NMSA

AN INSTMC SPECIAL INTEREST GROUP

METROLOGY SKILLS FRAMEWORK
NMSA-1 – CORE STANDARD

National Metrology Skills Alliance

Version 1.0, 20th December 2023

InstMC

Foreword

NMSA-1 is the Core Standard that underpins the series in the Metrology Skills Framework. The standards were formed to promote and support the standardisation of metrology skills, driving efficiency and consistency across industry. The National Metrology Skills Alliance (NMSA) is the governing body behind the creation and implementation of the standards. Further information is available on the InstMC NMSA Special Interest Group website at:

https://www.instmc.org/sigs/national_metrology_skills_alliance

Contents

1 Introduction

The quality and reliability of any measurement, depends upon the skills of individuals that specify, develop, approve and conduct the activity. A framework that defines the metrology skill standards of individuals is essential to continue to support the development of career pathways and to maintain good metrology practice. Both data quality and personal development are key interests of many organisations.

This standard defines a framework for metrology skills including:

- **Skill Levels** of individuals covering basic metrology awareness through to expert level.
- **Skills Objectives** for what an individual should be able to do at each level.

This allows organisations and individuals to:

- Clearly define the skills required for a particular task in a way that is internationally recognised.
- Define a development route / career pathway for individuals, helping to identify gaps and improvement opportunities.
- Benchmark the skills across an organisation and identify skills gaps and improvement opportunities.
- Adopt an international framework and avoid the need for developing an in-house standard for metrology skills.
- Develop approaches to skills development (e.g., education and training) in a standardised way.

It is anticipated in the future that this framework will be expanded to define qualification processes that will enable:

- Individuals to demonstrate their competence in a subject, at an appropriate level
- Organisations developing training and development solutions to demonstrate their solutions are aligned to this framework.

The relationship of the qualification processes to the overall framework is defined within this issue of this document. The detail will be added in a future issue of this standard.

2 Scope

Metrology is a vast subject and therefore this framework is intentionally concentrating on areas where there is both:

- A sector of the industrial and/or scientific user base comprising a “critical mass” of users to warrant a coordinated, standardised approach to skills.
- Recognition that the tasks performed by this user base are of major importance to the operation of their organisations and could include critical links to areas such as safety, product and/or business performance.

The structure is designed in a way that enables groups to create additional content once a critical mass is formed in different areas.

3 Applicability

This document may be applied to individuals who use metrology across science and industry. Levels 1-3 are targeted at metrologists whose role is predominantly based around metrology. The foundation level is aimed at those who require a foundational level of metrology skill to perform their role and/or effectively use measurement results. This document also applies to any individual responsible for specifying, developing and approving metrology for use.

4 Definitions

Definitions of terms used in this document and the whole NMSA Metrology Skills Framework are provided below. Metrology specific terminology used in this document are defined within the International Vocabulary of Metrology (VIM) (1). The verbs used within skills objectives are based on the Blooms Taxonomy system (2) & (3).

Table 1 - Definition of Terms

Term	Subject Definition
Certification	A written statement by an employer or accredited training organisation that an individual has met the applicable requirements of this standard.
Conceptual Knowledge	Knowledge of classifications, principles, generalisations, theories, models, or structures pertinent to a particular disciplinary area.
Experience	Actual performance of something specific to a discipline, subject, or area of study conducted in a work environment resulting in acquisition of knowledge and skill. This does not include formal classroom training but may include laboratory and on-the-job training as defined by the employer's written practice.
Factual Knowledge	Knowledge that is basic to specific disciplines. This refers to essential facts, terminology, details or elements individuals must know or be familiar with in order to understand a discipline or solve a problem in it.
Skill Level	The position on the scale of amount, complexity, intensity, or quality of an ability that has been acquired by training, experience, coaching etc..
Skill Objective	Describes what the individual is able to do at the end of the learning process that they couldn't do before.
Procedural Knowledge	Information or knowledge that helps to do something specific to a discipline, subject, or area of study. It also refers to methods of inquiry, very specific or finite skills, algorithms, techniques, and particular methodologies.
Competence	See BS EN ISO/IEC 17024:2012 (4)
Qualification	See BS EN ISO/IEC 17024:2012 (4)

5 NMSA Metrology Skills Framework Structure

The NMSA Framework comprises four major elements as described below in Figure 1:

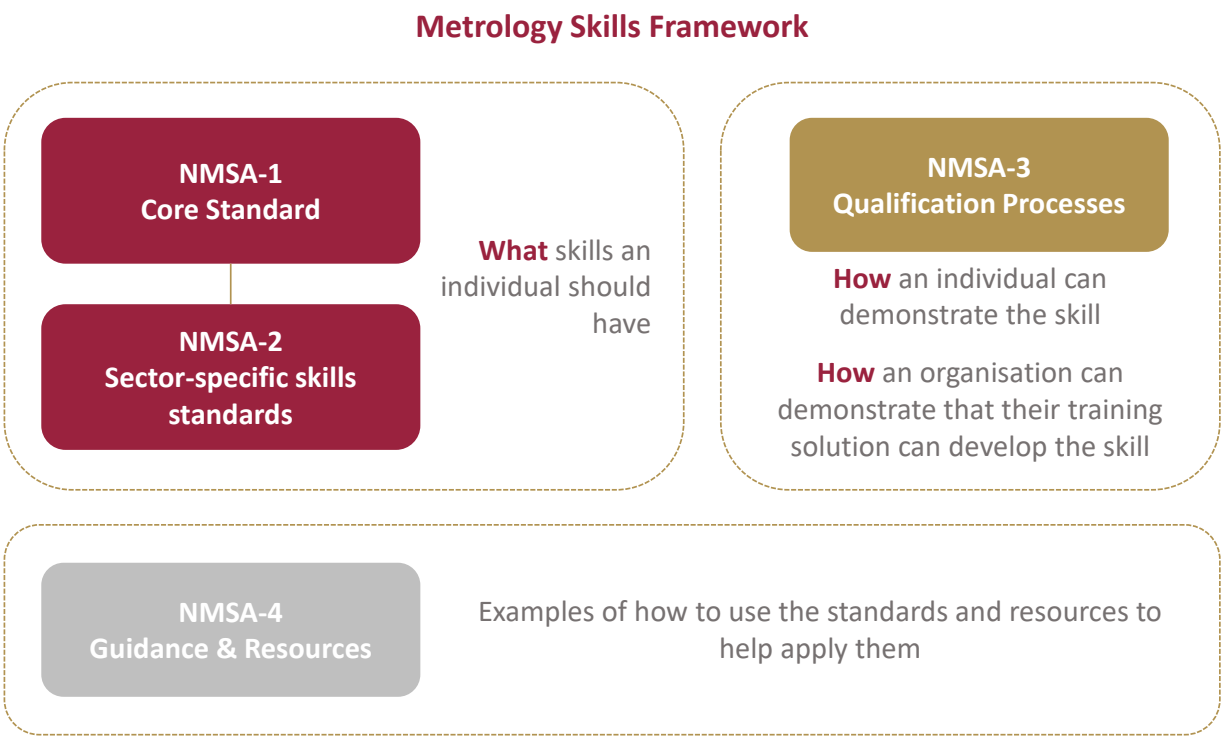

Figure 1 - NMSA Metrology Skills Framework

The four major elements are described in the following sections:

5.1 NMSA-1 – Core Standard (This document)

The overall structure of the NMSA Metrology Skills Framework is defined within this document. It defines the skill levels that are used across the NMSA standards. These skill levels are developed based on the widely recognised levels; Blooms' Taxonomy (2) & (3) and the Regulated Qualifications Framework (RQF) (4).

A set of six core metrology skills are defined within NMSA-1 that are applicable in any type of metrology. **Figure 2** shows the structure and content of this NMSA-1 standard.

An organisation may only require sections of this standard for an individual to perform their role therefore only certain sections of this standard and the associated training would be required, e.g., a shop-floor inspector may only require NMSA-"1.1 - Metrology Fundamentals" and "1.6 - Measurement Operations and Reporting" to effectively perform their role.

