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NATIONAL MEASUREMENT LABORATORY AND ITS ROLE IN THE AUSTRALIAN STANDARDS AND CONFORMANCE SYSTEM

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Abstract – The paper gives a brief introduction to the National Measurement Laboratory (NML), Australia's premier institution for measurement science and technology. A particular emphasis is placed on the role NML plays as a key element in the national standards and conformance infrastructure.

1. TRACEABILITY OF MEASUREMENT IN AUSTRALIA

The International Standards and Conformance System and its interface to the Australian System is shown in Figure 1. The Australian system mirrors the international system in that it has five different bodies responsible for the five separate functions of –

- I. physical metrology
- II. legal metrology
- III. laboratory accreditation
- IV. documentary standards
- V. accreditation of certification bodies

- *Physical Metrology*

Commonwealth Scientific and Industrial Research Organisation (CSIRO) is charged by the National Measurement Act (1960) with responsibility for maintaining, or causing to be maintained, standards of measurement for the physical realisation of the legal units listed in the Regulations under the Act. Most of Australia's physical standards of measurement are maintained at the National Measurement Laboratory (NML) within the CSIRO Telecommunications & Industrial Physics. CSIRO delegates responsibility for ionising radiation quantities to the Australian Nuclear Science & Technology Organisation and the Australian Radiation Laboratory. NML interfaces with the International Bureau of Weights and Measures (BIPM).

- *Legal Metrology*

The National Standards Commission (NSC) is responsible for administering the provisions of Australia's National Measurement Act of 1960 and for organising all legal metrology activities. NSC interfaces with the International Organisation for Legal Metrology (OIML).

- *Laboratory Accreditation*

The National Association of Testing Authorities (NATA) is the national body responsible for laboratory accreditation

and represents Australia at the International Laboratory Accreditation Conference (ILAC).

- *Documentary Standards*

Standards Australia (SAI) is the peak body in Australia responsible for the preparation of documentary standards. SAI represents Australia at the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC).

- *Accreditation of Certifying Bodies*

The Accreditation System of Australia and New Zealand (JAS-ANZ) has responsibility for accrediting quality systems certification bodies. JAS-ANZ interfaces internationally with the International Accreditation Forum (IAF).

Physical metrology is a vital component of national and international measurement systems and underpins much of the quality movement, industrial process control, equipment performance certification and trade and commerce. NML has responsibility in Australia for the national physical standards of measurement and for ensuring that the national standards are at a level comparable with those of Australia's main trading partners and must also demonstrate this comparability. Over the past three years it has been involved in more than 40 international comparisons, through the programs of the International Bureau of Weights and Measures (BIPM) and the Asia-Pacific Metrology Programme (APMP), and by direct bilateral comparisons with other national laboratories. NML is accepted by the International Committee of Weights and Measures (CIPM) as one of the national laboratories whose metrology competency is widely respected. As testimony to its standing in international metrology, NML has formal Statements of Equivalence with the National Physical Laboratory (UK), National Institute for Standards and Technology (USA), the National Research Council (Canada), Industrial Research Ltd (NZ) and the Korean Research Institute of Standards and Science (KRISS).

The ever-increasing emphasis on global trading, international trade agreements and the elimination of technical barriers to trade has led to a growing demand for mutual acceptance of national standards between economies and measurement traceability within economies. A global mutual recognition arrangement, the CIPM Mutual Recognition Arrangement (MRA) between National

