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Development of Metrology in the Small Island Developing State of Saint Lucia

Metrology for the people: How a small island state built metrology infrastructure from its foundation and embedded a knowledge of “metrology and metrication” throughout its culture

Saint Lucia Bureau of Standards (SLBS)
Saint Lucia (LC)



The Challenge

The island-wide survey of the accuracy of fuel dispensers, conducted by the Saint Lucia Bureau of Standards (SLBS) in 1996, revealed that consumers and motorists were not getting value for money during their fuel purchases due to archaic legislation, the Weights and Measures Ordinance, which was passed in 1911 when Saint Lucia was a British colony. A comprehensive survey of the accuracy of fuel dispensers was conducted using a calibrated 5 UK-gallon handheld test measure. Several dispensers were found to exceed the 0.5 % tolerance stipulated in the draft National Metrology Act, and the fuel dispenser adjustment mechanisms at independent fuel filling stations were found to be unsealed, which could facilitate fraudulent transactions.

In 1996, Saint Lucia hosted a Caribbean Metrology and Metrication Seminar, and all CARICOM member states were represented. This seminar was funded by the Department of Economic and Social Affairs of the Organization of American States (OAS). The seminar sought to raise the profile of metrology in the Caribbean and to promote the adoption of the International System of Units in the region. The press release about this metrology seminar was sent to print and electronic media in Saint Lucia. One local newspaper edited the word “metrology” to “meteorology” and published our press release under the caption “*Weathermen to Adopt New Standards*”!

The situation pointed to the need for modern metrology legislation and a new legal metrology regime. It should be noted that the 1911 Weights and Measures Ordinance made no reference to fuel dispensers and did not specify tolerances for these measuring instruments. The law hailed weights and measures inspectors (who were law enforcement officers) who imposed fines on weighing and measuring instruments found to be “unjust,” a highly subjective term, as tolerances for these instruments were not specified in the archaic legislation. There was no fairness in trade on the island from the consumer's perspective. There was a need to close this significant regulatory gap.

Further, the legal system of measurement in Saint Lucia prior to 2000 was based on the British Imperial system. It would have been difficult for the island to transition to the International System of Units (SI), commonly known as the metric system, when the main measurement law made no reference to it. Notably, the school curriculum in Saint Lucia had been metricated 20 years earlier (in 1980), and all students in infant, primary, and secondary schools were introduced to the metric system of measurement. However, there was little to no reinforcement of the metric concepts learned, as market traders and the commercial

sector continued to use British (UK) units of measurement. This, coupled with the lack of regulation of the retail petroleum sector to ensure motorists received fair value for money at the petrol stations, pointed to the need for a new regulatory framework for legal-for-trade measurements and the corresponding measuring instruments in Saint Lucia.

The Solution

Following a change of government in Saint Lucia in 1997, the SLBS, which was established as the national standards body (NSB) in 1991, was tasked with playing a greater role in national development. A brief on the proposed Metrology Bill was prepared for consideration by the Minister of Commerce in 1999. The Metrology Bill was based on Grenada's National Metrology Act, shared by the Grenada Bureau of Standards (GDBS). This brief provided justification for promulgating a Metrology Act. The following year, a summary of the Metrology Bill was prepared for Saint Lucia's Ministry of Legal Affairs, which served as the basis for a Memorandum to the Cabinet of Ministers on the Metrology Bill.

The objects of the Bill were:

- a) to establish a comprehensive regulatory mechanism for weights and measures;
- b) to discourage fraudulent practices when measuring instruments (for example, scales and gas pumps) are used in trade;
- c) to facilitate the trade at local, regional, and international levels of products whose commercial value is based on measurement;
- d) to allow for the phased implementation of the metric system of measurement as the legal measurement system in Saint Lucia;
- e) to authorize the Saint Lucia Bureau of Standards (SLBS) to take responsibility for the management of the National Metrology System, a role traditionally held by the Royal St. Lucia Police Force.