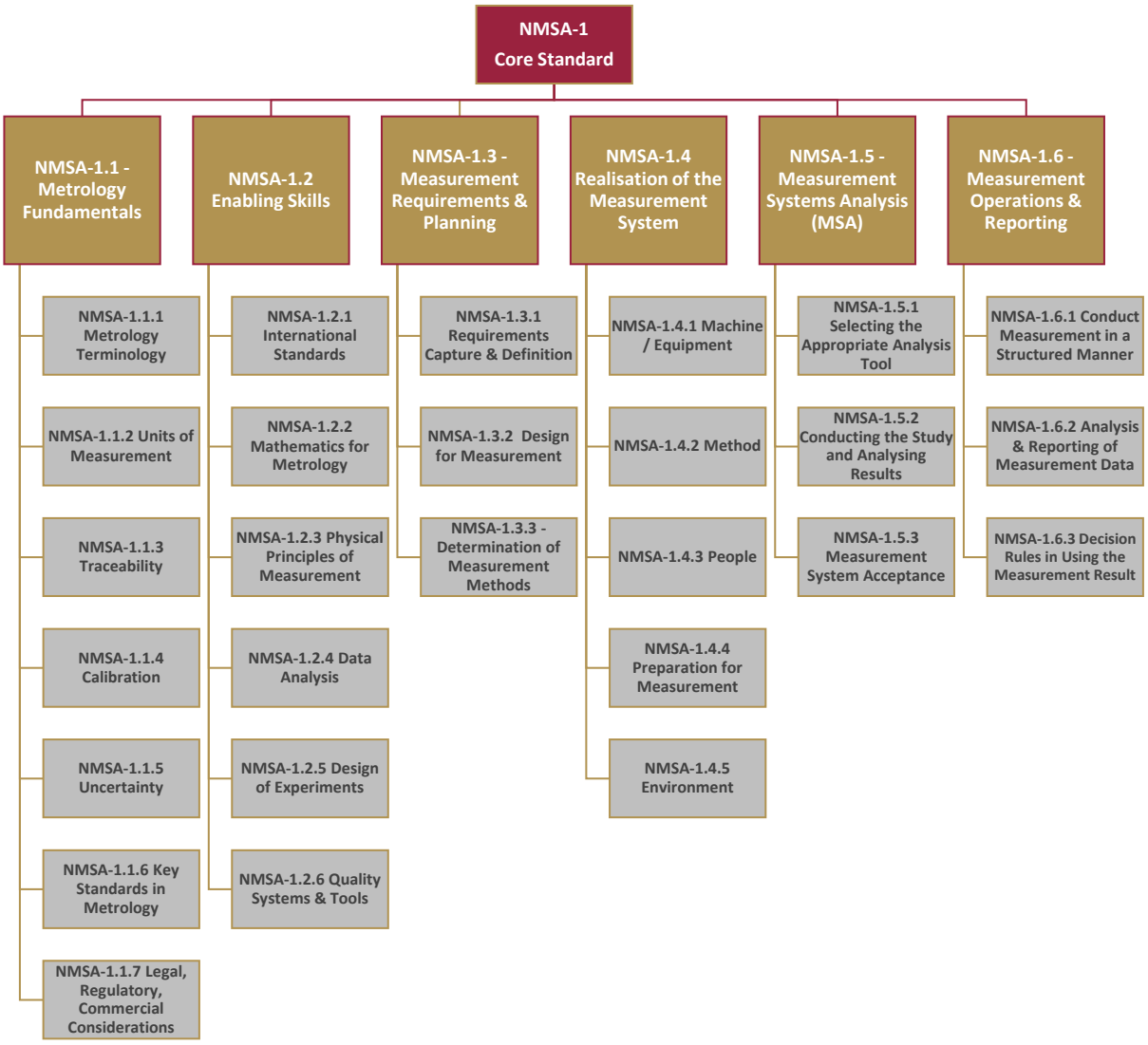

Figure 2 – NMSA-1 Structure

5.2 NMSA-2 – Sector-Specific Skills Standards

Each metrology discipline used by different industrial and scientific sectors will often have specific methods and technologies. NMSA-2 caters for this by providing a framework for a series of standards (e.g., 2.1, 2.2, ….2.x) to define skills specific to a defined scope that addresses particular requirements in a given sector.

The scope of these NMSA-2.x documents will be based on the "critical mass" concept described in section 2, where there is a need for a coordinated, standardised approach to skills for a defined group. This enables flexibility in NMSA-2 to adapt to the needs of the user base, without taking a "rigid" approach (e.g., driven by SI units) that could drive inefficiency.

Each NMSA-2.x standard may add additional detail to the metrology fundamentals (defined in NMSA-1) as well as including skills specific to the methods and technologies within scope. **Figure 3** shows the detailed relationship of the NMSA framework with an example of the relationships between the documents.

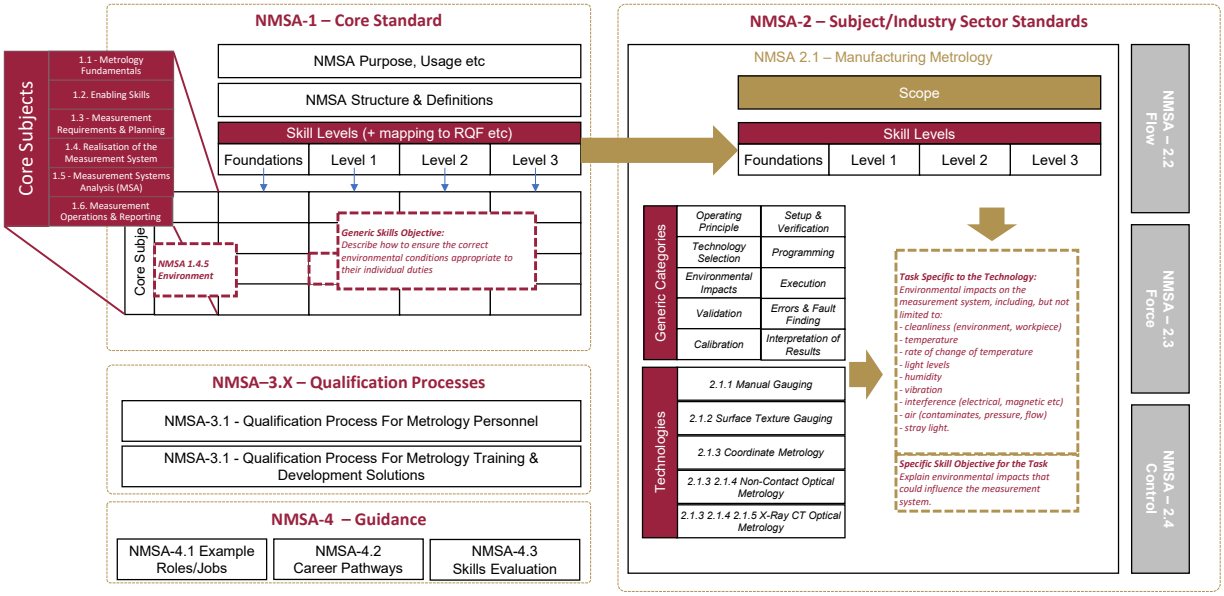

FIGURE 3 - NMSA DETAILED STRUCTURE

5.3 NMSA-3 – Qualification Processes

NMSA-1 and NMSA-2 define what an individual should be able to do at different levels and technical specialisms within metrology. NMSA-3 will define processes to qualify individuals and the provision of skills development, including trainers and training materials, against the standards defined in NMSA-1 and NMSA-2. For example:

- Some organisations may require an independent process for an individual to demonstrate their competence to conduct a particular activity. This is particularly important for activity that is highly dependent on skills and the outcome of the activity is critical (e.g., product safety). Therefore NMSA-3 will provide processes for an individual to demonstrate that they possess the skills at a particular level. This demonstration could be through a range of approaches (e.g., examination, evidence of appropriate experience etc.). Other areas, most notably Non-Destructive Testing within ISO/IEC 9712:2021 (6) already use qualification processes extensively.
- To develop skills, organisations and individuals can use a range of solutions including training and education. A qualification process is planned that will enable providers of training and

education to obtain an “accreditation” for their solutions, demonstrating that they meet the requirements of NMSA-1 and -2. This certification will provide customers of these solutions the assurance that these solutions will meet the needs of their organisation in a standardised way.

