Industrial and scientific metrology: road to a developed NMI

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April 2014
The BIPM

♦ Is the International Bureau des Poids et Mesures
♦ Established by the 1875 Metre Convention
♦ Has 56 Member States and 39 Associates
♦ Is based near Paris, France. It is financed jointly by the Member States and Associates, and operates under the exclusive supervision of the CIPM.
♦ Its mandate is to provide the basis for a single, coherent system of measurements throughout the world, traceable to the International System of Units (SI).
  ♦ This task takes many forms, from direct dissemination of units (as in the case of mass and time) to coordination through international comparisons of national measurement standards (as in length, electricity and ionizing radiation).
♦ It maintains laboratories in areas of:
  ♦ mass, time, electricity, ionizing radiation, and chemistry.
♦ It has an international staff of around 75.
♦ Its budget for 2014 is around thirteen million euros.
Content:

- **Introduction to metrology and traceability to SI**
- Metrology and trade: economic benefits of metrology
- Status, needs and key challenges of NMIs in the region
- The role of BIPM worldwide and in the region
Introduction to metrology

Metrology is a very broad field and may be divided into three subfields:

- **Scientific or fundamental metrology** concerns the establishment of measurement units, unit systems, the development of new measurement methods, realization of measurement standards and the transfer of traceability from these standards to users in society.

- **Applied or industrial metrology** concerns the application of measurement science to manufacturing and other processes and their use in society, ensuring the suitability of measurement instruments, their calibration and quality control of measurements.

- **Legal metrology** concerns regulatory requirements of measurements and measuring instruments for the protection of health, public safety, the environment, enabling taxation, protection of consumers and fair trade.

The BIPM, established in 1875 by the Metre Convention (a diplomatic treaty between 51 nations), ensures worldwide uniformity of measurements and their traceability to the International System of Units (SI).

[www.bipm.org](http://www.bipm.org)

The OIML, established in 1955, is an intergovernmental organization whose principal aim is to harmonize the regulations and metrological controls applied by the national metrology services of its national members.

[www.oiml.org](http://www.oiml.org)
Introduction to metrology

Why Measure?

Measurement requirements grew from the need to locally trade commodities.

Egyptians

Greeks

Romans

Medieval

but...... for the Egyptians and Romans building construction was also important - a reliable measure of the cubit was essential!

Pont du Gard: The Aqueduct

Built ~2000 years ago to bring water 50 km to Nîmes down a total gradient of only 17 metres (a gradient of 1:3000!!).
Measurement in the 20\textsuperscript{th} Century

The Industrial Revolution introduced many new measurement challenges which continue to be of importance in the 21\textsuperscript{st} century.
Introduction to metrology

Today's growing demands for better measurements

Metrology influences, drives and underpins much of what we do and experience in our everyday lives, though often unseen. Industry, trade, regulation, legislation, quality of life, science and innovation all rely on metrology to some extent.

It is estimated that in Europe today we measure and weigh at a cost equivalent to 2%-7% of GDP.
Introduction to metrology

Grand challenges for sustainable development

Climate change
Security
Reducing poverty
Globalisation
Healthcare
Energy security
AIDS

A few of today’s grand challenges
Importance of measurement traceability

Health
- Laboratory in medicine
- Traceable measurements
- Insulin for diabetics
- Chemical therapy for treatment of cancer
- Overdose +
- Dose
- No results
- Human Health

Industry
- Traceable measurements
- Components manufactured in different countries
- Interchangeable/interoperable components

Science
- Traceable measurements
- Internationally recognized technical evidence
- Results of science
- Innovation
Metrology is of fundamental importance in industry and trade – not only from the point of view of the consumer but also for those involved in manufacturing. Both groups must have confidence in the accuracy and reliability of the measurements upon which they depend. Within the manufacturing process, to ensure the accuracy of measuring instruments, it is essential that they should be periodically calibrated against more accurate standards, which in turn should have their calibration traceable to even more accurate national measurement standards at the national level and, eventually, the international level. When these various levels of calibration have been documented, a chain of traceable calibrations is created.
Importance of measurement traceability

- **SI**
- **NMI**
- **Accredited calibration laboratories**
- **Calibration laboratories**
- **Industry**
- **Measurement instruments**

**CIPM MRA**

**ILAC MRA**

**Declaration of CMC**

**ILAC**

**NABs**

**International recognition**

**TRACEABILITY**

**COMPLIANT, COMPETITIVE and INTERNATIONALLY TRADEABLE PRODUCTS**

- Participation in the structure that supports the International System of Units (SI)
- Participation in the scientific and technical forums that will help you to continuously improve your measurement capabilities
- Participation in the arrangement which is the recognized way to demonstrate competence, interoperability and international acceptance of your measurement capabilities

**CIPM MRA**

**ILAC MRA**

- **In standards such as ISO/IEC 17025**, metrological traceability of measurement results to primary realizations of the SI (often referred to as national measurement standards) is required, and in other similar standards traceability should either be to the SI or to other agreed international references where SI traceability is not, or not yet, possible.