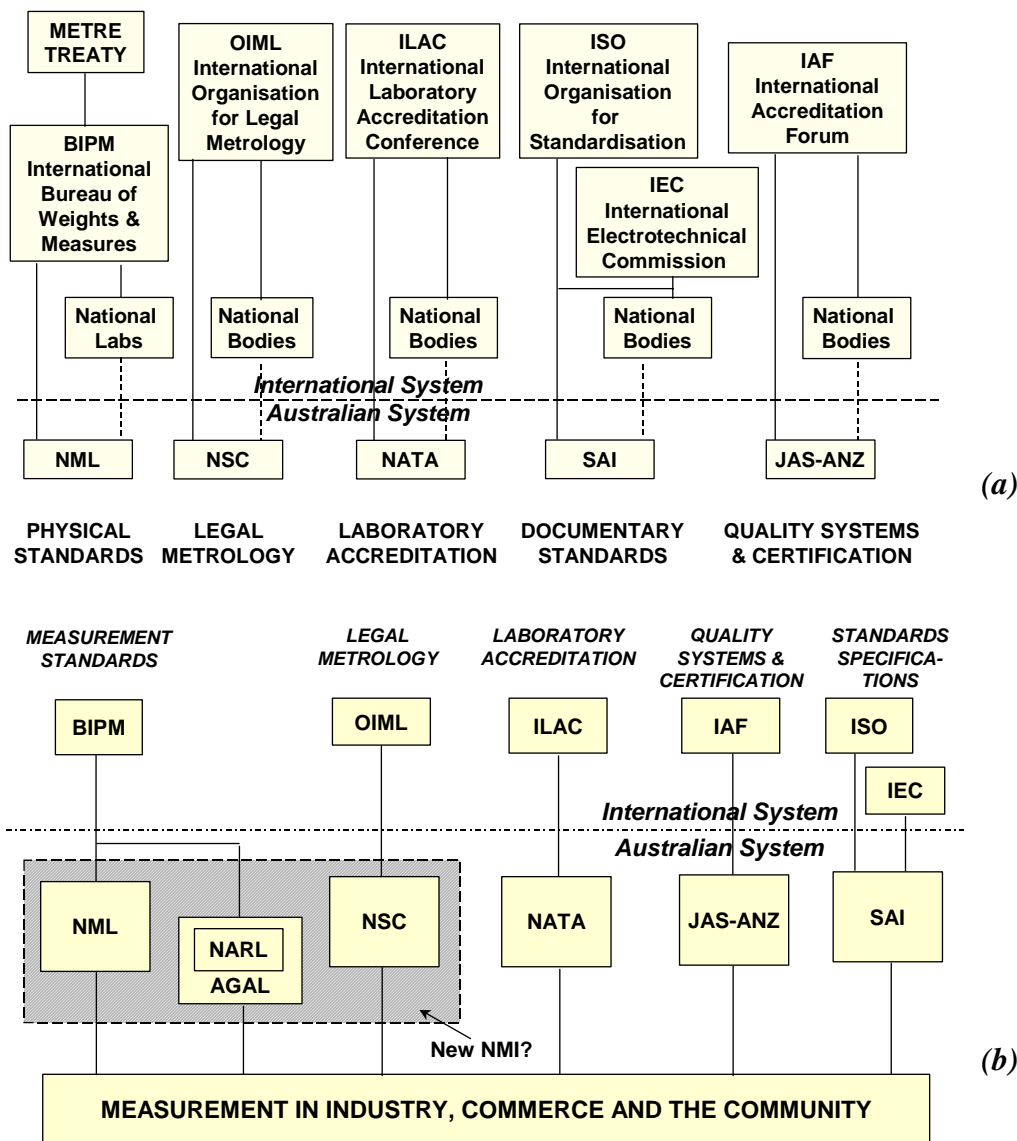


Fig. 1. International (a) and Australian (b) Standards and Conformance systems

Metrology Institutes (NMIs) for the mutual recognition of national standards and calibration certificates issued by NMIs has been established by the BIPM and was signed in October 1999 by Directors of 38 NMIs, including Australia's National Measurement Laboratory, and 2 specially invited international organisations. Its success will depend on an international program of 'key comparisons' and the demonstration and mutual acceptance of competence between NMIs. Through its participation in the key comparison programs, NML is playing its role in underpinning Australia's participation in the global marketplace.

The hierarchy of measurement in Australia is shown in Figure 2. Traceability of measurement is established through an unbroken chain of calibrations performed by NML, NATA accredited laboratories, and Verifying Authorities, linking measurement in industry and the community to the national standards. NML works closely with the National

Association of Testing Authorities (NATA) and the National Standards Commission (NSC) to ensure the competence of accredited laboratories and to ensure an effective national traceability system. NML undertakes the calibration of secondary standards and precise measuring equipment primarily for NATA registered laboratories, defence laboratories, other government laboratories and Verifying Authorities.

