

Proposal

Metrology and Calibration Technology

Technical Degree Program

In Partnership with the Metrology Institute



A STRATEGIC CASE FOR A

Metrology and Calibration Technology

TECHNICAL DEGREE PROGRAM

Advancing America's Metrology Workforce

- ✓ High Demand
- ✓ Exceptional Pay
- ✓ Impacts Lives

Presented by:

Ken Racen

Executive Brief: Metrology and Calibration Technology Technical Degree Program

Program Concept

The Metrology and Calibration Technology Technical Degree program at Technical College will equip students with the skills to ensure the accuracy, reliability, and safety of measurement instruments across industries. Aligned with U.S. Bureau of Labor Statistics SOC code 17-3028 and CIP code 15.0303, the program will prepare graduates for careers in aerospace, manufacturing, energy, defense, medical technology, and more.

- **First-in-class program in Missouri and among the few in the nation**
- **Incorporates OSHA safety training, ISO/IEC 17025 compliance, and NIST GUM uncertainty analysis**
- **Prepares students for ASQ Certified Calibration Technician (CCT) certification**
- **Hands-on training with industry-grade calibration equipment, tools, and software**
- **Direct partnerships with OEM suppliers/employers for equipment donations, technical expertise, and internships**

Economic Impact

This program addresses a critical workforce shortage in calibration and metrology, with demand spanning multiple high-wage, high-demand sectors. By producing job-ready graduates, State Tech will support Missouri's advanced manufacturing base, strengthen national security-critical industries, and attract new business investment.

- **Fills skill gap in a nationally recognized shortage occupation**
- **Supports quality and compliance in regulated industries**
- **Expands Missouri's reputation as a leader in technical workforce training**
- **Generates high-wage job opportunities for Missourians**

Workforce Benefits

Graduates will be trained to calibrate, maintain, and certify precision measurement equipment used in Missouri's key industries. Skills are transferable across sectors, ensuring long-term career flexibility and growth.

- **Career pathways in aerospace, defense, energy, manufacturing, and healthcare**
- **Directly complements existing State Tech programs (e.g., Aviation Maintenance, Biomedical Engineering, Electrical Technology, Precision Machining)**
- **Enhances employability with stackable skills supporting interdisciplinary technical roles**

By launching this program, Missouri will solidify its leadership in precision measurement science, address a critical workforce gap, and deliver lasting economic and community benefits.

Introduction

As part of our institution’s ongoing commitment to excellence in workforce development and community advancement, this proposal presents a forward-thinking vision for establishing a Metrology and Calibration Technology Technical Degree program. Developed in response to a comprehensive review of emerging industry demands and educational priorities, the program is intentionally aligned with U.S. Bureau of Labor Statistics occupation code 17-3028 and CIP code 15.0303, ensuring regulatory relevance and national reporting compatibility.

Metrology—the science of measurement—and the discipline of calibration are the unsung pillars of every precision-driven industry, from aerospace and energy to healthcare, advanced manufacturing, and beyond. This program reflects a vital mission: to prepare **students with** cutting-edge, standards-based, and industry-validated skills that are in high demand across sectors critical to economic progress and public safety.

More than a degree pathway, this initiative is a strategic investment in people and potential—equipping the next generation of Metrologists with the tools, knowledge, and confidence to safeguard quality, ensure compliance, and drive innovation at all levels. It affirms our role not just as an educational provider, but as a community anchor and national contributor, dedicated to delivering accessible, high-impact technical training that changes lives, sustains industries, and secures America’s leadership in precision and reliability.

Program Overview

Metrology is the science of measurement, while calibration ensures instrument accuracy. Technicians in this field test, verify, and adjust instruments used in manufacturing, diagnostics, maintenance, and compliance. The discipline supports sectors such as aerospace, automotive, medical, energy, defense, semiconductor, life sciences, and pharmaceutical.



