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## INTERNATIONAL METROLOGY: THE EVOLVING ROLE OF THE METRE CONVENTION

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At the 21st General Conference on Weights and Measures (CGPM) in 1999, the International Committee for Weights and Measures (CIPM) presented to Member States a Report entitled “*National and international needs relating to metrology: international collaborations and the role of the BIPM*”. This Report (its full text is on the BIPM website: [www.bipm.org](http://www.bipm.org)) gave a broad view over the whole of metrology and one of its main purposes was to look further forward than the usual four-year period covered by successive CGPMs. A number of important decisions were made by the CIPM and endorsed by the Member States at the Conference. Among these was the decision to expand the terms of reference or even create new Consultative Committees to ensure that where international activities in metrology were needed all fields could be covered. Over the last five years the need for accurate and reliable measurements has developed at a great pace, not only in the manufacturing sector and domains of national and international trade, but also in the areas of human health and safety, protection of the environment, communications, and in all fields of science and engineering.

For the 22nd CGPM that will take place in Paris in October 2003, the CIPM has produced a new Report for Member States. This can be considered an update of the 1999 Report and is entitled “*Evolving needs for metrology in trade, industry and society and the role of the BIPM*”. In this new Report, the CIPM builds upon and extends the one presented in 1999 taking account of the rapid evolution in perceived needs since then. In 1999 it was not thought likely that the CIPM would find it necessary to update its Report so soon, but the pace of change has been so fast that last year it had become clear that such an update was becoming highly desirable. The CIPM, therefore, asked its Secretary Dr Robert Kaarls, to undertake the task. Among the main conclusions of the new Report, adopted by the CIPM at its meeting in October 2002, are the following, (taken from text of the Report):

### NEW METROLOGY NETWORKS, NEW PARTNERS

- The broad need for internationally recognized, traceable and comparable measurement standards and measurements and tests in all areas of society has led to new networks of cooperating international and intergovernmental organizations. Over the last two years

the CIPM has signed Memoranda of Understanding (MoUs) or Arrangements with the World Health Organization (WHO), World Meteorological Organization (WMO), and the International Laboratory Accreditation Cooperation (ILAC). It is expected that more international cooperation arrangements will be concluded with bodies such as the World Anti-Doping Agency (WADA) and the Codex Alimentarius Commission (created by the WHO and the FAO – Food and Agriculture Organization of the UN).

- In 2002 a Joint Committee for Traceability in Laboratory Medicine (JCTLM) was established by the BIPM, IFCC, ILAC with representatives also from quality assessment organizations, producers of certified reference materials and the IVD industry associations of the EU, Japan and the USA as well as from regulatory authorities of these countries and with the participation the WHO. This is likely to be the precursor to a more formal structure that in the future will be needed.
- It is of importance that similar cooperations are established at the global as well as at the regional and national levels.

### METROLOGY IN DEVELOPING COUNTRIES

- An internationally recognized metrology infrastructure in developing countries and countries in transition is now recognized as a high priority. For these countries, the lack of such a structure is hindering development as it raises the vulnerability to non-tariff barriers to trade, that in turn delays market access and further industrial and economic development. Exchange of information and know-how, awareness creation and coordination of assistance to these countries in metrology, accreditation and standardization are now being attempted through a new Joint Committee on coordination of assistance to Developing Countries in Metrology, Accreditation and Standardization (JCDCMAS) comprising the BIPM, the Regional Metrology Organizations (RMOs), ILAC, OIML, ISO, IEC, the International Accreditation Forum (IAF), the United Nations Industrial Development Organization (UNIDO) and the International Telecommunications Union (ITU).

## METROLOGY IN PHYSICS AND ENGINEERING

- In many domains, particularly in time and frequency, dimensional metrology, as well as other mechanical and electrical applications, the required accuracy is increasing by factors of between three and ten per decade. In several cases, the present accuracy is barely sufficient for trade or safety requirements and limits set by law. Sometimes, traceable references do not even exist. Some National Metrology Institutes (NMIs) are responding with major research initiatives.
- The general trend towards the miniaturization of products and sub-micron technologies, like the “lab-on-a-chip”, leads to completely new principles of measurement. Nanometrology, including biotechnical applications, is a field at the frontiers of physics in which new measurement techniques are being developed and is a high priority for several NMIs. Much remains to be done in devising suitable primary and secondary standards applicable for very small dimensions or new quantities.

## NEW APPLICATIONS FOR METROLOGY

- The requirements for metrology in chemistry and biotechnology have become manifest much more rapidly than was foreseen five years ago. International trade in chemicals, certified reference materials, gas and oil products, pharmaceuticals, food and measuring equipment for chemical analysis continues to increase. An increasing range of legal requirements has been approved with respect to safety and environmental protection, all requiring internationally recognized traceable and comparable measurements.
- Traceability of measurements in health care is now high on the agenda. Such traceability will shortly be required by law in the European Union through the *In Vitro Diagnostic Medical Devices (IVD) Directive*, and similar legal requirements have been or will be introduced elsewhere in the world, for example the United States of America and Japan. The technical basis for providing such traceability is still rudimentary in some areas.
- Reliable and comparable metrology in food testing is becoming increasingly important not only because of the high volume and the large export value of food products in international trade but also because of the questions raised by society with respect to general matters of food safety including the content of Genetically Modified Organisms (GMOs). In different countries and economic communities legislation which requires comparability of measurement results and related measurement uncertainty is coming into force yet there is no formal system for creating the necessary technical infrastructure.
- Measurements related to the quality of life, biotechnology and the monitoring of our environment with respect to pollution and climate change require reliable, long-term stable and comparable measurements demanding corresponding measurement standards. Also in these matters various countries and economic

communities are enacting legislation addressing the quality of measurements.

