Strengthening Calibration Services through Improved Focus and Planning

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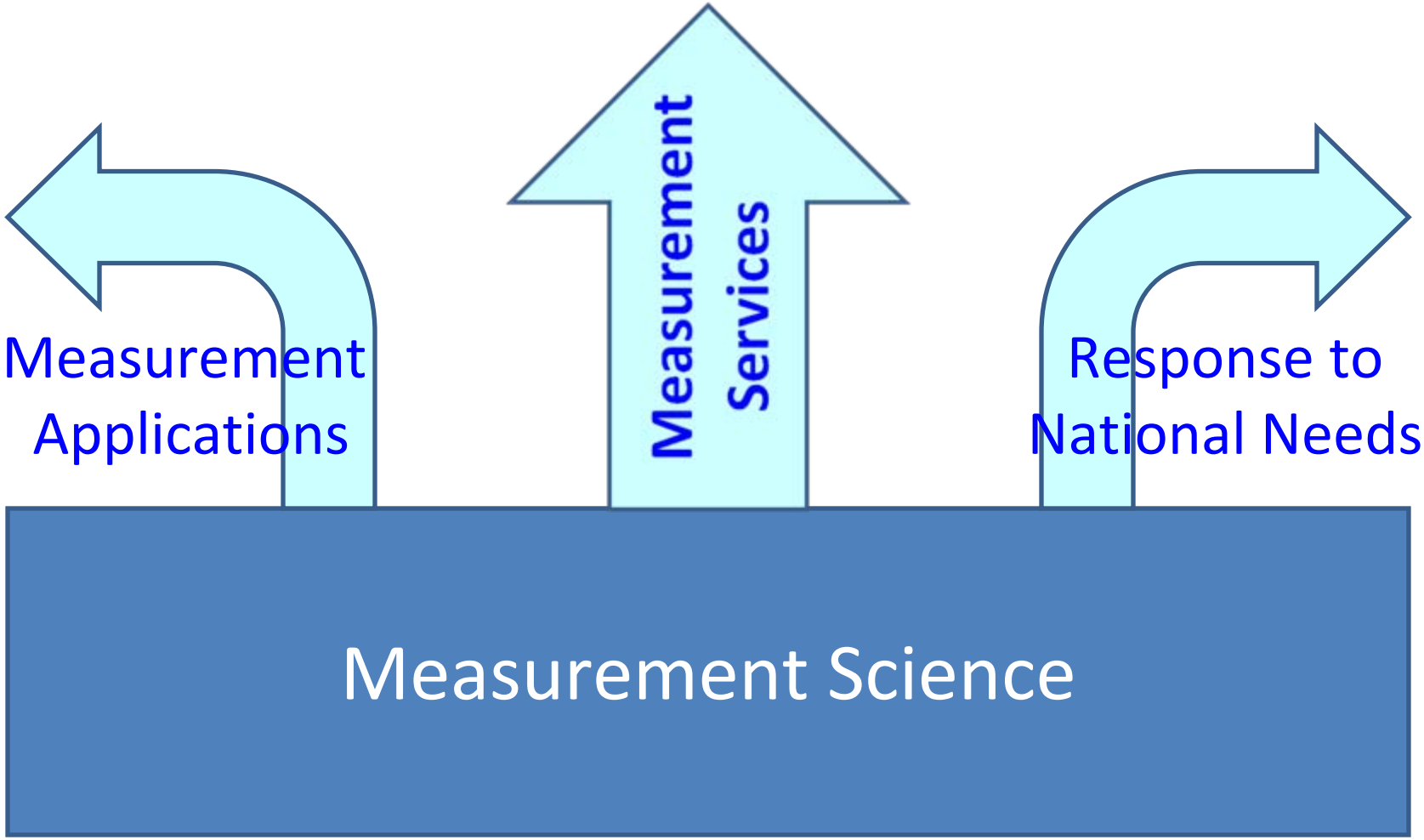
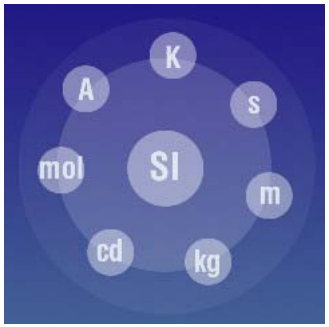
Points