The Metrology and Calibration Technology program prepares students for high-demand careers in precision measurement, calibration, and quality assurance. This two-year program equips graduates with hands-on experience in electrical, mechanical, dimensional, pressure, thermal, force, mass, and DC/low-frequency calibration techniques. The program emphasizes industry standards, including ISO/IEC 17025:2017 and measurement uncertainty based on the NIST Guide to the Expression of Uncertainty in Measurement (GUM).

Metrology and Calibration: A Cross-Disciplinary Foundation

Metrology is the scientific discipline of measurement, and calibration is the practical application that ensures the accuracy of every tool and instrument used in manufacturing, diagnostics, maintenance, and inspection. This field intersects with virtually every technical program currently offered:

- In biomedical engineering and aviation maintenance, regulatory compliance hinges on precise instrumentation validated by trained calibration personnel.
- In automation, robotics, and electrical technology, multimeters, sensors, and process instruments require routine calibration.
- In precision machining and welding, dimensional inspection tools (e.g., calipers, micrometers, CMMs) must meet tight tolerances traceable to SI Units through NIST.
- In HVAC and facilities maintenance, accurate voltage, current wattage, temperature, and pressure measurements are essential.

By integrating a Metrology and Calibration Technology program, you can strengthen the measurement backbone that supports the reliability and safety of all applied technologies across your curriculum.

Market Demand and Workforce Gaps

According to the U.S. Bureau of Labor Statistics (SOC 17-3028) and national industry data, there is a critical and growing shortage of Calibration Technologists and Technicians. This shortage spans aerospace, energy, medical devices, defense, and semiconductor manufacturing—all sectors experiencing heightened regulatory scrutiny and reliance on precision.

Key indicators include:

- Aging workforce and retirements with minimal pipeline replenishment
- Increased employer demand for ASQ Certified Calibration Technicians (CCT)
- Emphasis on ISO/IEC 17025 compliance and uncertainty analysis (NIST GUM), now required in many accredited labs and global supply chains

Offering this program would enable your institution to supply the industry with highly specialized, job-ready professionals, closing a documented skills gap.

Institutional Value and Academic Synergy

Launching a Metrology and Calibration Technology program would:

- Enhance vertical integration with existing programs, enabling interdisciplinary collaboration and cross-training
- Provide a credentialed pathway aligned to CIP 15.0303, supporting federal reporting and financial aid eligibility
- Prepare students for national certification (ASQ CCT), thereby boosting graduate placement rates and alumni reputation
- Create new partnerships with accredited calibration labs, manufacturers, and national metrology institutes, enriching our externship and employer pipeline

This program complements our core mission while enabling faculty collaboration, equipment sharing, and curriculum innovation across departments.

Competitive Differentiator: Elevating Our National Standing

Currently, very few technical colleges in the U.S. offer dedicated training in metrology and calibration. By becoming one of the first to offer a full-fledged Technical Degree program in this field:

- Position the institution as a pioneer in a niche technical discipline with high workforce ROI
- Attract industry attention, federal grant opportunities, and increased employer engagement
- Offer prospective students a unique specialization with direct application to high-tech industries
- Fulfill a national workforce development priority with real, measurable impact

Offering a Metrology and Calibration Technology technical degree demonstrates your strategic foresight and leadership in equipping tomorrow's workforce with essential precision skills.

By advancing the development of a Metrology and Calibration Technology program aligned with CIP 15.0303 and SOC 17-3028, your institution reaffirms its legacy of excellence in technical education and its pivotal role in strengthening America's industrial workforce. This program is more than timely; it is a strategic investment in the future of precision, safety, and innovation across sectors that define national progress and defense. As a recognized leader among trade schools, the commitment to launching high-impact, industry-aligned programs ensures the institution remains a trusted partner to employers, a catalyst for student success, and a cornerstone of America's skilled labor pipeline.

Why a Career in Metrology is Especially Suited for Women

Metrology offers a stable, well-paying, and intellectually engaging career that values precision, problem-solving, and analytical thinking over physical strength. It provides women with opportunities to work in diverse, high-tech industries such as healthcare, medical device, pharmaceutical, aerospace, nuclear, and manufacturing, where accuracy and attention to detail are critical. With growing demand for skilled calibration professionals, transferable skills across sectors, and strong industry support for diversity in STEM, metrology is an ideal field for women seeking meaningful, advancement-oriented careers in technology.