**The CIPM MRA and the ILAC MRA are complementary. Their combination helps to provide confidence in the consistency of SI-traceable measurements worldwide.**

**Through a system of international agreements accredited laboratories receive a form of international recognition, which allows their data to be more readily accepted on overseas markets. This recognition helps to reduce costs for manufacturers and exporters that have their products or materials tested in accredited laboratories, by reducing or eliminating the need for retesting in another country.**

**Declaration of CMC**
The BIPM, OIML, ILAC, and ISO endorse the following recommendations:

• In order to be able to rely on their international acceptability, calibrations should be performed in National Metrology Institutes who should normally be signatories to the CIPM MRA and have CMCs published in the relevant areas of the KCDB or in laboratories accredited by accreditation bodies which are signatories to the ILAC Arrangement;

• Measurement uncertainty should follow the principles established in the GUM;

• The results of the measurements made in accredited laboratories should be traceable to the SI;

• NMIs providing traceability for accredited laboratories should normally be signatories to the CIPM MRA and have CMCs published in the relevant areas of the KCDB;

• Within the OIML's MAA, accreditation should be provided by bodies which are signatories to the ILAC Arrangement and the above policies on traceability to the SI should be followed;

The above principles should be used whenever there is a need to demonstrate metrological traceability for international acceptability.

Use of this Declaration

These principles underpin a world measurement system which provides a robust, internationally accepted framework within which users can have confidence in the validity and acceptability of measurement results. BIPM, OIML, ILAC and ISO strongly urge legislators and regulators to refer to the Arrangements described earlier in this Declaration and also to accept measurement results made within this system, thereby helping avoid technical barriers to trade. We also invite interested parties to endorse these principles and to make use of them in their own work.
Content:

- Introduction to metrology and traceability to SI
- **Metrology and trade: economic benefits of metrology**
- Status, needs and key challenges of NMIs in the region
- The role of BIPM worldwide and in the region
A sound measurement system is fundamental in fields of science, production of goods and services, health, commerce, communications,...It creates the framework in which suppliers of products and services can demonstrate compliance with specifications within an internationally standardized system.
Metrology impacts your economy

- Measurement technologies
- Measurement methods
- Nationally and internationally aligned standards

Generate, optimise and assure confidence in the technical data innovators need to -

- Validate new ideas
- Reduce new product time to market
- Accelerate processes
- Improve process efficiency
- Reduce waste/downtime
- Increase reliability
- Extend the operating envelope
- Meet standards/regulation
The cost of technical barriers to trade

- Developed and G22 countries lose 1%-15% of trade because of lack of compliance with standards etc whereas developing and LDCs lose between 10% and 40%
- 70% of the burden on developing countries’ manufactured exports comes from trade barriers erected by other countries
- The EU single market reduced trade costs of the pre-expansion EU by 2.5% by using “harmonised” standards
- New Zealand exporters pay 5%-8% of exports to overcome TBTs
National Laboratory
>5,000 calibrations pa

~400 UKAS Accredited Laboratories
>700,000 calibrations pa

Industry and Other Users
1,000,000,000s of traceable measurements pa
National measurements systems

Accuracy

BIPM

NPL, UK

NIST, USA

PTB, GERMANY

WORLD TRADE, INTERNATIONAL HEALTHCARE etc etc

Measurements for Industry, science, health and commerce

Number of measurements
Why do we want “quality”? 

- Because “quality” is the term we use to describe the ability of a product or service to meet the “customer” expectations 
- Note that some expectations are explicit expectations, some are implied expectations 
- Some quality expectations are differentiators, 
  - When you choose whether to by a car from company A or company B your choice will be influenced by your judgment regarding the relative merit and value of the offerings defined in the specification 
  - You will have an implied expectation that either company will provide a working car 
  - You will have an implied expectation that either company will provide a regulatory compliant car
Trade and quality of life are intimately linked

Quality of life is protected by regulation

Trade access depends on meeting regulation, and being able to demonstrate that regulation is met in a way that is acceptable to the importing country
Why do we want “quality”?

