WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR INSTRUMENT AND METHODS OF OBSERVATION
OPAG-SURFACE

EXPERT TEAM ON SURFACE TECHNOLOGY AND MEASUREMENT TECHNIQUES
First Session

Geneva, Switzerland, 13-16 October 2004

CIMO/OPAG-SURFACE/
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ITEM: 4.1

Original: ENGLISH ONLY

THE STATE-OF-THE-ART OF INSTRUMENTS AND AUTOMATED SURFACE OBSERVING SYSTEMS (ASOS)

Development of Instruments and ASOS

Submitted by Chairman

Summary and Purpose of Document

The document contains an introduction on the ongoing actions on instrument development.

ACTION PROPOSED

The meeting is invited to take notice of the document and to supply suggestions or recommendations on how to inform Members on this issue and provide guidelines on new developed observing techniques and proposals on further review and analysis.

References:

1. CIMO-XIII, Abridged final report
2. CIMO MG (2003) Final report
3. Instrument Development Inquiry #7 (to be published as an IOM report)

Background

1.1. Introduction

Many CIMO sessions have requested for reports on instrument development. Information on the state-of-the-art is found of outmost importance for all Members, who have to make decisions on the introduction of new equipment or alternative techniques. Not only the potential and capabilities but also cost reduction and improved performance request are identified as relevant issues to be investigated. Obviously, this information is very relevant for *e.g.* the issues stated in documents 3(1) to (4).

For this purpose until now seven *Instrument Development Inquiries* (IDI) were carried out, *i.e.* one IDI every intercessional period. The IDI reports contain information on instruments under development and on instruments put into operational use during the last couple of years. An IDI also contains information as to which instruments included in the last IDI as being under development, were actually put into operational use. Publishing of the last inquiry, IDI-7, is delayed, but is planned for 2004. Based on the analysis of the results of these IDIs, it is possible to report on the ongoing development of any kind of surface measuring device or observing system. The reports of these IDIs contain such analyses.

Since the introduction of the World Meteorological Instrument Catalogue, which was issued for the first time by the China Meteorological Administration in 2000 some complementary or overlap between the IDI and this catalogue should be avoided. It was therefore decided that IDI-7 should focus only on new instrument developments and the Catalogue should give an overview of all existing operational surface-based instrumentation worldwide. As a consequence the IDI-7 report will have a more restricted contents than the previous IDIs. Each IDI is based on a standard questionnaire providing uniform reports that are well structured[1]. The questionnaire, which was send out for IDI- 7 is given in Annex I.

1.2. Further development

All CIMO sessions have stated the usefulness of the IDI reports and stipulated that the uniformity and structure should be maintained to be able to make mutual comparisons. Today, the Internet offers the potential to search through the web finding newly available instruments if not already available through the Catalogue. Popular relevant websites are presented in Annex 2. A lot of information could also be found on CIMO/IMOP website "WEB PORTAL on Development, Maintenance and Operation of Instruments, Observing Methods and AWS": http://www.wmo.int/web/www/IMOP/WebPortal-AWS/Index.html. However information on instruments under development is hardly to obtain, so a new inquiry is still useful and will be carried out (IDI- 8). To give the next CIMO meeting up-to-date information, the report of IDI-8 will be published just before the next CIMO session, begin of 2007. Taking into account one year of preparation and analysis, the questionnaire should go out end of 2005.

It should be noted that publication of this IDI every four years on average might not fulfill the users needs taking into account the rapid development of modern technologies. Some developments may be out-of-the-date within a period of four year or the reported developments might be overruled by newly developed. Alternatively, web pages on the Intranet can be updated frequently

[1] For the IDI-6 report, see:
http://www.wmo.int/web/www/IMOP/publications/IOM-71-IDI-7/Instrument-Inquiry6.pdf

and the introduction of an "IDI look alike facility" containing the actual developments through Internet might be a better approach. EUMETNET already organizes such a facility through the OBS-INFO project[2] hosted by DWD (Germany), but covers developments by the EUMETNET Members only. To cover all developments it might be considered to set up a more simple website with direct, but actual links to up-to-date replies on the questionnaire. Of highest importance of such a website is it's actuality, easiness to consult and low maintenance.

Activity plan

2.1. Planned activities

In line with CIMO XIII, the CIMO management group has decided to continue the work on reviewing and reporting on the state-of-the-art of instruments and automated surface observing systems. For this purpose a questionnaire can be send out to the Members and replies will be collected and analyzed for publication in a new IDI report. Moreover, to obtain a more up-to-date information system, data from this questionnaire can be used in a new to be generated website on Instrument Development. The ET will consider this possibility and suggest CIMO on this matter.

Based on the analysis of the replies on this questionnaire a report with conclusion will be offered to the CIMO session, which will be published as an IOM report in combination with the IDI-8 report.