1. Emphasis on Skill, Not Physical Strength

Unlike many traditional technical fields that historically emphasized heavy physical labor, metrology relies on analytical skills, attention to detail, and mastery of precision tools and instruments. This levels the playing field and allows women to excel based on their technical knowledge, accuracy, and quality-focused mindset.

2. Growing Demand and Career Security

The shortage of qualified calibration and metrology professionals, combined with the expansion of high-tech and regulated industries, means stable, well-compensated opportunities for women entering the field. From medical device calibration to aerospace quality control, employers are actively seeking diverse, skilled candidates.

3. Opportunities for Leadership and Specialization

Metrology offers numerous pathways for career advancement—from laboratory management to quality systems auditing and standards development. Women in the field often bring collaborative leadership styles and meticulous organizational skills that are highly valued in these roles.

4. Cross-Industry Impact

Skills in metrology are transferable across sectors, allowing women to work in industries that match their interests—whether that’s renewable energy, defense, healthcare, or advanced manufacturing. This flexibility supports career longevity and adaptability in a rapidly changing economy.

5. Supportive Environment for STEM Diversity

As industries and professional organizations, such as the American Society for Quality (ASQ), actively work to increase gender diversity in technical fields, metrology stands out as a career where women can enter, thrive, and influence the next generation of STEM professionals. Mentorship programs, professional networks, and leadership development opportunities further support women in building long-term careers.

A career in metrology empowers women to apply precision, problem-solving, and analytical expertise in roles that are critical to quality, safety, and innovation worldwide. It offers stability, advancement, and the chance to make measurable contributions—literally and figuratively—to industries that shape our future.

Advancing America's Metrology Workforce



Metrology—the science of measurement—is the foundation of modern industry, innovation, and national security. It underpins every critical system, from aerospace and defense to healthcare, energy, and advanced manufacturing. Without accurate measurement, there can be no precision, no quality assurance, and no technological advancement.

Calibration technicians, as metrology professionals, ensure that the tools, systems, and processes driving our economy meet exacting standards of accuracy and reliability. Their work safeguards public safety, supports regulatory compliance, and sustains global competitiveness.



Yet our nation faces a growing shortage of skilled metrology professionals. This gap threatens to erode innovation, weaken safety protocols, and disrupt critical supply chains. To secure America's leadership in science, technology, and manufacturing, we must elevate metrology as a national workforce priority and invest in the next generation of measurement experts.

Advancing America’s metrology workforce is not a luxury—it is a necessity. Calibration technicians are the unsung professionals behind safe aviation, sterile surgical instruments, accurate diagnostics, and reliable microelectronics. Sustaining U.S. leadership in innovation and manufacturing requires strategic investment in those who uphold measurement accuracy and standards compliance.



From AI and missile guidance to semiconductors and medical devices, calibration professionals ensure precision, traceability, and safety in critical systems. Yet a nationwide shortage of skilled technicians poses a serious risk, undermining innovation, compromising safety, and threatening regulatory compliance across high-tech and defense sectors.

To maintain global competitiveness and national security, metrology must be recognized as a strategic workforce priority.