- The expectation (in developed economies) is that:
  - The goods or services will meet any relevant regulatory requirement that may exist
  - The goods or services will “do what is says on the tin” in terms of performance

- Over and above this expectation we make judgements on perceived quality, which wraps up issues such as value for money, brand value, utility to the user, etc etc
The role of Quality in trade

One way of looking at quality in trade - single market

- Performance standards (in many cases)
- Voluntary codes of practice in some sectors
- Old Approach specifies what and how
  - Mandated standards (documentary standards)
- New Approach essential requirements only
  - Directives (transposed into MS legislation)
  - Regulations (directly and immediately applicable)

Regulated
- Quality meeting expectations
  - Yes = access to the market
  - No = exclusion from the market

Unregulated
- Voluntary codes of practice in some sectors
- Performance standards (in many cases)
- Global Approach aligned conformity assessment
  - An assessment of conformity is required, this may be a manufacturer's declaration, or more detailed certification by, typically a notified body + Possible market surveillance

And some hybrids such as rating schemes, that can be “voluntary”: (Euro NCAP car safety performance), or can be a requirement to categorise, (EU energy label - power consumption ratings for washing machines, freezers etc)

Help demonstrate added value and differentiate product
There may be additional performance standards for the product
Remember, compliance doesn’t mean anyone will buy!
There may be additional performance standards for the product
Many:
- Regulations
- Directives
- Written standards
require measurements/ tests which need to be correct and international acceptable (traceable to the SI or if this is not yet practical to other internationally recognized reference standards)!!!
A very important lesson:

- Compliance with regulatory requirements gives you potential access to markets.
- It does not, on its own, persuade anyone to actually buy your goods or services!
- Whilst MAS-Q to demonstrate compliance is an essential, alone it is often not enough!
Expectations of “quality”

- Regulatory compliance is often invisible to the user/consumer
  - If “it” doesn’t comply, “it” is not on the market
- So when it comes to choosing your product over a competitor’s product, quality will be assessed on “value for money”. The interpretation of value for money will vary from person to person (or organisation to organisation)
Metrology is the **building block** for all of these elements, if you cannot measure:

- You cannot generate reliable data
  - You cannot demonstrate compliance
  - You cannot add quality

….and if you cannot comply…

- you have no market

….and if you cannot add quality……

- you cannot add value
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Azerbaijan well on the way to becoming an Associate – hi Rahima!
All NMIs have to decide

where to focus their resources

....and their activities
Decision Analysis Tree

1. **Define the national needs in metrology**
   - Will funding a national capability bring a worthwhile national net benefit to the economy?
     - Yes
     - No
       - Does NMI have the capability?
         - No
         - Yes
           - Should the capability be developed at the NMI?
             - Yes
             - No
               - Develop capability
               - DI delivers in the national system
             - Yes
             - No
               - Does it warrant a creating a DI?
                 - Yes
                 - No
                   - Rely on the KCDB for availability from other country

2. **Provide service**
   - National provision only
     - Yes
     - No
       - Demonstrate availability and acceptability via the KCDB.
         - Provide service
       - Develop relationship
         - Yes
         - No
           - Rely on the KCDB for availability from other country
**Decision Analysis Tree**

Develop capability

- Does national standard need to be primary?
  - Yes
    - Primary realization as a National standard
      - Demonstrate availability and acceptability via the KCDB. Provide service
      - Develop a secondary standard
        - Provide service
  - No
    - Is the national standard (non primary realization) is needed?
      - Yes
        - Get a traceability from NMI of other country that demonstrated availability and acceptability via the KCDB
          - Maintain a non primary standard
            - Demonstrate availability and acceptability via the KCDB.
            - Provide service
      - No
        - Get a traceability from other country that demonstrated availability and acceptability via the KCDB
          - Provide service
Options for NMIs providing traceable services

National needs in metrology
(measurement area, range, uncertainty and other parameters are defined)

Accreditation or Self declaration to the requirements of ISO/IEC 17025 or relevant standard