Reference to NMSA-3 is included here for clarity on the overall intent and structure of the NMSA Metrology Skills Framework. A future issue of this standard will fully define NMSA-3.

5.4 NMSA-4 – Guidance and Resources

To assist with the adoption of the NMSA Metrology Skills Framework a set of resources will be developed in the future to guide people. This may include:

- **Job role descriptions** that show examples of how the NMSA Metrology Skills Framework can be used when recruiting people as well as developing organisational designs.
- **Career Pathways** showing how an individual can plan their career development in metrology.
- **Skills Evaluation / Gap-Analysis** tools to help with identifying skills gaps in individuals and across organisations.
- **Guidance and Good Practice** resources to aid organisations in deploying the NMSA Metrology Skills Framework.

6 Skill Levels

The NMSA Metrology Skills Framework defines four levels of skill ranging from a foundational awareness of the subject through to metrology professionals with authority to make critical decisions. These levels are as follows:

Table 2 - NMSA Skill Levels

Level	Summary	Description
Foundation	Awareness, Non-Metrologist	Foundation Level is appropriate for an individual who is not a metrologist but has to interact with measurement data in their role. It could be a scientist/engineer or manager who may be the "customer" of a measurement and make decisions based on information obtained from measurement data.
1	Practitioner, Technician/Skilled	A Level 1 metrologist carries out measurements or related activity in accordance with a predetermined procedure under the supervision or authority of a Level 2 or 3 metrologist. This procedure will generally be limited to conducting a measurement, checking results for their validity, and then reporting the results.
2	Senior Technician / Team Leader / Skilled	A Level 2 metrologist will typically be carrying out measurements in an operational environment but with additional responsibilities to support and coach Level 1 metrologists, act as the link between Level 1 and Level 3 as well as have some limited decision-making responsibility within predetermined boundaries.
3	Approver, Engineer, Manager/ Expert	A Level 3 metrologist will usually be specifying measurement methods, processes and procedures. They will typically coach Level 2 metrologists and be involved in decision making in complex situations. Will usually have some level of formal accountability in an organisation for metrology.

Typically, these levels build on each other where it is implicit that at a higher level an individual should have the skill to generally operate at one of the levels below. However, it is unlikely an individual at each level would possess and maintain all the skills of every level across the broad spectrum of processes and technologies utilised within the working environment. More realistic is that an individual at each level would have the experience to understand how the levels below operate and be able to coach/support accordingly.

The following sections give some descriptors for each of the levels, defines the expected level of autonomy and responsibility an individual would have, as well as the complexity of the tasks the individual would typically undertake.

6.1 Foundation Level

These descriptions are based on the Blooms Taxonomy system (2) & (3).

Descriptor	**Awareness e.g., Non-metrologists, Manager and Support, Trainee or Apprentice.**
Autonomy	• Seeks guidance from metrologists.
Responsibility	• Ensure compliance with metrology requirements as agreed with metrology individuals. • Works under direct assigned supervision and knows when to seek assistance. • Uses limited discretion in attending to enquiries.
Complexity	• Routine. • Performs routine activities in a structured environment. • Requires assistance in resolving unexpected problems. • Participates in the generation of new ideas.

6.2 Level 1

Descriptor	**Practitioner e.g., Technician, Inspector, Fitter, Shop Floor.**
Autonomy	• Partially Guided. • Determines when to seek guidance in unexpected situations.
Responsibility	• Supervised. • Works under routine direction. • Plans own work within short time horizons. • Uses limited discretion in resolving issues or enquiries.
Complexity	• Routine. • Performs a range of work activities in varied environments. • May contribute to routine issue resolution and continuous improvement activities (inside and outside the metrology function). • May apply creative thinking or suggest new ways to approach a task.

6.3 Level 2

Descriptor	**Overseer e.g., Senior Technician, Supervisor/Team Leader, Lead Metrologist.**
Autonomy	• Partially Guided. • Receives specific direction. • Accepts guidance and has work reviewed at agreed milestones. • Plans and monitors own work (and that of others where applicable) competently within limited deadlines.
Responsibility	• Supervised. • Works under general direction. • Uses discretion in identifying and responding to complex issues related to own assignments. • Determines when issues should be escalated to a higher level.

	• Can coach Level 1 Practitioners.
Complexity	• Complex. • Performs a broad range of work, sometimes complex and non-routine, in a variety of environments. • Applies a methodical approach to routine and moderately complex issue definition and resolution. • Applies, facilitates and develops creative thinking concepts or finds innovative ways to approach a deliverable. • Investigates, defines and resolves complex issues.

6.4 Level 3

Descriptor	**Approver e.g., Metrology Engineer, Manager, Subject Matter Expert.**
Autonomy	• Corporate Guided. • Works under broad direction. • Work is often self-initiated. • Is fully responsible for meeting allocated technical and/or group objectives. • Analyses, designs, plans, executes and evaluates work to time, cost and quality targets. • Establishes milestones and has a significant role in the assignment of tasks and/or responsibilities.
Responsibility	• Managed. • Accountable for achieving assigned objectives, decisions made by self and others. • Implements and executes policies aligned to strategic plans. • Plans, schedules and monitors work to meet given objectives and processes to time and quality targets. • Uses substantial discretion in identifying and responding to complex issues and assignments as they relate to the deliverable/scope of work. • Can coach Level 2 Metrologists.
Complexity	• Complex. • Provide leadership to achieve desired work results; manage resources, set milestones and drive work. • Engages and coordinates with subject matter experts to resolve complex issues as they relate to customer/organisational requirements. • Understands the relationships between own specialism and customer/ organisational requirements. • Has deep expertise in own specialism(s) and an understanding of its impact on the broader organisation and wider customers.

6.5 Alignment of Skills Levels to Recognised Frameworks

To assist in interpretation of the NMSA skill levels, Table 3 describes the approximate alignment of NMSA skill levels to those described in other related frameworks and standards. NMSA is independent of other skills frameworks and does not require individuals to have formal qualifications to operate within the metrology elements of their responsibilities. It is recognised that some individuals may have skills and knowledge exceeding what is defined in NMSA Level 3, this framework defines the minimum standard appropriate to each level.

Table 3 - Alignment of NMSA Skill Levels to Common Skill Frameworks

Level	Summary	Blooms Taxonomy (3) (2)	Regulated Qualifications Framework (RQF) (5)	Professional Recognition Level (7)	ISO 9712 Qualification and certification of NDT individuals (6)
Foundation	Awareness, Non-Metrologist	Knowledge	≤3	N/A	N/A
1	Practitioner, Technician/Skilled	Knowledge Comprehension Application	≤5	Technician	1
2	Senior Technician / Team Leader / Skilled	Knowledge Comprehension Application Analysis	≤6	Incorporated	2
3	Approver, Managing/ Expert	Analysis Evaluating Creating	≤8	Chartered	3

7 Core Subjects

Within this section, six core subjects are defined. These core subjects and their skills objectives are defined at a high level in this document. These are intended to be generic for all metrology disciplines. Documents within NMSA-2 may define additional detail associated with these core subjects that are specific for a particular discipline e.g., flow metrology.
These six core subjects are arranged around a simplified process flow for metrology as described in **Figure 4** below. Each of these six subjects have several sub-sections which cover the detail.