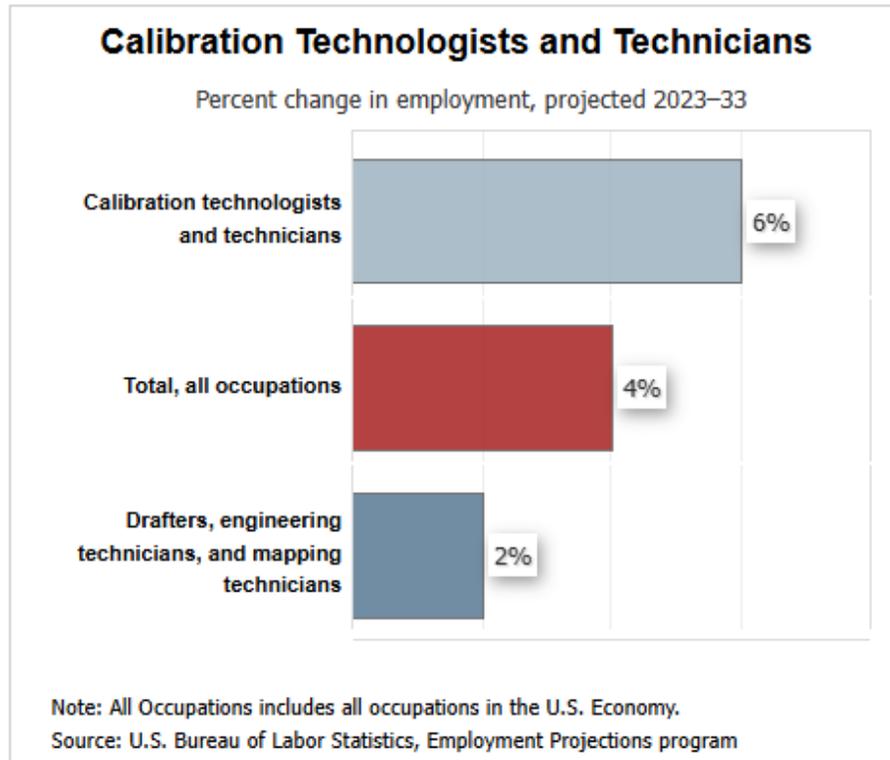
U.S. Bureau of Labor Statistics Occupational Classification

- **Title:** Calibration Technologists and Technicians
- **SOC Code:** 17-3028.00
- **Description:** Apply principles of measurement science, physics, electronics, and mathematics to calibrate inspection, measurement, and test equipment. May determine the suitability of standards, perform corrective maintenance, and follow quality system procedures, often under the direction of engineering staff.

National Center for Education Statistics

- **Title:** Electrical, Electronic and Communications Engineering Technology/Technician.
- **CIP Code:** 15.0303 (Electromechanical Technology/Electromechanical Engineering Technology)
- **Definition:** A program that prepares individuals to apply basic engineering principles and technical skills in support of electrical, electronics, and communication engineers. Includes instruction in electrical circuitry, prototype development and testing, systems analysis and testing, systems maintenance, instrument calibration, and report preparation.

Occupational Outlook



Source: <https://www.bls.gov/ooh/installation-maintenance-and-repair/calibration-technologists-and-technicians.htm#tab-6>

Employment in STEM Occupations

“Science, technology, engineering, and mathematics (STEM) occupations are a hot topic in economic research, job training and economic development programs, and the media. These occupations are at the forefront of cutting-edge activities such as artificial intelligence, robotics, medical research, and high-tech manufacturing. STEM occupations are generally high-paying and highly skilled: compared with all occupations, STEM occupations are more likely to have above-average wages and require postsecondary education for entry.¹ They are also fast-growing. According to data from the Bureau of Labor Statistics (BLS) Employment Projections program, STEM employment is projected to increase at nearly 3 times the rate of non-STEM employment between 2023 and 2033.” According to Andrew Watson, June 2025, [5]

Employment Statistics

Quick Facts: Calibration Technologists and Technicians	
2024 Median Pay ?	\$65,040 per year \$31.27 per hour
Typical Entry-Level Education ?	Associate's degree
Work Experience in a Related Occupation ?	None
On-the-job Training ?	None
Number of Jobs, 2023 ?	13,800
Job Outlook, 2023–33 ?	6% (Faster than average)
Employment Change, 2023–33 ?	800

Source: <https://www.bls.gov/ooh/installation-maintenance-and-repair/calibration-technologists-and-technicians.htm#tab-1>