Scope of NMI activities

Recognition via Accreditation

ILAC
  ↓
  ILAC MRA
  ↓
  NABs
  ↓
  Recognition via Accreditation

ILAC
  ↓
  ILAC MRA
  ↓
  NABs
  ↓
  Recognition via Accreditation

METRE CONVENTION
  ↓
  CIPM MRA
  ↓
  Participation through the RMO
  ↓
  Recognition under the Metre Convention

Scope of NMI activities

Academic or Self declaration to the requirements of ISO/IEC 17025 or relevant standard

Requirements

National needs in metrology
(measurement area, range, uncertainty and other parameters are defined)

Scope of NMI activities

Recognition via Accreditation

ILAC
  ↓
  ILAC MRA
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  ↓
  Recognition via Accreditation

METRE CONVENTION
  ↓
  CIPM MRA
  ↓
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Requirements

Traceability:
- from another NMI (CMCs published in the KCDB) or
- from the Cal.Lab accredited by NAB (ILAC MRA)

Technical evidence:
RMO comparisons or other Inter-laboratory comparisons

Assessment by the NAB

Certificate of Accreditation

Accredited scope with CMCs

Requirements

Traceability:
- Primary realization or
- from another NMI (with CMCs in the KCDB)

Technical evidence:
Participation in CC or RMO Key and supplementary comparisons

RMO TC on QS review

Intra-RMO and inter-RMO review of CMCs

CMCs in the KCDB

April 2014
Conclusion: Key challenges for the NMIs in the region

- Establishing and maintaining an NMI that:
  - Operates a quality management system ISO/IEC 17025
    - and if relevant for reference materials ISO Guide 34
  - Has national standards (primary realization or not as appropriate) for the highest priority national needs with the right balance of benefit verses cost.
    - Very low uncertainties are very expensive
    - Not realistic to provide every possible capability
    - Must align with real national downstream needs
    - Human resource is critical
  - Participates in accreditation and/or Metre Convention (CIPM MRA) to demonstrate capability and ensure international acceptability
  - Disseminates traceability from the national standards to customers via calibration services and/or reference materials
  - Provides advice to stakeholders/ customers related to the calibration services and other measurement challenges
  - Provides advice to stakeholders/ customers on where to obtain internationally accepted traceable services when not provided by the NMI
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The Metre Convention was signed on May 20, 1875 by representatives of 17 states.

From the text:
“Desiring the international uniformity and precision in standards of weight and measure...”
THE METRE CONVENTION

International Convention established in 1875 with 55 Member States in 2013. The institutional foundation of the International System of Units (now the SI).

CGPM – Conférence Générale des Poids et Mesures

Composed of Member State representatives. Typically meets every 4 years to decide on matters pertaining to the Metre Convention and the SI.

CIPM – Comité International des Poids et Mesures

18 individuals of different nationalities appointed by CGPM. Supervises BIPM and generally supplies chairs to Consultative Committees.

BIPM – Bureau International des Poids et Mesures

Research institute founded by the Metre Convention. Administers interlaboratory comparisons and provides measurement services to member NMIs.

Consultative Committees (CCs)

- CCAUV – Acoustics, US & Vibration
- CCEM – Electricity & Magnetism
- CCL – Length
- CCM – Mass and related
- CCPR – Photometry & Radiometry
- CCQM – Amount of substance
- CCRI – Ionizing Radiation
- CCT – Thermometry
- CCTF – Time & Frequency
- CCU - Units
BIPM

It has headquarters near Paris, France. It is financed jointly by the Member States and Associates, and operates under the exclusive supervision of the CIPM.

• Its mandate is to provide the basis for a single, coherent system of measurements throughout the world, traceable to the International System of Units (SI). This task takes many forms, from direct dissemination of units (as in the case of mass and time) to coordination through international comparisons of national measurement standards (as in electricity and ionizing radiation).

• It maintains laboratories in areas of: mass, time, electricity, ionizing radiation, and chemistry.

• It has an international staff of around 75.
Mission of the BIPM

The BIPM is an intergovernmental organization established by the *Metre Convention*, through which Member States act together on matters related to measurement science and measurement standards.

The **mission of the BIPM** is to ensure and promote the global comparability of measurements, including providing a coherent international system of units for:

- Scientific discovery and innovation,
- Industrial manufacturing and international trade,
- Sustaining the quality of life and the global environment.
Working with Governments, National Metrology Institutes, and the accreditation community so as to maintain confidence in the world measurement system for science and trade.