- Calibrations are critically important
- We have great strengths
- We have issues and weaknesses
- We are moving forward

Building on a foundation



NIST provides traceability



Working Standards

Transfer Standards

Customer Labs

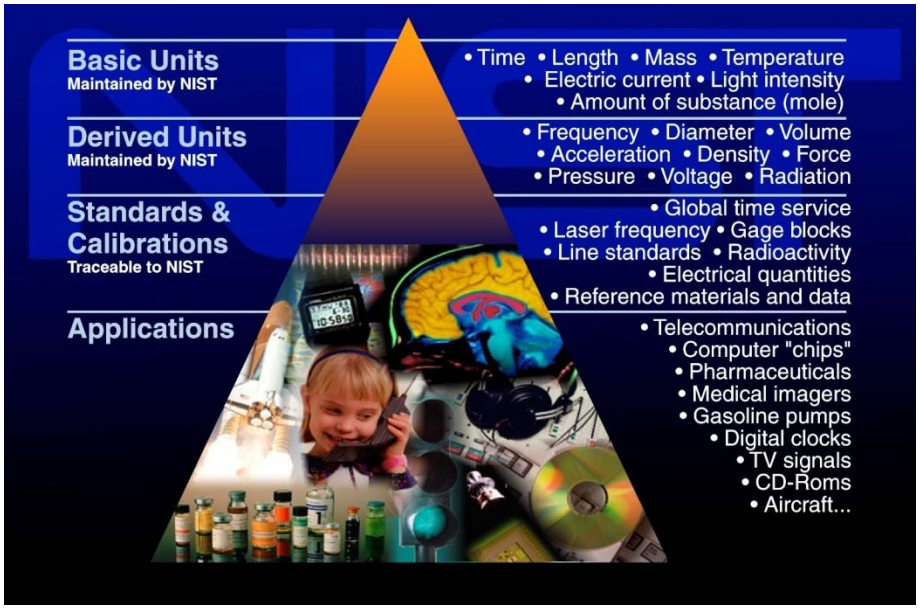
Realization

Representation

Dissemination

Secondary Customers

Calibrations are critical



- 40+ million mammograms delivered at 9,000 US facilities trace back to 2 dozen proficiency tests and calibrations per year from NIST

- NIST supports the US power system ($300B annually) through approximately 25 power and energy calibrations per year
- 400,000 annual calibrations of mass standards performed at State Weights and Measures Laboratories rely on just 30 highly accurate calibrations performed at NIST

Calibrations are critical

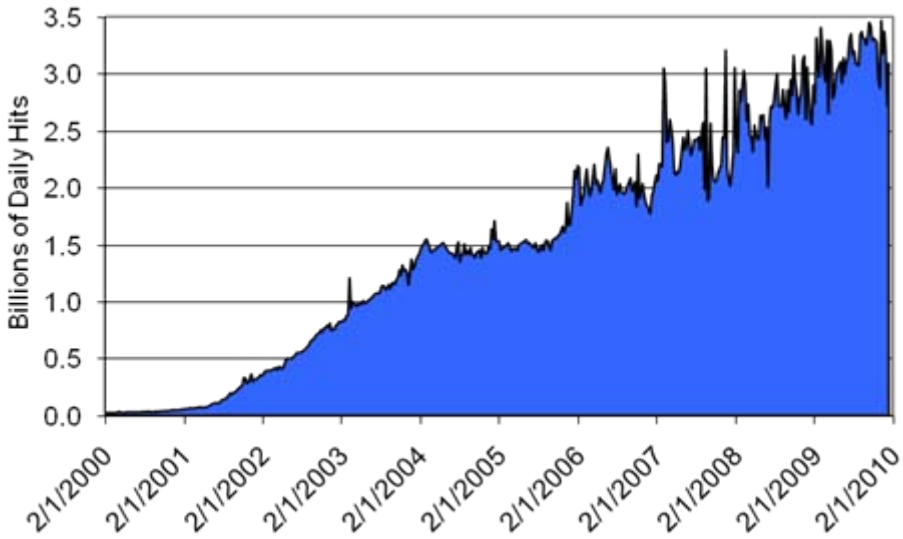
- NIST calibrations ensure the accuracy and reliability of over 1.8 million Navy calibrations performed on approximately 140,000 different types of instruments