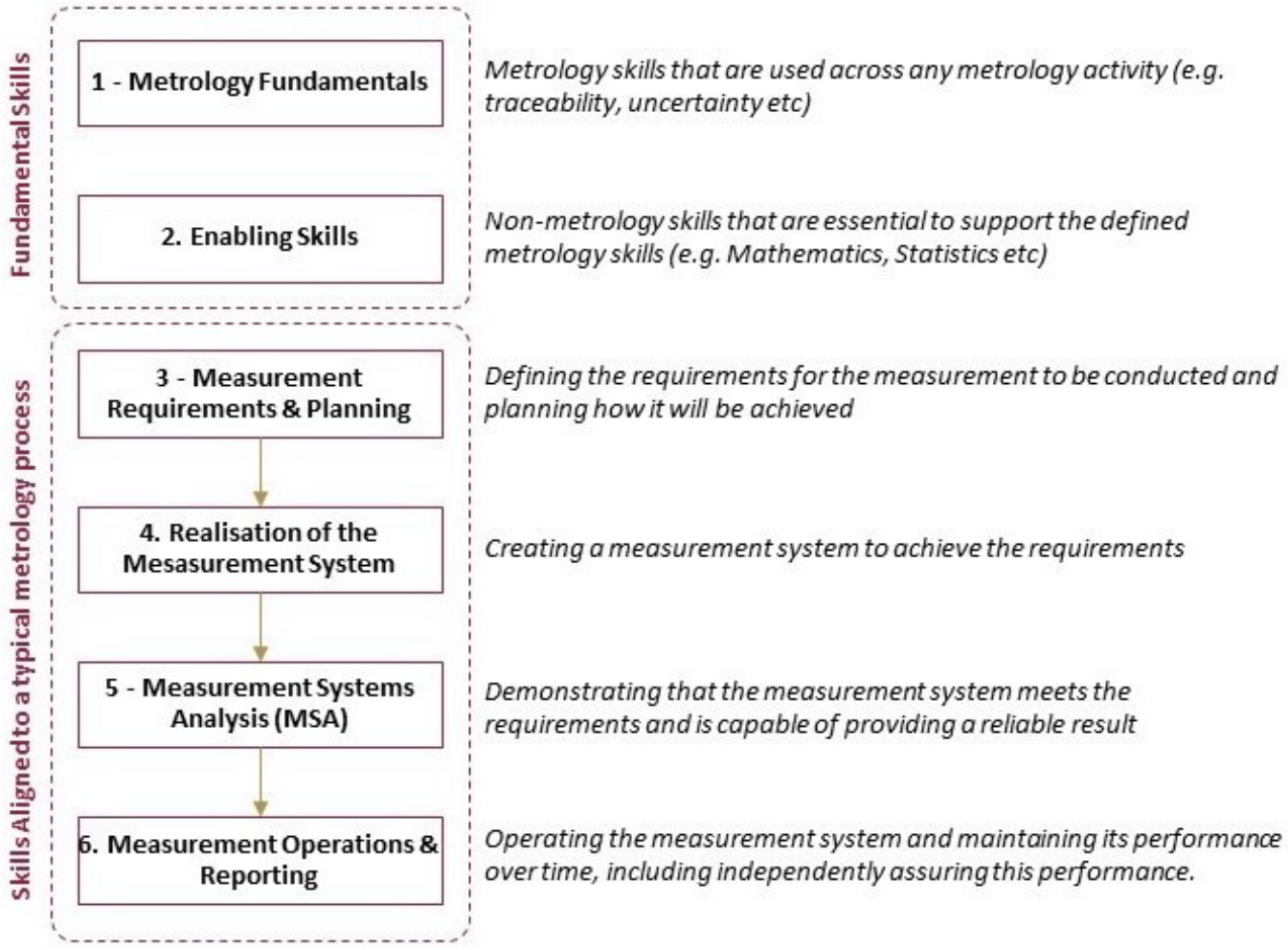

Figure 4 - NMSA Metrology Skills Framework - Core Subjects

The following sections define the skills objectives for each of the 6 core subjects and are arranged as follows:

Category	Description	Foundation, Level 1, 2 & 3
Grouping of skills within a particular subject	Description of the Category	Skill descriptions for each of the 4 levels from foundation through to Level 3. These describe what an individual at each level should be able to do, related to the category.

NMSA-1.1 Metrology Fundamentals

Metrology skills that are used across any metrology activity (e.g., traceability, uncertainty).

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.1.1 Metrology Terminology	Understands the major elements of metrology and terminology and is able to describe what they are. Including any discipline specific terminology defined within the relevant NMSA2.X standard (e.g., flow).	Recall where to find the correct terminology documentation. Describe the importance of using the correct language and terminology. Identify who to go to for support and further information. *E.g., know the organisation's point of contact for metrology, know of the International Bureau of Weights and Measures (BIPM) website.*	Demonstrate appropriate reference to the documentation in their work. Choose the correct terminology in spoken discussion. Demonstrate the importance to the organisation of such documents. *E.g., know of the existence of JCGM200 (International vocabulary of metrology – Basic and general concepts and associated terms (VIM) and reference).* (1)	Demonstrate appropriate reference to the documentation in their work and explain to non-metrologists. Choose the correct terminology in formal documents and spoken discussions. Demonstrate the importance to the organisation of such documents. *E.g., updating their organisation's process instructions/policy documents to ensure adherence to JCGM200 (VIM).* (1)	Create/modify their organisation's terminology documentation to ensure it is up-to-date and available. Ensure suitability for the requirements of the organisation's policies and objectives. Explain terminology at appropriate senior levels. Evaluate compliance to terminology standards. Is the organisation's operational acceptance authority. Point of contact internally for further support across the organisation. *E.g., producing, reviewing and amending their organisation's process instructions/policy documents to ensure adherence to JCGM200 (VIM).* (1)

NMSA-1.1.2 Units of Measurement	The principles of measurement units including base and derived International System of Units (SI) and non-SI units, and their link to fundamental constants.	Locate the correct information from verified sources. Recognise the SI base and derived units and their symbols. Select the names and symbols of the decimal multiples and sub-multiples of SI units. Identify non-SI units. *E.g., know the organisation's point of contact for metrology, knowledge of the International System of Units (SI) and other units in common usage in their industry and/or country, (e.g., Pascal is SI but PSI is US Customary, metre is SI but yard and feet are Imperial/US Customary etc.).*	Write the unit symbols and names, and express the values of quantities as per SI Brochure on measurement records and documents. Convert between different units and measurements of the same quantity. Demonstrate the correct application of the names and symbols of the decimal multiples and sub-multiples of SI units on measurement records and documents. Write the unit symbols and names, and express the values of quantities of non-SI units on measurement records and documents. *E.g., record 's' not 'sec', '°C' not 'C' or '°c', 'in' not '"', 10 kΩ not 10kΩ or 10KΩ etc.; convert from bar to Pascals or Torr, Kelvin to Celsius, degrees to radians etc.; 0.001 m written as mm not MM or m.m., 10-6 kg 1 mg not 1 µkg etc..*	Show the relationship between the SI base units and the derived units in terms of the base units. State the relationship between base units and derived units of non-SI units. Convert between different units and measurements of the same quantity. Be able to apply coefficients to convert between units. Demonstrate the correct application of the names and symbols of the decimal multiples and sub-multiples of SI units on measurement records and documents. Write the unit symbols and names, and express the values of quantities of non-SI units on measurement records and documents. *E.g., as for Level 1 and define SI units as products or powers of base units, length's relationship to acceleration (m to ms^{-2}), force to energy (N to J), etc.; mass to volume (pound to pint), mass to pressure (pound to pound-force per square inch), etc..*	Identify and describe the seven defining fundamental constants, the SI units. Define the SI base units in terms of the seven defining fundamental constants. Explain the derivation and application of the derived units. Illustrate the metrology traceability chain back to the SI units. Establish and verify organisation policy/ procedures on units aligned to the requirements of customers and regulators. Be able to explain the business-criticality of traceability to SI units. *E.g., Planck constant to the kilogram, Boltzmann constant to the Kelvin, etc.; producing, reviewing and amending their organisation's process instructions/policy documents to ensure adherence SI Brochure: The International System of Units (SI).*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.1.3 Traceability	Tracing all measurement through an unbroken chain of uncertainties back to the SI units. It should not only be related to calibration, but also the measurement process itself.	Recall the basic concept of traceability in measurement. Recall where to find the correct information from verified sources. *E.g., know the organisation's point of contact for calibration and traceability, know of the National Measurement Institute (country specific) website for guidance.*	Explain the concept of traceability in measurement. Comply with organisation's traceability policies and procedures and good practice. *E.g., know of the existence of external and internal documentations and policies regarding traceability of measurement, such as ISO 17025* (8).	Apply the basic concept of traceability in measurement, provide evidence of the chain of traceability within a measurement process. Supervise and ensure the compliance of organisation's traceability policies and procedures in practices. *E.g., demonstrate a working knowledge of external and internal documentations and policies regarding traceability of measurement, such as ISO 17025* (8).	Calculate the chain of traceability through the uncertainties. Verify the use of equipment, different measurement methods and processes via the traceability chain. Author or validate good practice guides for the organisation. *E.g., producing, reviewing and amending their organisation's process instructions/policy documents to ensure adherence to traceability of measurement documentation, such as ISO 17025* (8).