To address the common interest of the NMIs of States Parties to the Metre Convention in dealings with international and intergovernmental bodies such as the World Meteorological Organisation, World Health Organisation, the International Federation of Clinical Chemistry, International Laboratory Accreditation Co-operation, International Organisation for Legal Metrology etc. as the occasion arises.
Towards the late 1980s several factors had emerged that led to the idea of forming an agreement among NMIs to formalize a system of mutual recognition of national measurement standards and calibration certificates:

- Pressure from accreditation bodies for demonstration of NMI capabilities to which the laboratories they accredited were expected to be traceable and of equivalence of NMI calibration certificates.
- The development of regional groupings of NMIs to undertake cooperative activities - EUROMET in Europe, APMP in the Asia-Pacific.
- The reduction of tariff barriers resulting from GATT Uruguay round of negotiations and the conclusion of the Technical Barriers to Trade Agreement increased attention paid to TBTs among which intergovernmental acceptances of testing methods and standards is of relevance to metrology.

The CIPM Mutual Recognition Arrangement (CIPM MRA) was signed on 14 October, 1999 by the Directors of the National Metrology Institutes of 38 States signatories to the Metre Convention and two international organizations.

The essence of the CIPM MRA is that it provides the institutional and technical framework (the “what”, “who” and “how”) for NMIs to recognize each others’ measurement standards and calibration certificates.
The objectives of the CIPM MRA are stated as:

- to establish the degree of equivalence of national measurement standards maintained by NMIs
- to provide for the mutual recognition of calibration and measurement certificates issued by NMIs
- thereby to provide governments and other parties with a secure technical foundation for wider agreements related to international trade, commerce and regulatory affairs

The objectives of the CIPM MRA are to be achieved through:

- International comparisons of measurements, to be known as key comparisons
- Supplementary international comparisons of measurements
- Quality systems and demonstrations of competence by NMIs
The outcome of the CIPM MRA processes are statements of the internationally recognized calibration and measurement capabilities (CMCs) of each NMI published in the database maintained by the BIPM and publicly available online.

http://kcdb.bipm.org/
The CIPM MRA has now been signed by the representatives of 93 institutes – from 52 Member States, 37 Associates of the CGPM, and 4 international organizations – and covers a further 150 institutes designated by the signatory bodies.
The BIPM key comparison database

Georgian National Agency for Standards, Technical Regulations and Metrology

Complete CMCs in Thermometry for Georgia (.PDF file)

Temperature. Water triple point cell, 0.01 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in mK: 0.25
Direct comparison
Thermostat: ice bath
Approved on 14 March 2014
Internal NMI service identifier: GEOSTM/1

Temperature. Tin cell, 231.928 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in mK: 2.6
Direct comparison
Temperature-controlled furnace: 3-zone
Approved on 14 March 2014
Internal NMI service identifier: GEOSTM/2

Temperature. Long-stem standard platinum resistance thermometer, 0.01 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in mK: 0.3
Calibration at water triple fixed point
Thermostat: ice bath
Approved on 14 March 2014
Internal NMI service identifier: GEOSTM/3

Temperature. Long-stem standard platinum resistance thermometer, 231.928 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in mK: 3.5
Calibration at tin fixed point
Temperature-controlled furnace: 3-zone
Approved on 14 March 2014
Internal NMI service identifier: GEOSTM/4

Temperature. Industrial platinum resistance thermometer, 0 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in mK: 10
Calibration at ice melting point
Thermostat
Hysteresis uncertainty for IPRT must be added to uncertainty quoted in calibration report
Approved on 14 March 2014
Republic of Moldova, NMI (MD) (The National Metrology Institute of the Republic of Moldova)

Complete CMCs in Thermometry for Republic of Moldova (.PDF file)

Temperature, Digital thermometer thermocouple, 29.7546 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in k: 0.4
Calibration at Gallium fixed point
Temperature-controlled furnace
Approved on 06 September 2013
Internal NMI service identifier: NMI (MD)/41

Temperature, Digital thermometer thermocouple, 159.5985 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in k: 0.6
Calibration at Indium fixed point
Temperature-controlled furnace: 3-zone
Approved on 06 September 2013
Internal NMI service identifier: NMI (MD)/42

Temperature, Digital thermometer thermocouple, 231.928 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in k: 0.6
Calibration at Tin fixed point
Temperature-controlled furnace: 3-zone
Approved on 06 September 2013
Internal NMI service identifier: NMI (MD)/43