Top Employing Industries

1. **Aerospace & Defense**
2. **Energy & Utilities (Nuclear, Oil & Gas, Renewables)**
3. **Medical Device & Healthcare Manufacturing**
4. **Pharmaceuticals & Biotechnology**
5. **Metrology and Calibration Service Labs (ISO/IEC 17025 Accredited)**
6. **Military and Federal Agencies (e.g., DoD, NASA)**

Growth Drivers

- **Increasing reliance on automated systems and precision instrumentation**
- **Expansion of aerospace, healthcare, and renewable energy sectors**
- **Emphasis on compliance with international quality standards (ISO/IEC 17025, FDA, FAA)**
- **Rising importance of data integrity and uncertainty management in regulated industries**

Calibration Technician Important Qualities

Quality	Description
Attention to Detail	Calibration work requires precise measurement, documentation, and adherence to procedures—minor errors can lead to major system failures.
Analytical Thinking	Ability to interpret data, evaluate uncertainty, and determine whether instruments meet required specifications.
Problem-Solving Ability	Technicians must troubleshoot faulty instruments, address calibration failures, and identify root causes.
Integrity & Ethics	Required for maintaining traceability, following quality systems, and ensuring compliance with ISO 17025 standards.
Manual Dexterity	Working with delicate instruments and test equipment demands fine motor skills and hand-eye coordination.
Organizational Skills	Technicians often handle multiple tools, schedules, and documents—organization is key to efficiency and accuracy.
Communication Skills	Must document results, write calibration reports, and sometimes explain findings to engineers or auditors.

Key Technical Skills

Skill Area	Examples
Calibration Techniques	Dimensional, electrical, pressure, temperature, mass, and RF calibration methods
Measurement Science	Understanding SI units, traceability, and metrological hierarchy
Uncertainty Analysis	Applying NIST GUM principles to evaluate and document uncertainty
Quality Standards	Implementing ISO/IEC 17025:2017 procedures, audits, and corrective actions
Instrumentation Use	Oscilloscopes, DMMs, signal generators, pressure and temperature devices, dimensional measuring tools, torque, force, mass, and electronic measuring equipment
Software & Data Tools	Calibration software, Excel (for uncertainty), LabVIEW, Met/Cal, CMM Applications, or automation platforms
Preventive Maintenance	Cleaning, tuning, and servicing test equipment according to schedules

TWO-YEAR TECHNICAL DEGREE PROGRAM

Program Title: METROLOGY AND CALIBRATION TECHNOLOGY

SOC Code: 17-3028 – Calibration Technologists and Technicians

CIP Code: 15.0303 (Electromechanical Technology/Electromechanical Engineering Technology)

Degree Awarded: **Associate of Applied Science**

Preparation for ASQ Certified Calibration Technician (CCT) exam

Program Overview

This two-year, four-semester (**72 Credit Hours**) technical college program is aligned with **CORE 42**, the U.S. Bureau of Labor Statistics (BLS) occupation code 17-3028: Calibration Technologists and Technicians, and the Classification of Instructional Programs (CIP) code 15.0303 for Calibration Technology. It integrates OSHA safety and PPE training, core calibration and metrology coursework, ISO 17025:2017 quality systems, advanced metrology software and systems instruction, and culminates in an internship and capstone project. Graduates will be prepared to take the ASQ Certified Calibration Technician (CCT) certification exam.

Example Course Curriculum

Semester 1: Foundations of Metrology and Safety

Course Title	Credits	Course Description
English Composition, ENG 101	3	MOTR ENGL 100, (CORE 42)
College Algebra, MAT 115	3	MOTR MATH 130, (CORE 42)
Introduction to Metrology and IM&TE	3	Introduction to measurement systems, NIST, SI units, and basic metrology equipment. Covers instrument traceability and introduces the fundamentals of calibration.
Professional Ethics and Technical Communication	1	Focuses on professional conduct, calibration documentation, and communication skills.
Quality & Safety in the Calibration Lab (OSHA 10)	2	Introduces lab safety standards and OSHA 10 certification. Emphasizes PPE and hazard recognition.
Introduction to Calibration Procedures	3	Overview of calibration steps, procedures, and recordkeeping for standard instruments.
Precision Measurement Tools & Equipment	2	Hands-on training with calipers, micrometers, dial indicators, height gauges, and other precision instruments.
Total	17	

