

# EMRP GENERAL OBJECTIVES

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## Abstract

With the overall goal of accelerating innovation and competitiveness, generating data and knowledge necessary to improve quality of life, and providing better tools for the scientific community the European Metrology Research Programme (EMRP) aims, through European integration, to develop new measurement capabilities which have strategic impact for Europe.

## Résumé

Le programme de recherche européen en matière de métrologie (EMRP), par une intégration au niveau européen, a pour but de développer les nouvelles possibilités de mesure qui auront un impact stratégique pour l'Europe. Ce programme a pour objectif d'être un accélérateur d'innovation et compétitivité, de développer la connaissance afin d'améliorer la qualité de la vie et de fournir de meilleurs outils à la communauté scientifique.

## Introduction.

The European Metrology Research Programme (EMRP) is a partnership between 16 EU Member states, 2 EFTA countries and Turkey. It aims to join relevant European national programmes and activities to accelerate the development of vital research capabilities that, on the one hand supports competitiveness and on the other hand provides an infrastructure that supports EU policies. The Joint Programme is based on Article 169 of the European treaty. The European Commission (EC) will co-fund this Joint Programme through Article 169 - the most advanced instrument for the integration of European Research. The EMRP will play an important part in the construction of the wider European Research Area.

The context of the programme is to enable Europe to respond to the growing demands for cutting-edge metrology as a tool for innovation, scientific research and support for policy, particularly in emerging technological areas.

The programme objective is to accelerate the development of new measurement capabilities and to significantly improve dissemination and application of the knowledge generated throughout the stakeholder community.

## Context

Industry, trade, and increasingly quality of life depend on precise, reliable and comparable measurements. Therefore the demands on metrology are steadily growing, and can be expected to grow even more rapidly in the future. The drivers behind this pressure may be considered threefold:

- traditional areas of industry are becoming more complex and are requiring broader measurement ranges and lower uncertainties;
- new areas of technology are emerging, e.g. nano-technology and biotechnology;
- areas in which the value of metrology is increasingly being recognised, though not in themselves new, e.g. chemistry, clinical medicine or food safety;

placing considerable stress on the traditional approach of advancing metrology mostly national R&D initiatives with occasional ad-hoc international collaborations.

The International Committee for Weights and Measures (CIPM) – the governing body of the Intergovernmental Organisation of the Metre Convention comprising of 51 member States and some 20 Associated countries – addressed the challenges in a report “Evolving Needs for Metrology in Trade, Industry and Society and the Role of the BIPM”, CIPM, 2003. The report concluded that: “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”. Whilst cooperation in the scientific comparisons of measurement standards is well established, there has so far been no attempt at strategically planned R&D collaboration. Furthermore in late 2005 the CIPM formally called on the international metrology community to increase its R&D resources and effort to work towards new definitions of the kilogram, the ampere and the Kelvin – in effect a redefinition of the fundamental units – and set out an ambitious timetable which places greater urgency on the launch of the EMRP.

Europe collectively is the single largest contributor to and participant in world metrology, and the investment has a significant impact on the economy and quality of life within Europe. “The increasing complexity and range of applications of advanced measurement science clearly required a step increase in impact from the available resources, particularly in the cutting edge R&D. Recognising the challenge, the European Commission organised a high level conference in 2002 in Warsaw entitled “An Integrated Infrastructure for Measurement”. Commissioner Philippe Busquin emphasised the importance of overcoming fragmentation in research and

called on the metrology community to up its game and contribute to the ERA.

The European metrology community agreed that the fractured approach limits the impact and the enormous potential of European metrology research. Critical mass in R&D on important topics cannot be assembled nationally in many cases and some R&D is duplicated in different national programmes. Hence mechanisms were sought to enable the European metrology research community to address crucial activities requested by stakeholders not currently supported due to national budget constraints, to respond to new challenges, and to start strategic large projects above a critical mass threshold.

The metrology community formally responded in 2003 when the EC supported a feasibility study examining the options for metrology in the context of the European Research Area. The study confirmed that strategically planned collaborative R&D was essential if the various publicly funded national measurement systems were to meet their objectives in the future. In 2005 the European Commission launched an ERA-NET to establish the appropriate conditions for such collaboration with the stated objective of launching a joint European metrology research programme in FP7. The project has established the approach, built the appropriate consensus, developed structures, procedures and processes necessary for the EMRP. Furthermore it transformed EUROMET, an informal collaboration amongst the 33 European countries, into EURAMET e.V., a legal entity suitable for the execution of the EMRP.

## The EMRP

### The programme objective

Within the context of the EMRP the main strategy is to significantly accelerate and broaden the development of metrology as a cross disciplinary, scientific discipline which:

- is instrumental in the innovation process within the context of both the wider research community and advanced industrial development;
- supports EU policies by providing the technical basis for conformity assessment and regulatory requirements.

The EMRP focuses on three key approaches:

- A new approach for the metrology research community in which “grand challenges” are addressed by bringing the various strands of measurement science to bear on issues of European and international relevance. The key challenges have been identified. They relate closely to the priority areas of the Seventh Framework Programme, and will require input from the EMRP Research Council to focus resources in the most effective way on the appropriate metrology and measurement aspects.
- Developing cross-disciplinary solutions to solve direct challenges related to fundamental

metrology, typically the fundamental constants and the redefinition of the SI units.

- Focused R&D within single metrology disciplines aimed at improving the accuracy of the realisation and dissemination of the primary and secondary units of measurement.