Temperature, Digital thermometer thermocouple, 419.527 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in k: 0.6
Calibration at Zinc fixed point
Temperature-controlled furnace: 3-zone
Approved on 06 September 2013
Internal NMI service identifier: NMI (MD)/44
CIPM MRA: Engagement

The BIPM key comparison database

Refine your search

CMC AREA
- CMCs General Physics (171)
- CMCs Chemistry (21)
- CMCs Ionizing Radiation (1)

PHYSICS
- Temperature (28)
- Dimensional metrology (23)
- Sound in air (22)
- Frequency (25)
- Radio frequency measurements (17)
- AC voltage, current, and power (13)
- Impedance up to the MHz range (12)
- High voltage and current (9)
- Time scale difference (7)
- Fluid flow (3)
- DC voltage, current, and resistance (3)
- Time interval (3)

IONIZING RADIATION
- Activity per unit volume (1)

CHEMICAL MATERIAL
- Natural gas (7)
- Aqueous pH buffer solution (6)
- Nitrogen (4)

Result of the search
Your query 'Ukraine' produced 193 results

Ukraine, NSC IM (National Scientific Centre "Institute of Metrology")

Complete CMCs in Thermometry for Ukraine (.PDF File)
Temperature, Long-term standard platinum resistance thermometer, 0.01 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in max: 0.20
Water triple fixed point
Thermometer: ice bath
Approved on 06 September 2013
Internal NMI service identifier: NSC IM/26

Temperature, Long-term standard platinum resistance thermometer, 0.01 °C to 29.7646 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in max: 0.20 to 0.35
Calibration at fixed points
Fixed points: TPW, Ga
Approved on 06 September 2013
Internal NMI service identifier: NSC IM/27

Temperature, Long-term standard platinum resistance thermometer, 0.01 °C to 156.5985 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in max: 0.20 to 1.1
Calibration at fixed points
Fixed points: TPW, In
Approved on 06 September 2013
Internal NMI service identifier: NSC IM/28

Temperature, Long-term standard platinum resistance thermometer, 0.01 °C to 231.928 °C
Absolute expanded uncertainty (k = 2, level of confidence 95%) in max: 0.20 to 1.3
Calibration at fixed points
Fixed points: TPW, In, Sn
Approved on 06 September 2013
Internal NMI service identifier: NSC IM/29

Temperature, Long-term standard platinum resistance thermometer, 0.01 °C to 419.527 °C
This display only one part of a multi-component CMC.
Some Facts

**Claim**
- Offshore plant order by BP, USA.
- **Calibration traceable to NIST** required.

**Solution**
- DSME, accredited by KOLAS, a member of ILAC MRA.
- DSME keeps traceability of its standards traceable to KRISS.
- KRISS and NIST are all signatory to the CIPM MRA.
- NIST confirmed that "traceability to KRISS is equivalent to traceability to NIST" via the CIPM MRA.
- **BP accepted** accreditation by KOLAS and calibration certificates issued by KRISS.

**Benefit**
- **US$ 11 million saved**
- US$ 30,000 Invested for calibration

- recalibration at NIST; **US$ 1 million**
- penalty of 2 month delay; **US$ 10 million**
SHI - SEIC, Russia [2003]

**Claim**

- SHI constructing an offshore platform ordered by SEIC, Russia.
- **All the measuring instruments installed in the platform required to be traceable to NMS of Russia.**

**Solution**

- KRISS and VNIIMS participate in the CIPM MRA.
- KRISS and VNIIMS concluded a protocol recognizing the equivalence of NMS of both countries.
- **SEIC approved all the measuring instruments of SHI traceable to KRISS as traceable to VNIIMS.**

**Benefit**

- **US$ 16 million saved**
- **US$ 150,000 Invested for calibration**

< The dimensions of the platform is approximately 95 m x 130 m x 120 m >
POSOCO – India, Mexico [2004]

**Claim**
- Mexican manufacturer of automobile parts demanded the proof of reliability of POSCO steel.
- Indian buyer of POSCO steel **required the certification from BIS (Bureau of India Standard).**

**Solution**
- POSCO’s testing laboratory had been accredited by KOLAS.
- KOLAS is a member of APLAC and signatory to the ILAC MRA.
- **POSCO has a traceability to KRISS participating in the CIPM MRA.**
- POSCO’s steel accepted without being retested in India and Mexico.

**Benefit**
- **US$ 5 million saved**
- **US$ 70 000 Invested for calibration**

**ROI**
- **70 times**
Thank you for your attention

http://www.bipm.org

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