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.1.4 Calibration	Principles of metrology traceability through an established calibration hierarchy; the role of national and international standards; traceability routes for calibrations of all measurements; calibration principles and practices, interpretation of calibration results, assessing validity of calibration approach including confidence levels and uncertainty.	Describe the importance of calibration, including the importance of using calibrated equipment. State why the use of uncalibrated equipment for quantitative measurement is undesirable, and therefore should not be used. Locate the organisation's systems for compliance to relevant internal and external standards and associated documentation. *E.g., know of the existence of JCGM200 (International vocabulary of metrology – Basic and general concepts and associated terms (VIM))* (1)*. External standards could include contract, customer, legal, regulatory etc..*	Organise the calibration resources (e.g., artefacts and documentation) to ensure the effective operation of the calibration systems and procedures. Carry out specified calibration tasks in accordance with the defined procedures. Able to explain the concept of metrology traceability in measurement. Comply with organisation's traceability policies and procedures in practices. *E.g., know where to find or recall a basic definition of traceability and calibration* (1)*. Know the organisation's point of contact for metrology.*	Carry out verification and validation tasks in accordance with the defined procedures. Analyse the operation of calibration procedures by evaluating data, identifying and responding to improvement opportunities (e.g., calibration frequencies). Review calibration certificates and assess against the defined procedures. Apply the basic concept of traceability in measurement. Comply with organisation's traceability policies and procedures in practices. Demonstrate the importance of traceability to the organisation of such documents. *E.g., link the calibration hierarchy to calibration traceability.*	Comprehensively explain the impact of international standards (ISO, ILAC etc.). Create procedures for the ongoing management of calibration in compliance with relevant standards. Evaluate non-standard situations, make and justify the appropriate decision. Calculate the chain of traceability through the uncertainties. Validate the use of equipment, different measurement methods and processes via the traceability chain. *E.g., could include procedures for verification and validation, equipment registers, scheduling, audit, failure reporting etc. Non-standard situations are where judgement must be applied to determine the appropriate course of action, e.g., calibration extensions, marginal results etc..*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.1.5 Uncertainty	The principles of measurement uncertainty, uncertainty budgets and their use and management in accordance with international standards. The implications of measurement uncertainty on measurement operations and on the uses of data.	Describe the concept of measurement uncertainty and its importance. *E.g., know the organisation's point of contact for measurement uncertainty, know of the existence of National Measurement Institute (country specific) website for support and guidance.*	Describe the importance of individual contributors in the uncertainty budget and the measurement / calibration process. *E.g., should be able to state the typical major components of uncertainty (Type A and Type B) for their work (e.g., temperature etc.) and link these to practical actions that are instructed in their area.*	Construct an uncertainty budget for the measurement task at hand. Apply the measurement uncertainty policies relevant for their measurement processes. *E.g., demonstrate a working knowledge of external and internal documentations and policies regarding uncertainty of measurement, such as ISO 17025* (8)*, GUM* (9)*, UKAS M3003* (10)*, and the application within their organisation.*	Comprehensively explain the principles of measurement uncertainty, including the relevant international standards (e.g., ISO6461 (GUM) (9) and ISO 14253 (11)). Create and maintain policies for the ongoing management of measurement uncertainty budgets in compliance with relevant standards. Explain the business-criticality of understanding measurement uncertainty. *E.g., producing, reviewing and amending their organisation's process instructions / policy documents to ensure adherence to uncertainty of measurement documentation, such as ISO 17025* (8) *, GUM* (9)*, UKAS M3003* (10)*.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.1.6 Key Standards in Metrology	International and organisation standards applicable to business and metrology needs, operationally and legally.	Recall where to find the correct information from verified sources. Describe the importance of compliance with the standards. *E.g., know the organisation's point of contact for measurement and metrology standards, know of the existence of National Measurement Institute (NMI, country specific), British Standard Institute (BSI) website, and internal reference and support documentation for guidance.*	Recall where to find the correct documentation and be able to reference the documentation. Carry out measurement practice in compliance with standards where appropriate under guidance. *E.g., know of the existence of external and internal documentations and policies regarding measurement and metrology standards, such as NMIs, BSI and international standards.*	Recall where to find the correct documentation and be able to reference the documentation to ensure suitability and requirements of the task at hand. Apply standards where appropriate in formal written documentation. Summarise and supply evidence of compliance. Articulate the importance to the organisation of such standards. *E.g., demonstrate a working knowledge of and compliance with external and internal documentations and policies regarding measurement and metrology standards and the application within their organisation.*	Recall where to find the correct documentation and be able to reference the documentation to ensure suitability / requirements of the organisation's policies and objectives. Demonstrate and discuss the significance of compliance at appropriate senior levels. Recognise non-compliance, adjust / implement improvement and verify the compliance. Create, author and review formal written documentation for standard compliance. Would be the organisation's operational acceptance authority. *E.g., producing, reviewing and amending their organisation's process instructions / policy documents to ensure adherence to measurement and metrology national and international standards.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.1.7 Legal, Regulatory, Commercial Considerations	Describe the legal, regulatory and commercial responsibilities associated with metrology activities and the consequences for individuals and organisations.	Recall organisation's obligations regarding compliance with measurement standards and legal requirements. Be aware of the consequences of non-compliance. *E.g., know the organisation's point of contact for legal, regulatory and commercial considerations for measurement within the organisation (and wider supply chain).*	Be aware of organisation audit, obligations regarding compliance to measurement standards and legal requirements; and chain of legal responsibilities. Be aware of the consequences of non-compliance. *E.g., know of the existence of external and internal documentation and policies regarding legal, regulatory and commercial considerations for measurement within the organisation (and wider supply chain).*	Ensuring compliance with all internal and external legal and regulatory organisational and individual obligations. *E.g., demonstrate a working knowledge of, and compliance to external and internal documentation and policies regarding legal, regulatory and commercial considerations for measurement, and the application within the organisation (and wider supply chain).*	Responsible for ensuring correct compliance, auditing and reporting internally and externally against all legal regulatory obligations; including management and reporting of all observations and non-compliance. *E.g., producing, reviewing and amending their organisation's process instructions/policy documents to ensure adherence to legal, regulatory and commercial considerations for measurement within the organisation (and wider supply chain).*

NMSA-1.2 Enabling Skills

Non-metrology skills that are essential to support the defined skills (e.g., mathematics, statistics).