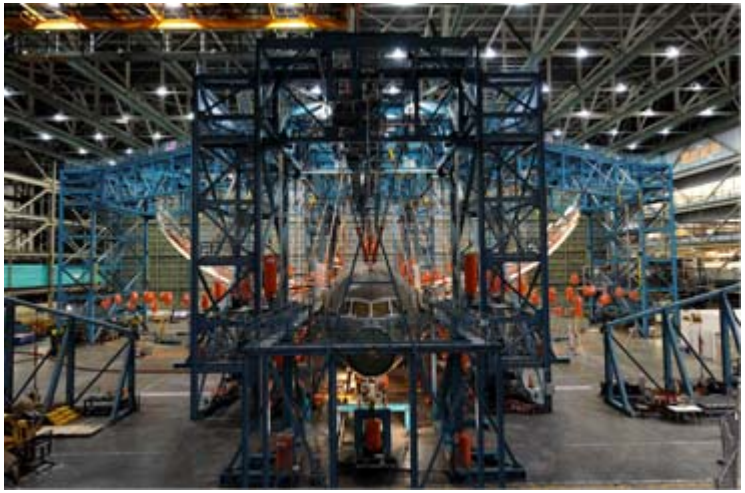
- 203 calibrations for DoE supported over 70,000 subsequent calibrations that help ensure the reliability and performance of the entire U.S. nuclear arsenal

- 8 NIST calibrations annually for the Air Force underpin 22,000 high voltage calibrations, 158,000 ac measurements, 77,000 inductance calibrations, and over 400,000 dc voltage calibrations

Calibrations are critical

NIST Internet Time Service
Synchronizing computers and networks more than 3 billion times per day. Applications include time-stamping of hundreds of billions of dollars of financial transactions each day.





NIST-calibrated load cells are used to provide traceable force measurements of hundreds of load cells used during dynamic testing of aircraft wing assemblies

Some success stories

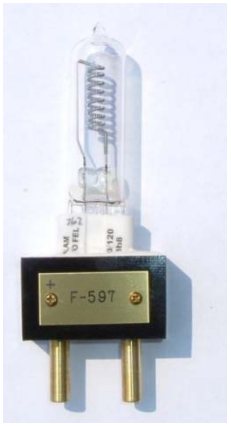
Reinvention of oscilloscope calibrations

- Collaboration with Intel engineers
- Enables measurement of rapidly time-varying signals like those found in digital electronics
- New procedure for digital waveforms increased pass-fail range by factor of 3 or more, reducing unnecessary circuit board rejections

Solid state lighting

- In response to 2001 Report of the Council of Optical Radiation Measurements
- Accurate measurement of incremental R&D successes (improved efficiency) by industry
- Resulted in documentary standards, NVLAP accreditation of commercial laboratories, implementation of DOE/EPA SSL Energy Star program and product labels, international standards for SSL commerce/trade, and training

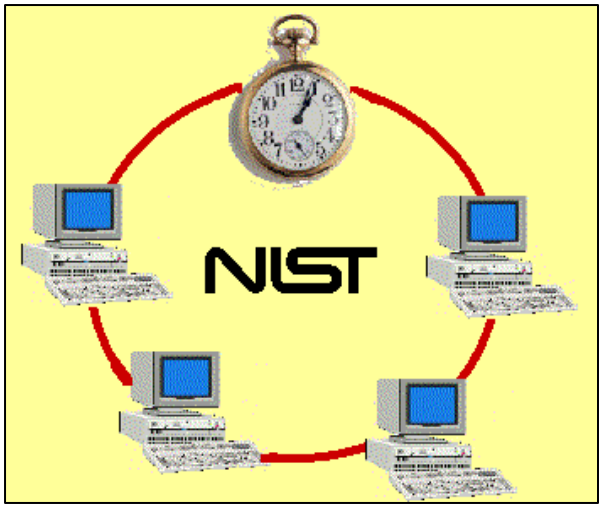
Some weaknesses



Spectral irradiance

One staff member is responsible for

- 5 labs
- 33 measurement services
- Multiple quality systems
- International comparisons