The modern Metrology Act No. 17 of 2000 was enacted in September 2000, followed in 2001 by the Metrology Regulations (Statutory Instrument 113 of 2001). The archaic 1911 Weights and Measures Ordinance was thus repealed. As derived from the OIML Document D 19:1988 *Pattern evaluation and pattern approval*, a series of OIML Recommendations (R 35 *Material measures of length for general use*, R 76-1 *Non-automatic weighing instruments*, R 79 *Labeling requirements for prepackages*, R 87 *Quantity of product in prepackages*, R 111 *Weights of classes E_1 , E_2 , F_1 , F_2 , M_1 , M_{1-2} , M_2 , M_{2-3} and M_3* , R 117 *Dynamic measuring systems for liquids other than water* and R 120 *Standard capacity measures for testing measuring systems for liquids other than water*), the Metrology Act, Metrology Regulations, and Metrology (Fees) Regulations were consolidated under the Metrology Act Chapter 13:18, which mandated the SLBS to provide type/pattern approval and verification of weighing and measuring instruments in trade, public health, postal services, sale of electricity and water, industry, engineering, or any other field.

As an illustrative example, in 2001, the SLBS verified a mechanical weighbridge at an agro-processing factory in a town near the western coastline of Saint Lucia. The company purchased copra from farmers and processed it into coconut oil for local consumption and for export. The verification was conducted in compliance with Saint Lucia's Metrology Regulations and OIML Recommendation R 76-1 (see **Figure 1**). This was the first time the SLBS had conducted a verification for this company; in previous decades, verifications were conducted by law enforcement. The results of the verification exercise revealed (**Table 1**) that as the applied load on the weighbridge increased, the errors increased significantly and exceeded all applicable maximum permissible errors (MPEs).

Unfortunately, there was a long history of financial difficulties at this factory. The mechanical weighbridge was obsolete and could not be repaired or adjusted, so the company purchased and installed a digital weighbridge. It was also unfortunate that the SLBS detected the inaccurate measurement after the problems had already become a major issue; the factory subsequently closed, and scores of people in the small town lost their jobs.

A Quantifiable Impact

Over nearly 30 years, Saint Lucia's progress in metrology has been driven by the application of good governance principles and sustained investment in time, personnel, equipment, and infrastructure. This has ensured that metrology, as a pillar of Quality Infrastructure, remains relevant to the sustainable development of its national economy and underpins its commercial enterprises and industrial functions, serving the prosperity of its entire population.

The SLBS, as of September 2000, officially became the National Legal Metrology Institute with responsibility for legal metrology. In 2002, verification of fuel dispensers under the Metrology Act 2000 and the supporting Metrology Regulations No. 113 of 2001 commenced. For the first time, rejection stickers were affixed to dispensers that did not meet the requirements of the Metrology Regulations. Importantly, Saint Lucia's Metrology Act, Chapter 13.18, which governs weights and measures, has served as a template for developing metrology legislation for English-speaking Caribbean countries. Acting on the advice of the SLBS, in 2005, Cabinet Conclusion 171/2005 allowed for the establishment of a Metrication Board to coordinate St. Lucia's transition to the metric system. At the same time, Saint Lucia, represented by the SLBS, became a signatory to the CIPM MRA in 2005 through CARICOM/CROSQ.



Figure 1. An illustration of an inaccurate mechanical weighbridge.

Table 1. The results of the mechanical weighbridge verification indicate that the error increases with applied load.