2.2. Time Table

	Deliverable	***Deadline***
a.	IOM Report on Instrument Development, based on IDI/8 and further analysis	February 2006
b.	Optional [to be decided]	TBD

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[2] See http://www.dwd.de/EUMETNET/

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ANNEX I

Instrument Development Inquiry
- Seventh Edition -
2001

Q U E S T I O N N A I R E
on
Instrument Development

Please read the instructions in Appendix II before completing this questionnaire
The **notes** […] **inserted** in this form refer to the numbers of the instructions given in **Appendix II**

Country: ..... **Name of institution:**	**No.:** ..... (Number of the completed questionnaires in sequence)

A. CLASSIFICATION

I. Tick one of the appropriate boxes:

1 Instrument under development	
2 Instrument put into operational use in the **past 2 years only** ..	

II. Category number(s) selected from *List of Categories* (see Appendix I):

(At least one number should be entered [9.]*)*

III. Background information on the reasons of the development:

(At least one box should be ticked.)

1 Improved cost effectiveness (initial or operational)	
2 Automation of manual observation	
3 New type of observation	
4 Improved reliability or accuracy	
5 Less maintenance	
6 Improved quality control	
7 Data reduction	
0 Other (please specify):	

B. QUESTIONS TO BE ANSWERED (if applicable)

Request on general information

1. Short identification of the instrument including the variable measured, or its function [11.]:

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2. Instruments under development or in operational use already

a) *For instruments under development **only***:
State of development:

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b) *For instruments put into operational use **only*** [1.], [2.]:
First year of operational use:

.....

3. Principle of operation; specify in <u>short terms</u> the basic technology:

.....

.....

4. Main technical characteristics [9.]

4.1 Application: .....

4.2 Measuring range: .....

4.3 Uncertainty: .....

4.4 Time constant: .....

4.5 Averaging time: .....

4.6 Reliability: .....

4.7 Interface and output details: .....

.....

.....

4.8 Power requirements: .....

4.9 Servicing interval: .....

.....

4.10 Other characteristics [12.]:

Experiences and other information

5. Experience from comparisons and tests performed:
(Especially important for instruments newly put into operational use. [1.], [2.]*)*

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6. Costs, preferably in US$:
(For instruments still under development, please enter estimated costs.)

6.1 Unit cost at factory (US$): .....

6.2. Annual operating costs (US$): .....

7. Personal data of the expert nominated as focal person for further contacts:

Family Name: Prof., Dr, Ms, Mr[3]:.....

First Name: .....

Position: .....

Institution: .....

Address: .....

.....

.....

Telephone: ..... E-mail: .....

Telefax: ..... URL/HTTP: .....www. .

[3] Please underline the appropriate !

8. Bibliographic and/or operational references, applicable patents, international standards, etc.[13.]:

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Date: ..... **Signature:**.....

(Permanent Representative or designated expert)

Please return the completed questionnaire by post, Fax or by E-mail as soon as possible, but not later than **15 December 2001** to:

Dr Tamas Prager
Rapporteur on Instrument Development
Meteorological Service of Hungary
P.O. Box 38
H-1525 Budapest
HUNGARY

Fax: (+36 1) 3464 629
E-mail: prager.t@met.hu

In case of questions, please contact Dr Prager via the above E-mail address or by Telephone: (+36 1) 3464 626

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Instrument Development Inquiry
- Seventh Edition -

L I S T o f C A T E G O R I E S[4]
for the
Questionnaire on Instrument Development

1. Measurement of Meteorological Variables:

1.1 General *(Not applicable)*
1.2 Measurement of temperature
1.3 Measurement of atmospheric pressure
1.4 Measurement of humidity
1.5 Measurement of surface wind
1.6 Measurement of precipitation
1.7 Measurement of radiation
1.8 Measurement of sunshine duration
1.9 Measurement of visibility
1.10 Measurement of evaporation
1.11 Measurement of soil moisture
1.12 Measurement of upper air pressure, temperature, humidity
1.13 Measurement of upper wind
1.14 Measurement of present and past weather; state of the ground
1.15 Observation of clouds

2. Observing Systems

2.1 Measurements at automatic meteorological stations
2.2 Instruments and observations at aeronautical meteorological stations
2.3 Aircraft observations
2.4 Marine observations
2.5 Special profiling techniques for the boundary layer and the troposphere
2.6 Rocket measurements in the stratosphere and mesosphere
2.7 Locating the sources of atmospherics

3. Other

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[4] The numbering applied is chosen according to the numbers of chapters used in the sixth edition of the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8, 1996))

WORLD METEOROLOGICAL
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Instrument Development Inquiry
- Seventh Edition -

I N S T R U C T I O N S
for completing the
Questionnaire on Instrument Development