Time & frequency

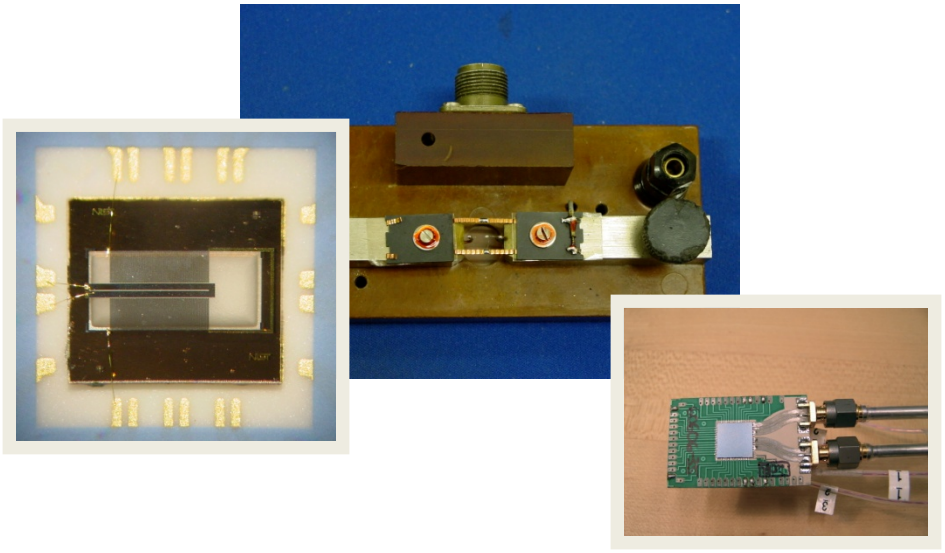
Entire service relies on single scientist – NIST Fellow Dr. Judah Levine

•Inventor and sole provider of NIST Internet Time Service and other NIST network time services

Some weaknesses

Low frost point generator

- Aging refrigeration system diminishes ability to maintain needed temperatures below –100 °C
- Limits measurements for Greenhouse gasses measurements (water vapor) and semi-conductor water vapor contamination



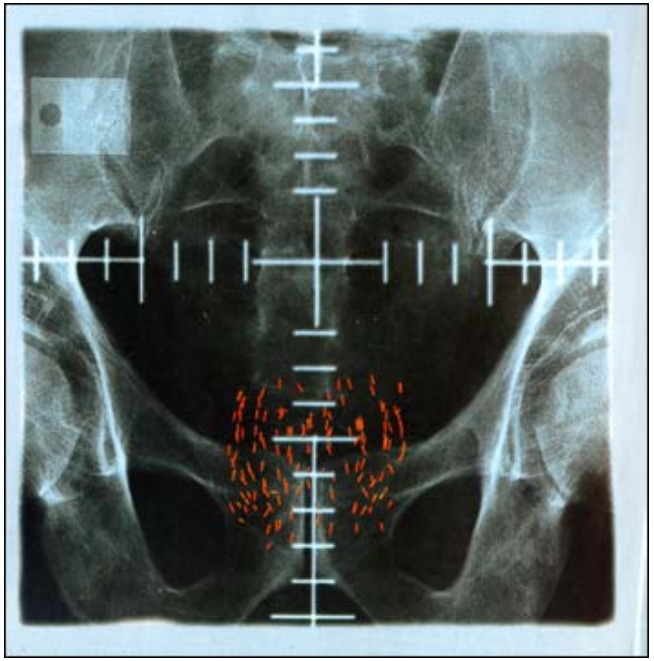
Electrical metrology

- Aging primary standards for AC voltage are failing and irreplaceable
- Research program is only 20% of program in 1990
- Unable to utilize benefits of new technologies such as graphene

Some unmet needs

High dose rate (HDR) ^{192}Ir brachytherapy sources

- Compelling need
  - Requested of NIST by American Association of Physicists in Medicine (AAPM) and the Council on Ionizing Radiation Measurements and Standards
  - Expanding area in prostate /other cancer therapies
  - Less-than-direct traceability chain back to NIST
  - Sources needed to improve treatment accuracy
- Multiple barriers to NIST engagement
  - Extensive shielding requirements for safety and protection of sensitive instrumentation
  - Dedicated lab required
- Impact
  - Limits the accuracy achievable in treatments



Significant issues for calibrations

- Inconsistent determination of the relevance and importance of calibration services relative to other programs.
- Full recovery pricing policy results in customers going to other NMIs.
- Flat resourcing has reduced staffing of critical calibrations.
- Legacy systems are difficult to modernize or replace.
- No uniform metrics exist to measure quality, impact, need, or success of existing services.
- Long term plans for the evolution, improvement, or discontinuation of services often do not exist.
- Research planning often is poorly connected to calibration and applied metrology needs.
- Customer interactions are uneven and often not effectual.