Applied Load (kg)	Indicated Mass (kg)	Error (kg)	MPE (kg)
0	0	0	2
2 500	2 672	+172	4
5 000	5 334	+334	6
7 500	8 027	+527	6
10 000	10 567	+567	6

Following several years of developing its legal metrology program and implementing weights and measures applications across commercial sectors, Saint Lucia, represented by the Metrology Department of the SLBS, was the first Caribbean country to win the prestigious OIML Award for Excellent Achievements in Legal Metrology in Developing Countries in 2015. To date, Saint Lucia is the smallest country in the world to receive this award. Further, in 2020, the Metrology Laboratory of the SLBS was the first calibration laboratory in the English-speaking Organization of Eastern Caribbean States (OECS) countries to receive ISO/IEC 17025:2017 accreditation. It was also the first calibration laboratory to be accredited by the Jamaica National Agency for Accreditation (JANAAC), and the SLBS was instrumental in extending JANAAC's signatory status under the ILAC (now GAC) MRA to include the accreditation of calibration labs in accordance with ISO/IEC 17025.

Legal metrology personnel from the SLBS visited a packaging business in Saint Lucia in June 2018 to conduct a verification of a digital non-automatic weighing instrument. The legal metrology inspectors observed that this weighing instrument, manufactured in Australia, bore an information plate bearing the Measurement Canada AM-5404 approval mark (see **Figure 2**). However, when SLBS downloaded the AM-5404 Notice of Approval, it was noted that the approval was not for the particular model encountered at the business place. Further, the information plate bore the name of a manufacturer that did not match the manufacturer listed on the Canadian type approval certificate. The information plate also had an Industry Canada initial examination mark. At this point, SLBS reached out to our counterparts at Measurement Canada to investigate if an unknown entity had fabricated a forged information plate. The Measurement Canada official theorized that the weighing instrument, manufactured in Australia, was sold online in Canada. The Canadian owner attempted to have it examined for trade, but could not because it is not approved for trade. Therefore, the owner resold it online to a customer in Saint Lucia, using a forged information plate to make it appear to be approved for trade in Canada. The official from Measurement Canada was appreciative of the time the SLBS spent in bringing this potential fraud scheme to their attention.

This incident highlighted how conformity assessment procedures and international cooperation among national legal metrology bodies that utilize OIML publications can thwart potential fraud schemes involving the use of weighing instruments in commercial transactions, and served as validation of our procedure for establishing proof of pattern/type approval as a prerequisite for verification. An article on legal metrology compliance was published in the October 2023 edition of the OIML Bulletin based on this June 2018 incident.¹ This work documented the collaboration between the SLBS and Measurement Canada in investigating this matter and served as a great example of legal metrology compliance and enforcement collaboration between Saint Lucia and Canada.

¹ Gittens, A. International cooperation to detect forged information plates and approval marks. OIML Bulletin. Volume LXIV. October 2023.



Figure 2. A weighing instrument manufactured in Australia with a Measurement Canada approval mark as an apparent forged information plate.

Saint Lucia, represented by its Ministry of Health, Wellness and Nutrition, actively participates in the Pan American Health Organization (PAHO) HEARTS in the Americas initiative. HEARTS will be the institutionalized model of care for cardiovascular risk management, with special emphasis on the control of hypertension and secondary prevention in primary health care in the Americas by 2027. The SLBS provides a verification service for clinically validated digital upper arm blood pressure monitoring devices (BPMs) using test procedures given in OIML International Recommendation R 149-2:2020 *Non-invasive automated sphygmomanometers*. Competence in the verification of sphygmomanometers was developed after personnel from the Metrology Department of the SLBS attended sphygmomanometer training courses organized by SIM's Legal Metrology Working Group, MWG 11. The World Health Organization (WHO) technical document "Technical Specifications for Pre-Market Assessment of Blood Pressure Measuring Device with Cuff Automated and Semi-Automated" was published in October 2023 with SLBS cited as a contributor. In Saint Lucia, approximately 40 % (2 out of 5) of adults aged 18 to 69 have hypertension or high blood pressure, and precise measurement of blood pressure is vital for accurate diagnosis, management, and control of hypertension. Robust clinical evidence underscores the necessity of using clinically validated blood pressure

measuring devices, but unfortunately, 80 % of the blood pressure monitors used worldwide lack clinical validation. Non-validated BPMDs can produce inaccurate readings, leading to misdiagnosis and improper patient management. Given the mandate of the SLBS under the Metrology Act for pattern/type approval of measuring instruments used in the field of public health and competence in the verification of BPMDs, the Ministry of Health has sought the assistance of the SLBS in establishing a regulatory framework for the exclusive procurement and importation of clinically validated, accuracy-certified BPMDs in Saint Lucia.