1. For instruments already included in the sixth edition of the Instrument Development Inquiry (see IOM-Report # 71, WMO/TD-No. 878, issued 1998)[5], you are kindly invited to provide information as to which of these instruments have actually been put into operation as well as on the experience obtained as a result of their operational application
2. For operational instruments already included in the World Meteorological Instrument Catalogue, 2000 Edition (issued and distributed by CMA China), you are asked to include them in the questionnaire only if significant changes have been made.
3. If possible, please prepare the replies by computer and send them by e-mail. The electronic copy of this Inquiry will be made accessible through WMO/CIMO's Web-Site. In case you prefer to send a hardcopy, please do not change the outline and format in the printed output.
4. A separate questionnaire form should be completed for each Category of instrument (see Appendix I).
5. The amount of information provided should fit into the space reserved for each question. Please **do not** send additional information sheets (such as documents, pictures, drawings, circuit diagrams, etc.). No provision is being made to retain them.
6. If not applicable, questions may be omitted. Please indicate: *Not applicable*.
7. Please return the completed questionnaire(s) by post, Fax or by E-mail as soon as possible, but not later than **15 December 2001** to:

Dr Tamas Prager
Rapporteur on Instrument Development
Meteorological Service of Hungary
P.O. Box 38
H-1525 Budapest
HUNGARY
Fax: (+36 1) 3464 629
E-mail: prager.t@met.hu

[5] It can be accessed through WMO/CIMO's Web-Site for ease of reference (URL: http://www.wmo.ch)

8. Please consult the *WMO Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8 sixth edition, issued in 1996) for consistent use of classification or characterization.

9. In the space marked "Category number(s)... ", enter the appropriate number from the *List of Categories* (see Appendix I). If the instrument development relates to two or more category numbers, fill in all these numbers.

10. Regarding "Identification of the instrument", the name of device and model number (if applicable) and the variable(s) measured should be given.

11. Regarding "Other characteristics", the following examples might be considered, as appropriate:

    - Stability of calibration characteristics, durability (weather conditions), specificity of response (sensitivity to other variables), exposure requirements (e.g. radiation shield for temperature measurements), linearity of response, maintenance requirements, lightning and other protection, autonomous operation, etc.

    - Data acquisition capacity, station sampling rate, local storage and data transmission, technique of interfacing and communication aspects, output format, summary of processing possibilities (quality control; raw signal/data conversion; production of significant meteorological variables), environmental conditions and protection, general characteristics of sensors.

12. If the instrument is classified in the Category 3. "Other", the space in "Other characteristics" may be used to enter the characteristics of the instrument.

13. Regarding "operational references", the approximate number of the instruments in operational use and/or the locations (countries) of major installations might be given.

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ANNEX II

TABLE OF USEFUL WEB SITES WITH GUIDANCE ON THE DEVELOPMENT, IMPLEMENTATION AND MAINTENANCE OF AUTOMATED OBSERVING SYSTEMS

WEB site ***Contents***
http://www.bom.gov.au/inside/services_policy/pub_ag/aws/aws.shtml *Bureau of Meteorology, Australia. Information of AWS.*
http://www.inmtn.com/weathersiting.htm *Intermountain Environmental, Inc. A site that gives an overview of siting of instruments and information of different types of instruments.*
http://www.weatherstations.co.uk/gooddata.htm *Information on how to collect data of good quality.*
http://205.156.54.206/om/coop/standard.htm *National Weather Service. A site that gives information on proper siting of sensors and instruments, a guide for observing weather and some information on station types.*
http://www.ag.arizona.edu/pubs/water/az1260.pdf *The University of Arizona. Siting and maintenance of Weather Stations.*
http://www.webmet.com/metmonitoring/table_of_contents.html *WebMet. A site that gives information on siting and exposure of instruments.*
http://www.meted.ucar.edu/export/asos *ASOS algorithm tutorials on the web. Meteorology education and training.*
http://www.nws.noaa.gov/asos *National Weather Service, USA. Information on ASOS and algorithm development. Other links related to the ASOS.*
http://www.oso3.nws.noaa.gov/asos/Mods.htm *National Weather Service, USA. Information on ASOS and maintenance.*
http://www.eumetnet.eu.org/ *EumetNet Web-site with links to AOS - and AWS - oriented projects*
http://www.nws.noaa.gov/wsom *"Weather Service Operations Manual (WSOM), Part H "Engineering". Engineering programmes, planning of facilities and training programmes to ensure maintenance quality and acceptable performance of the automated station.*
http://www.meteo-technology.com *Web site maintained by Meteo-Technology with useful information about manufacturers and suppliers of meteorological and related equipment.*
http://www.wmo.ch/ *WMO Web site with a link to the IOM reports.*