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.2.1 International Standards	The role of national and international standards and how they are applied within the organisation.	Describe the national and international standards applied to the organisation and its operating sector. Describe the organisation's policies and procedures applied to role. *E.g., universal international standards such as, ISO9001* (12)*, ISO14001* (13)*, ISO17025* (8)*. International technical standards aligned to industrial sectors such as AS9100* (14) *(Aerospace industry), TS16949* (15) *(Automotive industry) Technical Standards.*	Demonstrate knowledge of, and compliance with, all organisation's policies and procedures applied to own role. Carry out technical processes under supervision. *E.g., in an automotive industry-based organisation, demonstrate knowledge of application and practices for Measurement Systems Analysis as defined in TS16949* (15).	Demonstrate knowledge of, and compliance with, all organisation's policies and procedures applied to own role and function. Operate local processes without supervision and contribute to development or revision of local processes. *E.g., in an automotive industry-based organisation, demonstrate knowledge of application and practices for Measurement Systems Analysis as defined in TS16949* (15).	Demonstrate knowledge of, and compliance with, all organisation's policies and procedures applied to own role and function, contributes to development or revision of departmental and/or corporate standards. Operate local processes and adherence monitoring systems, and structure the development or revision of local processes. *E.g., in an automotive industry-based organisation, demonstrate knowledge of application and practices for Measurement Systems Analysis as defined in TS16949* (15) *and define local processes to ensure compliance.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.2.2 Mathematics for Metrology	The fundamental mathematical principles underpinning metrology, the instruments used for measurement, and the analysis of measurement data.	Understand how metrology instruments function and gather data. Understand how to analyse data, and question data analysis of metrological studies. *E.g., understand how metrology instruments work and how data is used for both single and repeated measurements.*	Explain underlying mathematical principles for metrology tasks within their role. Carry out and present mathematical calculations for routine metrology tasks. Understand the importance of the application of the correct statistical processing, analysis methods, manipulation of data using algebra and calculus. *E.g., understand the calculations used to provide data from the metrology instruments used in regular duties and the principles underlying the data analysis contained within their results, e.g., filtering settings in tactile surface scanning.*	Explain underlying mathematical principles for multiple metrology instruments. Carry out and present mathematical calculations for non-routine metrology tasks. Demonstrate the applications in statistical processing, analysis methods, manipulation of data using algebra and calculus. *E.g., understand the calculations used to provide data from multiple metrology instruments and the principles underlying the data analysis contained within their results, e.g., filtering settings in tactile surface scanning.*	Explain underlying mathematical principles for multiple metrology instruments. Formulate mathematical calculations for complex metrology tasks. Specify analysis methodologies and instrument settings for complex measurements not previously undertaken by the measurement facility. *E.g., understand the calculations used to provide data from multiple metrology instruments and the principles underlying the data analysis contained within their results, e.g., filtering settings in tactile surface scanning. Give guidance to Level 1 and 2 practitioners.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.2.3 Physical Principles of Measurement	The fundamental scientific principles underpinning metrology and the instruments used for measurement, traceability and the definition of the SI units.	Describe how metrology instruments function and gather data in simple terms. *E.g., recall basic principles of instrument operation and reporting, e.g., a tactile surface finish instrument draws a stylus across the surface and monitors its displacement before calculating the required parameters.*	Explain operating principles and SI units underpinning metrology instruments used as part of role. *E.g., summarise detailed operating principles, major sources of uncertainty and data reporting of instruments routinely used, e.g., filtering parameters for tactile surface finish measurement, influence of temperature and surface finish parameter calculations.*	Explain operating principles and SI units underpinning multiple metrology instruments within function. Contribute to the generation of uncertainty budgets by identifying influencing factors. *E.g., as Level 1 for multiple instruments used routinely within their function with broader range of uncertainty factors.*	Originates material to explain how the operating principles underpinning instruments used within function and traceability, route back to National Metrology Institutes. Use knowledge of scientific principles in producing good measurement practice guides and uncertainty budgets. *E.g., compiles training material for local use to promote understanding including instrument operation and detailed uncertainty calculations.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.2.4 Data Analysis	The science and theory of analysis methods applied to measured data to create valid results in engineering units, quantify and cascade sources of uncertainty, interpret results, and solve engineering problems.	Identify common analysis methods and explore results. Understand sampling methods and the influence of bias in data. Observe data collection, question results and consider implications of analysis. *E.g., act as an informed customer of the measurement process, review data with sufficient confidence to identify obvious errors.*	Describe different types of analysis methods. Explain sampling techniques, the influence of bias in data and the need for appropriate data coverage. Conduct routine data collection and analysis using manual and software-based systems. Explain and present measurement results and analysis findings for routine processes. *E.g., skills and knowledge necessary to provide insight into measurement results from routine measurement operations. Typical analysis methods include regression analysis, Control Charts etc., with operators able to conduct both manual and software-based data collection and analysis.*	Explain and conduct common types of analysis methods used for engineering applications. Explain and conduct signal processing techniques for time and frequency domain analysis. Construct simple analysis programs using commercial software. Evaluate and summarise measurement results and analysis findings for complex systems. *E.g., skills and knowledge to derive insight into complex measurement operations and communicate to a non-technical audience.*	Operate as functional leading authority on analysis methods. Explain and conduct common and specialised analysis methods used for engineering applications. Formulate signal processing techniques for complex systems. Construct complex analysis programs using commercial or bespoke software. Evaluate and summarise measurement results and analysis findings for complex, multi-process systems. *E.g., formulate robust analysis methodologies for measurements from complex systems. Acts as functional expert to determine analysis methods and technologies.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.2.5 Design of Experiments	Rigorous application of Design of Experiments toolset to ensure that an experiment delivers a required outcome effectively and efficiently.	Describe Design of Experiments. *E.g., understands the principles of Design of Experiments, when to apply, and the benefits of a structured approach to solving problems.*	Explain standard approaches to experiment design and conduct simple experiments under supervision. *E.g., basic working knowledge of common Design of Experiments techniques, e.g., Taguchi, and able to set up a study with 3-5 variables.*	Compare and organise a range of experiment design methods, for non-trivial applications. Conduct analysis for simple and non-trivial experiments. *E.g., detailed knowledge of techniques and able to run studies across complex systems with 5-10 variables.*	Plan and execute a range of methods for complex experiments and experimental programmes. Critically evaluate and approve study designs. Conduct analysis for complex experiments and present results. *E.g., able to design and run experimental studies with 10+ variables in complex multi-stage processes.*
NMSA-1.2.6 Quality Systems and Tools	Application of analytical and experimental tools to identify root causes of issues and resolve problems identified with metrology processes and operations.	Describe common quality tools and express confidence in analysis and problem solving. *E.g., commonly used tools such as '5-Whys?', Pareto analysis, Basic chart methods and analysis.*	Conduct problem identification, analysis and resolution actions for single process issues. *E.g., able to use common problem resolution tools and to develop action plans to identify and implement robust solutions.*	Conduct problem identification, analysis and resolution actions for multiple process issues. *E.g., able to use wide range of tools and apply to more complex issues.*	Plan and execute problem identification, analysis and resolution actions on complex issues across multiple processes / systems. *E.g., acts to identify root causes and introduce resolution actions for complex issues.*

NMSA-1.3 Measurement Requirements and Planning

Defining the requirements for the measurement to be conducted and planning how it will be achieved.

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.3.1 Requirements Capture and Definition	Analyses the engineering design for a new product and defines a measurement plan that evaluates product, process or service conformity throughout the lifecycle.	Describe the need for measurement planning and why the task must be completed before the end of the product, process or service design process. *E.g., understands that Measurement Planning is an integral part of developing new products, processes and services, from first prototypes through to end of life.*	Provide input from the metrology function in planning meetings and choose technical requirements for metrology. Identify potential product verification methods throughout product, process or service lifecycle. *E.g., provides technical input on feasibility of routinely validating product features and able to support with analysis of measurement process capability.*	Choose metrological requirements for verifying and reporting product, process or service functional performance. Construct and organise plans for verification considering uncertainty, cost and throughput requirements. *E.g., provides technical and commercial input to measurement planning discussions. Plan and execute analysis of measurement process performance.*	Evaluate and authorise measurement planning document meets organisational and product, process or service functional requirements. Empowered to authorise verification plans. Formulate and construct new technical solutions to achieve capability, cost and throughput requirements. Authorised to act as arbiter to ensure the completion of measurement definition. *E.g., acts as functional authority in the measurement planning process, approves proposed metrology planning and validation schemes.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.3.2 Design for Measurement	Ability to influence product, process and service design through allocation of realistic tolerances and technically feasible methods of verification.	Recall Design for Measurement (DfM) requirements for functional acceptance limits to deliver measurement planning. *E.g., understands the importance of robust data from measurement of similar, existing products, processes or services in providing insight into realistic and achievable tolerances for features.*	Make technical contributions to DfM discussions and supply robust data from existing similar product, processes and service. *E.g., provides data and insight from measurement of existing products, processes or services to the tolerance setting process.*	Organise detailed technical DfM discussions based on metrological requirements to realise design intent. *E.g., leads metrology aspects for setting tolerances for new products not previously manufactured by the organisation or from complex / multi-stage manufacturing processes.*	Organise complex technical DfM discussions with multiple engineering specialisms, including identification of novel metrology solutions to resolve issues. *E.g., leads discussions for organisation where new product features or manufacturing processes require the introduction of novel metrology into the organisation.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.3.3 Determination of Measurement Methods	Ability to implement a measurement plan that provides the best balance between cost, quality, delivery etc. for the organisation.	Describe measurement plan utilising existing facilities, equipment and software. Explain introduction of new measurement equipment to meet measurement plan demands. Participate in definition and procurement of new facilities, equipment and software to deliver the measurement plan. *E.g., supports the roll-out of the measurement plan into the organisation, including commercial and management implications.*	Construct measurement solution and data analysis based on existing facilities, equipment and software under supervision. Construct measurement plan and data analysis utilising new facilities, equipment and software based on current metrology technologies. Contribute to solution definition and evaluation of new equipment and software. *E.g., contributes to the detailed measurement requirements for product verification utilising existing metrology instruments and facilities.*	Organise requirements to deliver measurement plan using existing facilities, equipment and software. Complete requirements to deliver measurement plan using new facilities, equipment and software based on current metrology technologies. Investigate and identify potential new equipment and software, conduct evaluation exercises and lead selection and implementation processes for commercially available technologies / products. *E.g., defines the detailed measurement requirements for product verification utilising existing metrology facilities, equipment and software. Develops plans for measurement requirements where new instruments / facilities are required and conducts metrology aspects of procurement for new, commercially available equipment.*	Formulate measurement plan requirements for existing facilities, equipment and software whilst balancing workload demands. Formulate plan and deliver project to implement new facilities, equipment and software required for measurement plan. Investigate and identify potential new equipment and software, conduct evaluation exercises and lead selection and implementation processes. Influence the development of experimental / new products and technologies. *E.g., authorises the detailed measurement requirements for product verification utilising existing metrology facilities, equipment and software. Develops plans for measurement requirements where novel instruments / facilities are required and conducts metrology aspects of procurement. Liaises with metrology vendors and research institutes to influence the development of new metrology instruments.*