Some unanswered questions

- How do we evaluate the relative importance of large customers and small customers?
  - DoD accounts for 3 of the top 4 customers and approximately 40% of all calibration income
  - Nearly 600 different customers use NIST calibration services
- What resources should NIST commit to involvement in international metrology?
- How do we evaluate the relative importance of technical needs versus competitive needs of customers?
- What if the most effective means of dissemination generates no revenue?
- What do we do if we can no longer support a service that still demonstrates customer needs?

A path forward

2009 calibration income

Previous organization (by division)

Division	Calibration Income
Quantum Electrical Metrology	$892,351
Process Measurements	$858,359
Precision Engineering	$853,697
Manufacturing Metrology	$729,736
Optical Technology	$647,205
Optoelectronics	$447,357
Ionizing Radiation	$426,312
Electromagnetics	$375,532
Electron & Optical Physics	$31,415
Building Environment	$18,491
Physical & Chemical Properties	$10,805
Analytical Chemistry	$7,593
Manufacturing Systems Integration	$3,766
Time & Frequency	$0
TOTAL	$5,302,619

2009 calibration income

What's now in PML

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99% of all calibration income is now in PML Divisions

A path forward

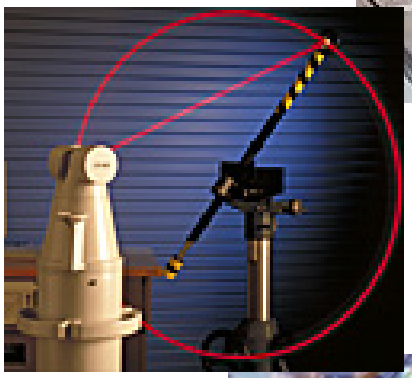
- Develop a common NIST vision for calibration services
- Define excellence for calibration services
- Develop strategic plans for services
- Define and monitor appropriate metrics
- Peer assessments
- Organizational planning to identify unmet needs to support resource growth

A path forward

- **NIST vision for calibration services**
  - Develop unified view and expectations of calibration services with PML Division Chiefs
  - Focus on relative importance of services compared to other projects
- **Excellence for calibration services**
  - Develop excellence criteria, including impact, need, quality of staff and facility, capabilities
  - Perform thorough assessment of capabilities and pricing compared to other major NMIs
- **Strategic plans**
  - Develop plans for each measurement area
    - Research, calibrations, development
    - Staffing and funding
    - Deliberate goals
  - Involve customers in planning discussions
  - Manage to the plans
- **Appropriate metrics**
  - Determine relevant metrics and monitor them
  - Reevaluate the NIST Quality System after realignment
- **Peer assessments**
  - Utilize peers from other NMIs
  - Directly engage key customers to evaluate performance
  - Determine value of additional “Councils”
- **Identify unmet needs to support resource growth**
  - Utilize strategic plans

What happens then?

- **Critically evaluate programs**
  - Achieve excellence in all calibration services
  - Manage calibration programs as a portfolio
  - Recognize staff performance
  - Effectively represent the US in international metrology efforts
- **Develop dynamic programs**
  - Better integrate research and calibration programs
  - Rapidly respond to industrial and national needs
  - Achieve significant and immediate impact solutions
- **Improve service**
  - Replace and upgrade legacy systems
  - Shorten delivery times
  - Develop more effective pricing policies
- **Improved customer interactions**
  - We understand their needs
  - They understand our plans
  - Increased customer satisfaction with processes
- **Act on critical measurement needs**
  - Direct existing resources to most important challenges
  - Obtain additional resources
  - Revitalize supporting research programs
  - Fill critical staffing needs
- **PML is recognized as the single-point source for calibration needs**
  - Consistent policies and implementation
  - One-stop shopping
  - Improved dissemination of measurement information



Questions?