Semester 2: Calibration Methods and Systems

Course Title	Credits	Course Description
Introduction to Physics with a laboratory, PHY 100	4	MOTR PHYS 100L, (CORE 42)
Calibration Systems and Procedures	3	Detailed study of calibration systems, lab environments, and calibration planning.
Measurement Uncertainty & Data Analysis I	3	Intro to uncertainty principles, Type A and B analysis, and basic statistics.
Measurement Systems and Error Sources	3	Explores error types, system bias, linearity, resolution, and environmental effects.
ISO/IEC 17025 and Z540.3 Quality Systems	2	Introduces ISO/IEC 17025 and ANSI/NCSL Z540.3 lab standards, audits, and compliance.
Calibration Lab Practicum I	2	Supervised lab time applying basic calibration principles and documentation.
Digital Tools for Calibration	2	Covers spreadsheets, digital templates, and introductory software tools for calibration management.
Total	19	

Summer Internship:

Course Title	Credits	Course Description
Internship in Calibration Laboratory	3	Structured internship in an accredited calibration lab. Real-world exposure to procedures and standards.

Semester 3: Advanced Calibration Techniques

Course Title	Credits	Course Description
Oral Communications, COM 111	3	MOTR COMM 100, (CORE 42)
Advanced Dimensional & Mechanical Calibration	3	Focuses on torque, force, and dimensional measurement using high-accuracy tools.
DC Low/Frequency	3	Calibration of DC/low-frequency devices, including DMMs, Oscilloscopes, function generators, and counters.
ISO/IEC 17025 Internal Audits & Quality Control	2	Covers internal audit procedures, CAPA, and continuous improvement.
Calibration Lab Practicum II	2	Advanced application of calibration with intermediate and complex instrumentation.
Process Control Instrumentation	3	Focuses on temperature, pressure, and process control instrumentation.
Total	16	

Semester 4: Industry Integration and Capstone

Course Title	Credits	Course Description
Technical Writing & Reporting for Metrology	2	Professional technical report writing, calibration certificate creation, and data reporting.
Measurement Uncertainty & Risk Analysis (GUM II)	3	Advanced application of NIST GUM principles, uncertainty budgeting, and TUR calculations.
Instrumentation Maintenance & Troubleshooting	3	Preventive maintenance procedures, diagnostics, and fault analysis for calibration instruments.
Metrology Software & Automation Systems	3	Training on MET/CAL, MET/TEAM, MOX, and PC-DMIS software. Focus on automation and data tracking.
Capstone Project in Applied Metrology	5	Final project integrating core competencies, uncertainty evaluation, and reporting.
Certification Prep & Career Readiness	1	Preparation for the ASQ CCT exam and career placement activities.
Total	17	

Total Credit Hours: 72

Textbooks and Resources:

The ASQ METROLOGY HANDBOOK, Third Edition, by Heather A. Wade, Editor, ISBN: 978-1-63694-019-9

Metrology Handbook: The Science of Measurement, by Nobuo Suga, ISBN: 978-0955613302

Metrology and Measurement Uncertainty: Concepts and Applications, by [Pedro Paulo Novellino do Rosario](#) (Author), [Alexandre Mendes](#) (Author), ISBN: 978-3031823022

MITUTOYO Metrology Books, <https://www.mitutoyo.com/resource-center/?resource-type=metrology-book#filter>

Fluke Online training resources: <https://www.fluke.com/en-us/learn/blog/calibration>

References:

- [1] **U.S. Bureau of Labor Statistics**, Calibration Technologists and Technicians, SOC Code 17-3028. Retrieved from <https://www.bls.gov/ooh/installation-maintenance-and-repair/calibration-technologists-and-technicians.htm>
- [2] **U.S. Bureau of Labor Statistics**, Occupational Employment and Wages, May 2023, 17-3028 Calibration Technologists and Technicians, Retrieved from <https://www.bls.gov/oes/2023/may/oes173028.htm>
- [3] **O*Net Online**, Calibration Technologists and Technicians, 17-3028, Retrieved from <https://www.onetonline.org/link/summary/17-3028.00>
- [4] **U.S. Bureau of Labor Statistics**, Calibration Technologists and Technicians, Employment Projections, Retrieved from, <https://data.bls.gov/projections/nationalMatrix?queryParams=17-3028&ioType=o>
- [5] Andrew Watson, June 2025, Employment and wages for alternate definitions of science, technology, engineering, and mathematics (STEM) occupations, Retrieved from, <https://www.bls.gov/opub/btn/volume-14/stem-alternate-definitions.htm>
- [6] **National Center for Education Statistics**, CIP Code: 15.0303 (Electromechanical Technology/Electromechanical Engineering Technology), Retrieved from, <https://nces.ed.gov/ipeds/cipcode/cipdetail.aspx?y=55&cipid=88143>
- [7] **American Society of Quality (ASQ)**, Certified Calibration Technician (CCT), Retrieved from, <https://www.asq.org/cert/calibration-technician>

About the Metrology Institute, Inc.



<https://metrologyinstitute.org/>

Our Purpose

The Metrology Institute aims to advance the science of measurement globally by providing high-quality education and eLearning training resources through strategic partnerships. We strive to foster a global community of metrology professionals with the knowledge and skills to drive progress and ensure quality across diverse industries, research initiatives, and societal applications. Through our commitment to excellence in measurement science, we support innovation, accuracy, and reliability in all areas where precise measurement is essential.

The Metrology Institute, Inc. is a Nonprofit 501(c)(3) training and educational organization dedicated to advancing the Science of Measurement.

Our Mission

To advance scientific knowledge and practical skills in the field of measurement.

Our Vision

We envision a world where the science of measurement fuels innovation, ensures quality, and drives global progress.

Biography:

Ken Racen, MBA, Founder and Chief Executive Officer, Metrology Institute (501(c)(3) Nonprofit)

Ken Racen is the founder and CEO of the Metrology Institute, a nonprofit 501(c)(3) organization dedicated to advancing the science of measurement through technical education, professional certification, and workforce development. With more than four decades of experience in metrology, laboratory operations, and quality management systems, Mr. Racen has consistently focused on the intersection of precision engineering and public impact—ensuring that accurate measurement supports both industrial advancement and societal well-being.



Mr. Racen holds a Master of Business Administration (MBA) with a concentration in Information Technology and Business, along with a comprehensive suite of industry-recognized credentials. These include certifications as an ASQ Certified Quality Auditor, Certified Calibration Technician, Lean Six Sigma Continuous Improvement Specialist, and numerous training certifications under NIST and NVLAP related to ISO/IEC 17025:2017. He also holds credentials in Advanced Geometric Dimensioning and Tolerancing (GD&T), Medical Device Safety Requirements (IEC 60601-1), and technical leadership development.

As Vice President and co-owner of ISL Corporation, Ken helped build one of the Midwest's premier commercial metrology laboratories in St. Louis and Kansas City, expanding access to high-precision calibration services across Missouri and surrounding states, and has developed several metrology software programs, including METNAV for commercial calibration laboratories.

Mr. Racen has held leadership roles spanning both laboratory management and quality systems development. Mr. Racen has contributed to the expansion and enhancement of calibration and metrology services throughout the central United States. His efforts have emphasized accessibility, technical rigor, and the importance of developing a qualified workforce to meet the evolving demands of modern measurement science.

The establishment of the Metrology Institute reflects Mr. Racen's enduring commitment to educational equity and technical excellence. His vision is to democratize access to advanced metrology training, support the development of a diverse and inclusive technical workforce, and reinforce measurement science as a critical enabler of innovation, public safety, and economic growth.

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