

Metrology of Ultrasound and Underwater Acoustics at the NMISA

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NMISA

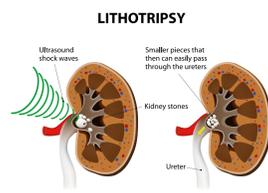
The National Metrology Institute of South Africa (NMISA) is responsible for realising and maintaining the International System of Units (SI) and derived units. This is accomplished by developing and maintaining national measurement standards of physical quantities for South Africa and comparing these standards internationally to ensure global measurement equivalence and competitiveness. The Physical Metrology Division is one of the four divisions of NMISA, under which Ultrasound and Underwater Acoustics Laboratory (UA), part of the Acoustics, Ultrasound and Vibration section falls.

Supports

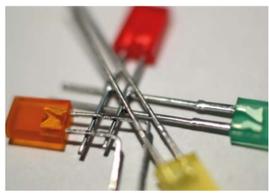
Mandated by the Department of Trade and Industry (the dti), the NMISA seeks to support the country's manufacturing, trade, people's quality of life and environmental protection by supporting hospitals and clinics, occupational and environmental health sectors, local industries and maritime activities. The NMISA works closely with the other dti Technical Infrastructure (TI) institutes towards a comprehensive standards, quality assurance, accreditation and metrology (SQAM) environment that supports 'Locking out' unsafe and poor quality imports and 'Locking in' access to increasing demanding export markets.

Why measure accurately?

- Health – food safety, medical safety for both diagnostics and therapy



- Environment – energy efficiency (LEDs, solar and wind power), radioactivity and global warming monitoring.



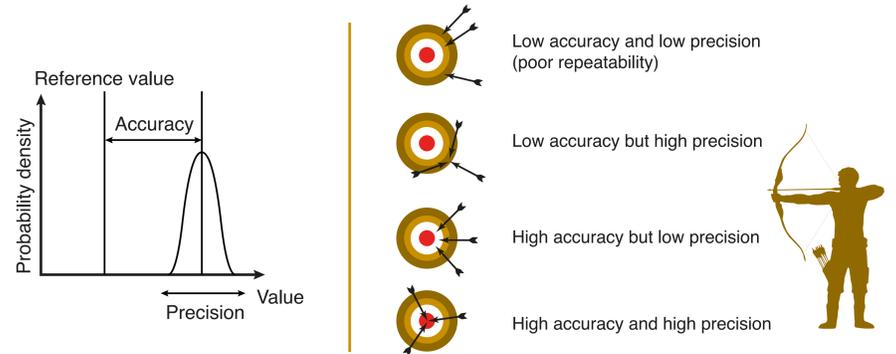
- Economics – product quality control and trade.



- Legal – compliance with law enforcement laws and regulations



Your measurement: Accurate or Precise?



Accuracy is a qualitative term relating the mean of the measurements to the true value, while precision is representative of the spread of these measurements. Even when we are precise and accurate, there will still be some uncertainty in our measurements; the scientists challenges are to evaluate the uncertainty and make this as small as possible. When the uncertainty of a measurement is evaluated and stated, then the fitness of purpose for a particular application can be properly understood.

SI Base Units

Ampere, A:

The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross-section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to 2×10^{-7} newton per metre of length.

kelvin, K:

The kelvin, unit of thermodynamic temperature, is the fraction $1/273.16$ of the thermodynamic temperature of the triple point of water.

second, s:

The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom.

kilogram, kg:

The kilogram is the unit of mass; equal to the mass of the international prototype of the kilogram.

meter, m:

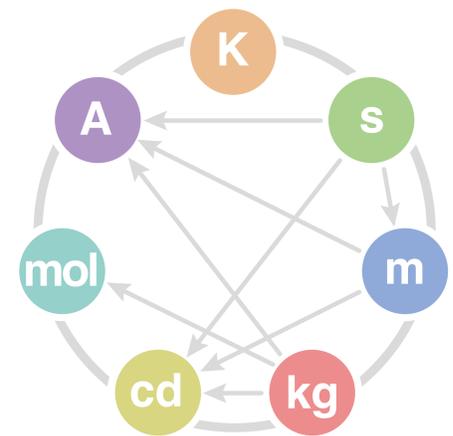
The meter is the length of the path travelled by light in a vacuum during a time interval of $1/299\,792\,458$ of a second.

mole, mol:

The mole is the amount of substance of a system which contains as many elementary entities as there are atoms in 0.012 kilograms of carbon 12. When the mole is used, the elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles, or specified groups of such particles.

candela, cd:

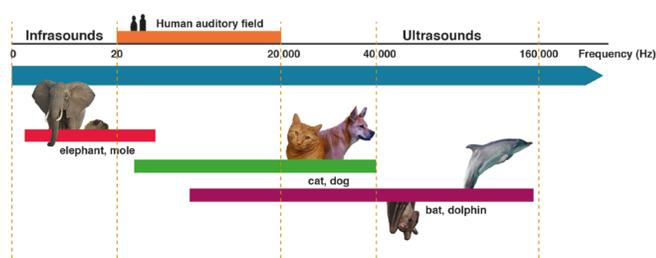
The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and that has radiation intensity in that direction of $1/683$ watt per steradian.



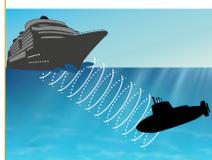
The ultrasound and underwater acoustics lab

Underwater acoustics is the science of utilizing sound waves underwater as a method of navigating, communicating or detection. Ultrasounds are acoustic waves with frequency greater than upper limit of human hearing range, 20kHz.

The NMISA UA laboratory is under development. When up and running, the laboratory will realize and disseminate ultrasound and underwater acoustics measurement solutions to the local health, ultrasonic non-destructive industry (NDT) and maritime industries.



MARITIME



APPLICATIONS:

- Navigation
- Communication
- Marine research (e.g. geophysical surveying, tomographic measurements of ocean currents and temperature)

TRANSDUCER CALIBRATION:

- Hydrophone
- Free-field sensitivity
- Directivity

THE LAB SEEKS TO SUPPORT:

- Scientific research and SA Navy

NDT



APPLICATIONS:

- Thickness measurement
- Internal flaw detection
- Weld inspection

TRANSDUCER CALIBRATION:

- Ultrasonic transducer
- Free-field sensitivity
- Directivity

THE LAB SEEKS TO SUPPORT:

- Local NDT industry, Railways and Additive manufacturing (AM)

MEDICAL ULTRASOUND



APPLICATIONS:

- Ultrasonography – Obstetrics
- High-intensity focused ultrasound (HIFU) – Cancer treatment, Cosmetic medicine (non-invasive liposuction), Lithotripsy (kidney stones)

TRANSDUCER CALIBRATION:

- Ultrasonic transducer
- Ultrasonic output power
- Directivity (beam pattern)

THE LAB SEEKS TO SUPPORT:

- Hospitals, clinics and medical specialists

OTHER AREAS OF FOCUS FOR NMISA

- Chemistry – Gas; Inorganic; Organic and Bio Analysis
- Electricity and Magnetism – Fibre optics; Photometry and Radiometry; RF Electrical; Temperature and Humidity; Time and Frequency; DC Low Frequency and RF
- Ionising radiation – Dosimetry Standards and Radiation Standards
- Physical – Acoustics; Ultrasound and Vibration; Length; Pressure and Flow; Torque and Hardness; Mass and Force



"Your Measure of Excellence"