshops. The information would be customized to the geographic area(s) of the workshop.

5. Provide advice on Quality Management Systems procedures for Instruments and methods of observation

5.a Develop performance measures to demonstrate continuous improvement in the quality of upper-air observations

28. This remains a work in progress.

5.b Review and update WMO Technical Regulations, Guides and other material related to Quality Management and standardization of upper-air observations.

29. This remains a work in progress.

6. Coordination between CIMO and climate community

6a. Improve coordination with the Climate Community on requirements for high quality radiosondes

30. The formal exchange of information at the WMO level has not been initiated, however national discussions have been held. The workshop brought together scientists with expertise in the full spectrum of climate activities to develop a set of requirements (spatial and temporal resolution, long-term stability, accuracy, etc.) for a suite of upper-air observations meeting the climate monitoring, prediction, and science needs. The workshop addressed; 1) The inadequacy, for climate purposes, of current upper-air observing systems; 2) the opportunities for observing system improvements offered by current US and international focus on earth observations; and 3) the need for well-articulated, community-supported, quantitative requirements for upper-air observations that support climate activities. Draft requirements are being reviewed and will be shared with the CCL, AOPC, and CCL; GCOS was a participant in this effort and represented by Mr. Howard Diamond, NOAA representative to GCOS. International participants included Mr. Mark McCarthy and Peter Thorn, UK Met Office, and Neville Nicholls, Australian Bureau of Meteorology. Information on the workshop can be accessed at <http://www.oco.noaa.gov>