2. FACILITIES AND SERVICES OF NML

As the keeper of Australia's measurement standards, NML works to equip industry with the ability to compete in world markets, to provide the basis for a legal measurement system in Australia, to qualify Australian commodities and products for export, and to support measurements for occupational health and safety, environmental protection and community needs.

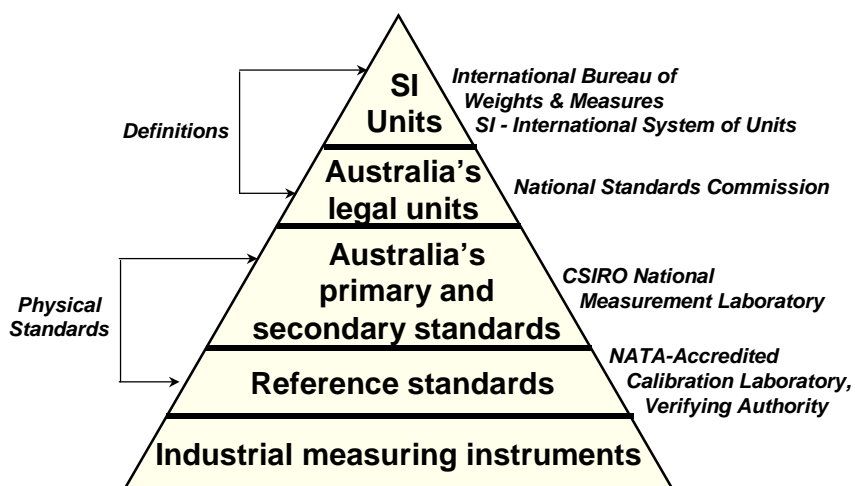


Fig. 2. The hierarchy of measurement in Australia

Many of the skills of NML’s workforce and its testing facilities are unique in Australia and, in some instance, in the Asia-Pacific.

The NML team of scientific and technical experts provides consulting and calibration services that cover the areas of:

temperature; length and dimensional quantities; time and frequency; acoustics, vibration and ultrasound; mass, force, pressure, density, viscosity, and humidity; optical radiometry; electromagnetic compatibility; electrical impedance, power, resistance and voltage at dc and low frequencies; ac-dc transfer; and electrical quantities at radio and microwave frequencies and at high voltages.

NML has facilities to perform many types of measurements. Specialised equipment includes: a deadweight force machine capable of measuring force to 550 kN and a hydraulic machine capable of extending the range to 10 MN; a high-accuracy three-coordinate measuring machine; and a high voltage and current testing laboratory unrivalled in Australia.

3. SPECIALISED RESEARCH AND DEVELOPMENT

Our R&D efforts are at the leading edge of measurement science. We are currently working on a number of projects which have the potential to define new measurement standards to meet the technological and industrial demands of the 21st century.

Future telecommunications and satellite positioning technology will require even greater accuracy than time and frequency standards can currently provide. We are making a major contribution to international research in this area. One of our trapped ion standards has the best performance to date of any passive atomic frequency standard.

The best physical standards are those based on atomic phenomena because they are stable, reproducible and can be regenerated if lost. Most primary standards are based on atomic phenomena, with the exception of the kilogram, which is still based on an artefact. We are part of an international effort to establish a new and absolute definition of the kilogram. NML's particular expertise is to produce and measure near perfect spheres of single crystal silicon that are being used in complementary research by national standards laboratories in Germany, Italy, USA, Belgium and Japan.

Regulations in the European Union have led the drive for electronic and electrical equipment to comply with specifications for electromagnetic compatibility. Within Australia, we provide the physical standards to underpin the tests that demonstrate compliance with these specifications. These tests qualify Australian products for export and also protect the Australian market from dumping of sub-standard products.

CONCLUSION

Measurement traceability is essential to underpin testing, conformance and international trade. Mutual recognition of national measurement standards and the competence of NMIs is a necessary condition for international traceability. The CIPM Mutual Recognition Agreement has been signed, based on a continuing program of BIPM 'key comparisons' and complementary activities undertaken by regional bodies such as APMP. NML provides the interface between the international system and measurement traceability in Australia. National traceability is dependent on third-party laboratory accreditation and proficiency testing. NML, together with NATA accredited laboratories and the Verifying Authorities, collectively provide the basis for measurement traceability in Australia.