NMSA-1.4 Realisation of the Measurement System

Creating a measurement system to achieve the defined measurement requirements.

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.4.1 Machine / Equipment	Able to apply an understanding of instrument / equipment sensing and transduction mechanisms, their strengths, limitations, performance and vulnerabilities to select the best method and equipment to address a given measurement problem.	Describe the importance of selecting the correct technology, including the impacts of utilising incapable or sub-par solutions. Describe several commonly used types of technologies including typical use cases. *E.g., understands that different measurement technologies have different accuracies and benefits. Describe typical measurement technologies in use in their industry.*	Describe the different types of measurement equipment available for the discipline, their working principles and key features of their specification. Describe sources of error that can affect the equipment. Explain a verification process for the equipment. Compare different types of sensor system and recall their strengths and weaknesses. Demonstrate industry standard terminology to specify a sensor system. Perform predefined sensor performance test and compare results to expected boundaries. *E.g., fully conversant with the technology of the equipment / instrument(s) they regularly operate and complete measurement tasks with appropriate uncertainty levels for the measurand.*	Identify appropriate measurement equipment for the discipline for common tasks. Define sensor and measurement system specifications. Define validation programmes for simple sensors and measurement systems. Specify, analyse and validate sensor systems for control and monitoring. Contribute to specification statements used in procurement of new measurement equipment. *E.g., makes equipment / instrument selection decisions to routinely evaluate product features to appropriate uncertainty.*	Authorise the use of identified measurement equipment and sensor systems. Provide advice and guidance to projects. Define, analyse, and validate complex sensor / measurement systems in demanding applications. Define / authorise organisation strategies for sensor systems. Evaluate non-standard situations (e.g., marginal results etc.), make and justify the appropriate decision. Authorise specification statements used in procurement of new measurement equipment. *E.g., acts as functional expert to ensure product features can be routinely measured to the required uncertainty and ensures evaluation and analysis is undertaken before commencement of routine measurement activities.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.4.2 Method	Definition, implementation and regular review of measurement procedures and the associated acceptance levels within an organisation and the alignment of these procedures to the relevant standards.	Describe the importance of defining and standardising the correct procedures, including the impacts of uncontrolled processes. *E.g., expresses confidence in activities used to ensure routine measurement is consistently undertaken and analysed.*	Describe how to ensure the validity of a measurement procedure, Standard Operating Instructions (SOI) or similar documentation. Describe any pre-checks to be performed for specific equipment. *E.g., undertakes necessary preparation and evaluation activities to ensure consistency of measurement and reporting for routine tasks.*	Recall standards relevant to instrumentation and incorporate into measurement procedures. Define measurement procedures (SOIs) in line with organisational standards. Verify the existing procedures suitable for review. Investigate and identify process improvements, with process documentation updated as appropriate. Organise the procedures to ensure effective operations and process compliance. Routinely analyse procedure effectiveness by evaluation of data. *E.g., drafts and reviews measurement procedures and standards to ensure continued consistency and adherence to local and international quality standards.*	Create and maintain procedures in line with organisation's policies and industry standards. Approve new measurement procedures and amendments to existing procedures following review or update. Evaluate non-standard methods, amend, approve or reject, and justify the decision. Comprehensively explain the alignment of an organisation's procedures and acceptance levels with relevant standards to other colleagues including company directors and / or senior management. *E.g., establishes and acts as authoriser for measurement procedures and standards to ensure compliance with organisational and international standards.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.4.3 People	The level of competency required to carry out specified metrology tasks within an organisation and the assessment and review of these competency levels within the metrology-related functions of the organisation.	Describe the importance of identifying individuals who are suitably qualified and experienced, including the impacts of non-competent staff carrying out measurements. *E.g., supports continuous professional development for metrology staff and questions competency levels to ensure optimal service from the metrology function.*	Demonstrates active participation in personal continuous professional development for self within the metrology-related functions. *E.g., regularly reviews personal skills against the requirements for the role and identifies personal technical development goals.*	Organise the individuals to ensure the effective operation of procedures. Carry out validation assessments in accordance with the defined procedures and communicates technical issues or subjects. Review assessment results and assess against the defined procedures. *E.g., ensures procedures are followed and updated as operational learning evolves.*	Create procedures for the ongoing management of individuals in compliance with relevant standards. Evaluate non-standard situations and determine the competencies required, justifying the decision. Evaluate the roles within an organisation against metrology framework and determining the level of competency required. *E.g., management tools can include Skills Matrix and scheduling assessments. Drives procedures and competencies against requirements and leads development activities within the organisation.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.4.4 Preparation for Measurement	The procedures associated with varying materials, manufacturing and supply methods and condition of supply within an organisation and how they impact the metrological activities.	Describe the impacts various materials, manufacturing and supply methods and condition of supply may have on the metrology activity. *E.g., understands the material properties and processing / handling considerations for materials commonly used within the organisation.*	Describe how to ensure the correct precautions and preparations for the measurand are applied. Carry out specified tasks in relation to measurand preparation. Identify opportunities for process improvements within own work. *E.g., follows procedures for safe and correct use of materials within metrology operations.*	Organise the material control systems to ensure the effective operation of measurement procedures. Carry out material validation assessments in accordance with the defined measurement procedures. Define material preparation procedures / Standard Operating Instructions (SOI). Investigate and identify opportunities for process improvements. *E.g., ensures procedures are adhered to.*	Approve measurand preparation and verification procedures. Evaluate and authorise non-standard preparation materials and processes. Evaluate the preparation materials being utilised from a metrology perspective and identify improvements. *E.g., acts as expert regarding the application and use of materials within the metrology function. Ensures standards and procedures are compliant with corporate standards and national / international standards and legislation.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.4.5 Environment	The environmental impacts and controls on metrology procedures taking place within an organisation and the alignment of these controls to relevant standards.	Describe the impacts of environmental variations on a measurement systems and list environmental controls that may be implemented to mitigate the error as result. *E.g., questions potential influence of environment for adverse results and understands environmental influences such as coefficient of thermal expansion (CTE) for commonly used materials and the need for environmental controls within metrology facilities.*	Understand the effect of variation in environmental conditions for their individual duties. Describe how to ensure the correct environmental conditions appropriate to their individual duties. Carry out specified tasks in relation to recording environmental conditions. *E.g., recognises the influence of local environmental conditions during measurement, monitors during measurement tasks and takes environmental factors into consideration when analysing measurement results.*	Analyse the operation of environmental sensors and procedures by evaluating data, identifying and responding to improvement opportunities (e.g., calibration frequencies). Define the environmental requirements for specific tasks and associated controls to be implemented. *E.g., maintains performance and results of local environmental monitoring systems and highlights environmental influences on development of new measurement tasks.*	Specify and approve the environmental conditions and requirements. Approve the control measures to be implemented for a measurement system. Create procedures for the ongoing management of environmental controls (e.g., verification and validation, equipment registers, audit, failure reporting etc.) in compliance with relevant standards. Evaluate non-standard situations (e.g., temperature fluctuations, vibration etc.), make and justify the appropriate decisions concerning mitigation of effects on measurements. *E.g., acts as expert in establishing and maintaining environmental conditions and controls, evaluates influence of environmental conditions on routine and non-routine measurement and acts as authoriser for measurement taken outside of standard operating conditions.*

NMSA-1.5 Measurement Systems Analysis (MSA)

Demonstrating that the measurement system meets the defined requirements and is capable of providing a reliable measurement result.