### The Governance of the EMRP and the budget

The Governance of the EMRP is assured by executing the Joint Programme through a common structure. The common structure is set out as a non-profit association according to German civil law (eingetragener Verein, e.V.). The e.V. is regulated under §§ 21 – 79 German Civil Code (BGB) with the legal title of EURAMET e.V., but hereafter referred to as EURAMET. This legal entity is constructed with a perspective that goes even beyond the execution of the EMRP and will be able to include tasks and obligations related to the European and global harmonisation of metrology. Consequently, membership of EURAMET e.V. is generally open to all European countries through their national metrology institutes. Thus, the EMRP partners effectively establish a substructure of the wider EURAMET e.V. for all matters of the EMRP.

The **budget** of the EMRP is for seven years. The national resources contributed to the Joint Programme are estimated at not less than 250 M€ over the 7-year period. Furthermore each country will maintain a defined reserve budget to ensure that the selection of projects, which is based on excellence and relevance, is not compromised by budget limitations in any one participating country. The European Commission will contribute the sum of 250 M€ to increase the impact of the EMRP.

### The EMRP work programme

The **EMRP work programme** will adopt a two-axis “top down - bottom up” approach to the research, addressing on the one hand “grand challenges” and on the other “applied and fundamental metrology”, with two support actions encompassing capacity building and addressing future actions for the EMRP. The capacity building is particularly important as currently a number of European countries have little or no metrology R&D capability, and are reliant on research undertaken elsewhere in Europe to develop the services they provide.

Metrology is a horizontal scientific-technical field which underpins almost all subject fields in natural sciences and engineering. It is a technically wide and multidisciplinary field under a common methodology – characterized by the scientific treatment of measurement uncertainties, mathematical methods and principles of traceability. Metrology is internationally structured under the intergovernmental Meter Convention and its organisations such as the International Committee for Weights and Measures (*CIPM - Comité international des poids et mesures*). The EMRP addresses metrological research activities at the frontiers of measurement science in order to meet the most urgent industrial and societal needs.

Metrological research and development is usually addressed in a single-discipline approach along a scheme of technical fields given by the Consultative Committees of the CIPM and the Technical Committees of EURAMET (as for EUROMET). This approach is powerful in many cases, especially in the established fields, and will be part of the EMRP. An increasing number of challenges, however, require a more multidisciplinary approach due to complexity of the topics. Thus coordination within the EMRP does not only mean coordination of national programmes in a specific field but also coordination of different research activities driven by a complex challenge. Consequently, the activity areas of the EMRP are structured in:

- Grand challenges for multidiscipline metrology (*health, energy, environment, new technologies*).
- Grand challenges on fundamental metrology.
- Focussed single-discipline and applied metrology.

All metrological research itself is supported by a common mathematics and software programme.

#### **Grand challenges for multidiscipline metrology**

**Grand challenges** comprise multidisciplinary metrology research needed to meet key socio economic objectives in the fields **health, energy, environment, and new technologies**. These fields require a research approach that – driven by the challenge – combines various technologies and methods. However, the metrology research in Europe in these fields has so far been rather fragmented and not yet been strategically coordinated. In the EMRP, the existing research activities and capabilities, which are directly related to the above-mentioned fields and which require a multidisciplinary approach, are combined, coordinated and supplemented by missing research needs. The priority setting will be carried out in consultation with the Research Council representing the key stakeholders. The selection of fields reflects the character of metrology as a horizontal research field with particular underpinning relevance for the 7<sup>th</sup> framework programme.

#### **Grand challenges of fundamental metrology**

Over the last decades, discoveries associated with new technologies, mainly in quantum physics, have led to important changes in thinking the world of metrology, in particular for fundamental metrology. The discoveries concern both the realisation of the base SI units and the possible redefinition of some units which could lead to an improved International System of Units (SI). The present trend is to connect directly current SI units to fundamental

constants, different detailed proposals being in discussion. Irrespective of the preferred redefinition, the definitive choice must wait the consistent experimental results, and the SI system must keep its coherence and consistency. The two main axis are the followings :

- R and D that has the potential to result in a step change on the SI, taking into account CCs and CIPM recommendations (fundamental constants, major SI-redefinition projects with cross-disciplinary approaches.
- Multi discipline metrology R&D.

#### **Focused single discipline and applied metrology**

Single discipline metrology is still the most powerful approach to address the challenges of most of the EU citizen in terms of quality of life, trade, commerce and safety. Extended to applied metrology, it covers the main needs of the subject fields of physics and chemistry when ensuring traceability of measurements and developing new standards and measurement techniques for the benefit of the EU industry and the citizen. This “classical field” approach allows to go deeper in the specific research needed in order to meet the most industrial and society needs. It underpins the 7<sup>th</sup> framework programme and will be coordinated by the EMRP committee in order to not overlap the research performed for the great challenges.

#### **Capacity building, KT and support activities**

Capacity building and future EMRP activities will address the two key axis, long term direction of the EMRP, including issues related to sustainability, and breadth through increased capacity for R&D and increased impact through knowledge transfer over and above that built into individual Targeted Programmes. The Theme addresses both the partner country NMIs and the wider world, specifically European NMIs that are not participating in the Article 169 and university researchers able to contribute significantly new ideas to the objectives of the joint programme.

## **Références**

[1] EU contract 016220, iMERA project, European Metrology Research Programme Outline 2007, Edition March 2007.