## METROLOGY; A HIGH RETURN ON INVESTMENT AND HIGH VALUE FOR PUBLIC MONEY

- Studies of the economic impact of metrology, carried out in the USA, UK, Canada and the EU, demonstrate that investments made by governments in establishing an internationally recognized metrological infrastructure rate among the most cost effective of government investments producing a high level of return to society.
- A recent study carried out for the BIPM by outside consultants (KPMG) has indicated the cost-effectiveness of the CIPM MRA and the role of the BIPM as the world’s spokesman and coordinator on behalf of the NMIs. The full text of this report is on the BIPM website.
- Member States are urged to maintain and where possible increase investments in national metrology structures that are needed in order to address the increasing demand for traceable and comparable measurements in all fields and to implement at the national level the results of actions at the international level driven by international trade and other international programmes, e.g. in the food, environmental and health sector.
- Where relevant the designation of other institutes than the main NMI, acting as a NMI for certain defined quantities and measurement ranges, should be considered

## THE WORLD’S MEASUREMENT SYSTEM; COOPERATION AND PARTNERSHIPS

- For all of the above, a reliable, accurate and universally available international measurement system is required. This can only be provided by the ensemble of the world’s national metrology institutes (NMIs) working in cooperation with each other and with the International Committee for Weights and Measures (CIPM) and the International Bureau of Weights and Measures (BIPM) under the Metre Convention.
- Much of this is now taking place through the CIPM Mutual Recognition Arrangement (MRA) of national measurement standards and of calibration and measurement certificates issued by the NMIs. This MRA has now been signed by the Directors of the NMIs of all the industrialized States of the world as well as by two international organizations and an increasing number of developing states and economies. The CIPM MRA brings together the NMIs, the Regional Metrology Organizations (RMOs) and the BIPM and is seen, among other things, as a key element in removing Technical Barriers to Trade (TBTs) and of direct importance in the implementation of Sanitary and Phyto-Sanitary (SPS, i.e., related to animal and plant quarantines) measures.
- The recent extension of requirements for accurate measurements into new fields and ever more demanding requirements for accuracy in traditional fields are very considerably stretching the capabilities of the NMIs and

the BIPM. It is increasingly recognized that no one NMI is capable of providing the whole range of measurement standards and services that are now needed and that networking and close cooperation among the world's NMIs is essential.

- Thus, traceability issues are high on the international agenda and require collaboration between international as well as between national and regional organizations in an increasingly wide range of sectors, bringing together officials from government agencies responsible for trade, regulation and specification standards.

#### THE INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES – BIPM

- International coordination in the field of metrology is one of the prime tasks of the BIPM under the guidance of the CIPM and in cooperation with the NMIs. The support given by the expert staff of the BIPM is of high value in achieving the aims of an efficient and effective international metrology infrastructure.
- The BIPM, to be effective, must continue to be recognized as a competent and authorized organization in the field of metrology. For this, a competent and knowledgeable staff is needed that can only be recruited and kept if the BIPM is active in metrology in its own laboratories in a selected range of fields covering not only the physical but also the chemical and biotechnology areas. The type of work to be done will be carefully chosen to complement that being carried out in the NMIs.
- The BIPM will continue to be the global organization responsible for keeping up-to-date and disseminating the concept of the International System of Units, SI, and where not currently feasible other suitable and internationally agreed references, to be the custodian of the International Prototype of the kilogram and to establish and disseminate International Atomic Time – TAI and Coordinated Universal Time – UTC.

- The CIPM, in response to the difficult financial situation now foreseen, has already assessed priorities for work at the BIPM and is terminating some of its existing activities while starting up and strengthening others including metrology in chemistry and fundamental metrological experiments, as well as support for the CIPM MRA and international coordination particularly related to bio and clinical analysis. All of this is in order to best place the BIPM, together with the NMIs, to address urgent metrological issues in these areas.
- Member states of the Metre Convention are urged to take the necessary steps to ensure that the BIPM be given the financial and other support corresponding to the pace of global developments in metrology.

There is no doubt that the increasing globalization of trade, manufacturing and services, together with the much increased awareness of governments of matters related to the environment and global climate change, will continue to demand ever closer cooperation between States in all matters related to metrology. The Metre Convention is the intergovernmental treaty established to provide the basis of this cooperation. At the 22nd CGPM in October 2003, the Member States will meet once again to receive an account from the CIPM of work done since the last General Conference and adopt a programme of work and budget for the period 2005 to 2008.

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