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.5.1 Selecting the Appropriate Analysis Tool	Choice of a suitable analysis tool(s) to give the required level of confidence for the chosen application.	Consider MSA tools and give examples of how MSA impacts on the scope of their function within the organisation. (e.g., Design Engineer, Senior Manager etc.). *E.g., should understand the measurement systems with a poor MSA may yield results that are not reliable. Should understand the impact this poor data may have on the decisions made using the data.*	Describe the MSA tools used on the instruments they routinely operate within their function and how and why they are conducted. *E.g., should be able to describe which tools they use when participating in MSA studies.*	Evaluate and select appropriate analysis tool based on defined procedures. Construct specific process for conducting measurement studies. *E.g., should be setting up MSA studies based on pre-defined parameters such as the number of repeat measurements, numbers of samples etc..*	Create and maintain procedures for MSA in line with organisation's policies and industry standards. Design MSA studies specific to a situation. *E.g., will be responsible for creating the procedures that a Level 1 and Level 2 would apply and also assisting in situations where there is ambiguity and the MSA study would need to be designed specifically for the situation.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.5.2 Conducting the Study and Analysing Results	Execute the chosen MSA study method and undertake and report analysis.	Consider MSA tools and give examples of how MSA impacts on the scope of their function within the organisation. (e.g., Design Engineer, Senior Manager etc.). *E.g., should understand the measurement systems with a poor MSA may yield results that are not reliable. Should understand the impact this poor data may have on the decisions made using the data.*	Carry out measurements to support the analysis in accordance with the defined process. *E.g., participate in an MSA study and conduct measurements in line with the process.*	Conduct analysis in line with the defined MSA procedures and generate MSA reports. *E.g., may analyse the measurement results from a MSA study with defined tools and processes to generate MSA reports.*	Apply non-standard analysis tools and justify their use. Critically evaluate the quality of MSA studies, methods and outputs, and update procedures if required. *E.g., where the situation does not fit a standard study type the Level 3 would be able to design an analysis that is appropriate and should be able to describe why the approach is acceptable.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.5.3 Measurement System Acceptance	Evaluate a measurement system and approve it for a specific task.	Consider MSA tools and give examples of how MSA impacts on the scope of their function within the organisation. (e.g., Design Engineer, Senior Manager etc.). *E.g., should understand the measurement systems with a poor MSA may yield results that are not reliable. Should understand the impact this poor data may have on the decisions made using the data.*	Understands acceptance limits for studies conducted in their normal operations. Identify and report potential improvements for failed studies. *E.g., will be able to explain acceptance limits for routine MSA studies within organisational standards. Identification of obvious issues for gross failures of MSA studies that the individual has conducted.*	Review MSA study reports and assess and disposition against the defined procedures. Identify areas of improvement following data analysis of MSA studies. *E.g., will be able to sentence an MSA as accept or reject against standard, clear pass/fail criteria. Can make recommendations for improvements based on reviewing MSA study data such as distinctive difference in results from one individual operator.*	Evaluate non-standard situations (e.g., marginal results, non-standard analysis techniques etc.), make and justify the appropriate decision. Identify and report potential improvements for complex studies that do not meet the organisation's approval criteria. *E.g., will be able to make decisions on accepting or rejecting the MSA where the situation requires a more complex analysis and/or does not fit a standard process. This could include where results are marginal, and the wider purpose of the measurement system has to be considered when making a decision.*

NMSA-1.6 Measurement Operations and Reporting

Operating the measurement system and maintaining its performance over time, including independently assuring this performance.

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.6.1 Conduct Measurement in a Structured Manner	Processes and procedures to maintain consistency of measurement operations over time including regular operations as well as independent assurance activities.	Describe the importance of following defined processes and procedures when performing measurements. *E.g., should be aware that measurements are subject to many different sources of variation (e.g., temperature, people, etc.) and therefore controlling these by following procedures in operation is important.*	Follow defined procedures to operate the measurement system and the associated controls. Identify measurement errors out-of-control situations and react in accordance with the defined procedures. *E.g., should be aware of and able to follow the relevant procedures to control measurement in their area (e.g., standard procedures for cleanliness, environmental control etc.).*	Support colleagues with judgements in marginal situations within the scope of the defined process and procedures. Diagnose measurement errors and resolve in line with defined process and procedures. Carry-out appropriate assurance activities in accordance with a defined plan. *E.g., should be involved in assurance activity such as informal audit / process-confirmation checks as well as support formal audit of their area.*	Create procedures and processes to maintain the operational consistency of the measurement system. Diagnose measurement errors and create procedures and processes that address the errors and prevent re-occurrence. Plan and carry-out appropriate assurance activities to detect issues and opportunities for improvement. *E.g., a Level 3 will be the "Measurement Authority" in their area and be accountable for defining how measurement is carried out and will be a point of contact for making decisions in more complex and / or non-standard situations.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.6.2 Analysis and Reporting of Measurement Data	The analysis, interpretation and communication of measurement data in line with the measurement requirement.	Explain the meaning of measurement results relevant to their role and the limitations of use of the data. *E.g., someone who uses measurement data in their role can interpret the measurement data appropriately and identify any limitations of use, e.g., a design engineer may use measurement results and a measurement uncertainty figure from a test to support design verification and validation work. Should be aware of the impact of measurement uncertainty on this activity.*	Follow the defined measurement reporting procedure and interpret measurement data within the boundaries of the defined procedure. Provide analysis and insight to potential causes of error for adverse results. *E.g., reporting should largely be simple and following a defined method. However, could be some level of interpretation required against a clearly defined standard (e.g., "shape" of a blend region between two radii against a defined acceptance standard, good and bad shapes).*	Support colleagues with judgements and insight in marginal situations within the scope of the defined process and procedures. Support the creation of new measurement reporting process and procedures, typically by modifying existing. *E.g., would often be providing coaching and support to less experienced colleagues, particularly where a level of ambiguity exists, or a complex skill is required. Could be responsible for creating new measurement procedures that are similar to existing.*	Create and approve procedures and processes to analyse, interpret and report measurement data. *E.g., a Level 3 will be the "Measurement Authority" in their area and be accountable for defining how measurement is carried out and will be a point of contact for making decisions in more complex and / or non-standard situations.*

Category	Description	Foundation	Level 1	Level 2	Level 3
NMSA-1.6.3 Decision Rules in Using the Measurement Result	Taking action based on the measurement data and analysis.	N/A at Foundation Level *E.g., could be taking action based on measurement results within the scope and accountabilities of their role but activity such as conformance assessment is beyond the scope of an individual operating at Foundation Level.*	Classify the measurement result in accordance with the defined specification. *E.g., will be conducting measurements and classifying the results as pass / fail. Could include activity such as production inspection, calibration, conformity assessment etc. Will always be a clear classification against a defined set of criteria.*	Classify the measurement result in accordance with the defined specification. Understands the concept of Producer and Consumer Risk and makes allowance for decision rules in the creation of measurement process instructions. *E.g., can provide recommendations for improvement or re-measurement for marginal results.*	Develops process and procedures for making appropriate decisions based on measurement data. Supports colleagues in assessing marginal situations and formulating an appropriate course of action with reference to organisation and international standards with regards to decision making rules. *E.g., will be the "Measurement Authority" in their area and be accountable for defining how measurement is carried out and will be a point of contact for making decisions in more complex and / or non-standard situations.*

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9 Version History

Version	Reason for Issue	Date
1.0	First Issue	20/12/2023