In 2022, Saint Lucia became the first OECS country to host a SIM Annual General Assembly. The Inter-American Metrology System (SIM) is the regional metrology organization of the Americas. In 2022, Saint Lucia, represented by the SLBS, was the first OECS country to become a Corresponding Member of the OIML. In 2023, the National Agricultural Diagnostic Facility (NADF) became the first Designated Institute (DI) from Saint Lucia and CARIMET under SIM. The NADF is owned by Saint Lucia's Ministry of Agriculture, Fisheries, Food Security and Climate Change and houses veterinary, plant research and food technology laboratories. The construction and equipping of the Facility was funded by the European Union under the Agricultural Transformation Programme/Banana Accompanying Measures (ATP/BAM) initiative. The Metrology Laboratory of the SLBS, which relocated to the NADF in 2021, has received its accreditation from JANAAC Global Accreditation, to ISO/IEC 17025:2017 requirements in the areas of mass and volume, effective 17th June 2026. The Metrology Laboratory is the first accredited laboratory at NADF.

At present, the SLBS continues to support the Government and people of Saint Lucia in the application of legal requirements for measurements and measuring instruments and, as a statutory body (quasi-governmental agency), operates on a cost-recovery basis, charging minimal fees for calibration and verification services. The Saint Lucia Forensic Science Laboratory has recently attested that they have greatly benefited from the services that SLBS Metrology Unit has provided, such that:

"the verification and calibration of our laboratory's non-automatic weighing instruments [by SLBS]... gives us confidence that our instruments are performing accurately and consistently. The service supports our ISO/IEC 17025 quality requirements, strengthens confidence in our analytical results, and ultimately contributes to the integrity of forensic science and law enforcement in Saint Lucia."

Furthermore, the SLBS is an active member of the Inter-American Metrology System (SIM) and participates in SIM Comparisons, which are registered in the BIPM's Key Comparison Database (KCDB). This database provides the technical basis for broader agreements in international trade, commerce, and regulatory affairs. Approved final reports for SIM/CARIMET/CARICOM Supplementary Comparisons in mass and volume are available on the KCDB under the identifiers SIM.M.M-S7 and SIM.M.FF-S13, respectively. The results of these comparisons demonstrated Saint Lucia's technical competence in mass and volume calibrations and will be used to support future entries of Calibration and Measurement Capabilities (CMCs) on the

KCDB. The SLBS also participated in the SIM.M.M-S19 and SIM.M.M-S21 comparisons in mass and related quantities, which are both at the Draft B stage. The SLBS provides calibration services for laboratory balances (non-automatic weighing instruments) utilized at accredited governmental and private sector laboratories on the island, and our participation in SIM comparisons, coupled with being a signatory to the CIPM MRA, has been accepted as demonstrating metrological traceability to the International System of Units (SI) by the accreditation bodies.

Going forward, the SLBS plans to provide a verification service for Electric Vehicle Supply Equipment (EVSE) that has been type-approved. SLBS will accept type approvals to OIML G 22 (when it becomes an OIML Recommendation), European Union (EU), United Kingdom, Measurement Canada, NMI Australia, and NTEP type-approved devices in accordance with NIST Handbook 44. This will support Saint Lucia's transition to electric vehicles (EV) as the preferred form of transportation. Measuring equipment used for the sale of electricity is subject to type/pattern approval, initial verification, in-service/subsequent verification, and verification after repair or modification under Saint Lucia's Metrology Act Chapter 13.18.

POC: Anselm Gittens, a.gittens@slbs.org