

The United States Measurement System (USMS) - The NIST Approach and Your Role

ARE YOUR MEASUREMENT NEEDS BEING MET BY THE USMS?

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Outline

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NIST Mission

To promote U.S. innovation and industrial competitiveness

- by advancing measurement science, standards, and technology
- in ways that enhance economic security and improve the quality of life for all Americans.



NIST Mission (continued)

- NIST is **not** a regulatory agency.
- NIST works with all stakeholders to assist with measurements and standards.
- NIST is a neutral-third party in the seller-buyer interface.



NIST and Healthcare: Did You Know ?

- **The United States spends about \$1.1 trillion on health care, and 10 percent to 15 percent of that is associated with making measurements — NIST's specialty.**
- **Without NIST, U.S. manufacturers of such products as glucose and cholesterol test kits — in vitro diagnostic (IVD) devices — wouldn't be able to meet requirements of new European Union regulations and would have been shut out of the \$7 billion European market where they now have more than 60 percent of the business.**
- **NIST measurement services underpin the safety and effectiveness of about 10 million medical procedures that use radioactive materials — from prostate- and breast-cancer treatment to diagnostic imaging.**

http://www.nist.gov/public_affairs/factsheet/NIST_Did_you_know.htm

NIST and Healthcare: Did You Know?

- **NIST X-ray standards and proficiency tests ensure proper radiation exposure levels in more than 9,000 facilities that perform more than 30 million mammograms yearly.**
- **Many of the tools and materials used in modern dentistry — from the panoramic X-ray to composite fillings to an array of adhesives — originated at NIST through a continuing 75-year-old partnership with the American Dental Association.**
- **NIST Standard Reference Materials helped to significantly improve the accuracy of cholesterol tests, resulting in better diagnoses and treatments and an estimated annual savings of about \$100 million.**

http://www.nist.gov/public_affairs/factsheet/NIST_Did_you_know.htm

NIST: Did You Know?

- **The National Research Council credits NIST Standard Reference Materials for DNA analyses with improving the accuracy of forensic DNA tests while reducing testing costs and that the criminal justice community depends on NIST to assure that its testing is accurate.**
- **NIST's weights and measures services, a job assigned to the federal government in the Constitution, provide the basis for the fairness and efficiency of sales totaling more than \$5 trillion — roughly half of the U.S. economy.**

http://www.nist.gov/public_affairs/factsheet/NIST_Did_you_know.htm

Clinical Reference Standards

Existing NIST clinical reference methods and materials for key health status markers:

Calcium	<i>Cancer, Blood Clotting</i>
Chloride	<i>Kidney Function</i>
Cholesterol	<i>Heart Disease</i>
Creatinine	<i>Kidney Function</i>
Glucose	<i>Diabetes</i>
Lithium	<i>Antipsychotic Treatment</i>
Magnesium	<i>Heart Disease</i>
Potassium	<i>Electrolyte Balance</i>
Sodium	<i>Electrolyte Balance</i>
Triglycerides	<i>Heart Disease</i>
Urea	<i>Kidney Function</i>
Uric Acid	<i>Gout</i>

New clinical reference methods and materials under development:

Troponin-I	<i>Myocardial Infarction</i>
Glycated Hemoglobin	<i>Diabetes Status</i>
Homocysteine	<i>Risk of Heart Disease</i>
Bilirubin	<i>Liver Function</i>
TSH	<i>Thyroid Function</i>
Speciated Iron	<i>Hemochromatosis, Anemia</i>
Human Serum Alb.	<i>Renal Failure</i>
PSA	<i>Prostate Cancer</i>
Cadmium & Mercury	<i>Toxic Metal Poisoning</i>
Cortisol	<i>Endocrine Function</i>
Thyroxine	<i>Thyroid Function</i>
Folates	<i>Neural Tube Defects</i>

National Measurement Institutes (NMIs)

NIST is the U.S.'s National Measurement Institute (NMI) and is responsible for the U.S. national standards and measurements.



Examples of other NMIs from around the world:

Institute for National Measurement Standards (INMS) – Canada

Bureau National de Metrologie (BNM-INM) – France

Physikalisch-Technische Bundesanstalt (PTB) – Germany

National Metrology Institute of Japan (NMIJ)

Korea Research Institute of Standards and Science (KRISS)

National Institute of Metrology (NIM) – China

**National Institute of Metrology, Standardization, and Industrial
Quality (INMETRO) – Brazil**

Objective of USMS Effort

Make an “assessment of the USMS” -

examine the nation’s measurement system as a whole and make a judgment as to its quality – assess its health.

NIST said that it would accept this challenge from its overseers and do such an assessment by next summer.

The primary objective of the NIST USMS effort is *to produce and deliver to the NIST Director by June 2006 a credible distributable report on a needs-based assessment of the state of the USMS.*

Logic and Focus of the NIST USMS Effort on Technological Innovation

Technological Competitiveness Act of 1988 expanded the role of the former National Bureau of Standards and renamed it the National Institute of Standards and Technology.

The NIST USMS effort was initiated with the proposition that *the USMS is a key component of the US infrastructure for innovation.*

The NIST Director has established as the first of the NIST strategies for success to *help the U.S. drive and take advantage of the increased pace of technological change.*

This NIST assessment of the USMS focuses on *measurement barriers to technological innovation* and is a principal element of the above strategy.

Logic and Focus of the USMS Effort and Report

Technology is a foundation of the U.S.'s economy and defense.

Innovation in technology is a major source of the nation's economic well-being and military strength.

Technological innovation is a basis for increased competitiveness, productivity, and quality.

*According to the U.S. Council on Competitiveness,
"Innovation will be the single most important factor
in determining America's success through the 21st century"*

Logic and Focus of the USMS Effort and Report

Technological innovation is the introduction into the marketplace of new technology.

This technological innovation may be a product incorporating new technology or a process (for producing products) incorporating new technology.

NIST Assessment of the USMS

The remainder of this presentation summarizes briefly:

- 1) The approach, output, and intended benefits of the assessment and**
- 2) Your role in helping NIST with its assessment.**

Basic Methodology of the Assessment

- Focus on measurement problems that pose technical barriers to economically important technological innovations
- Use an economic model of technological innovation as the basis for specifying the measurement needs
- Survey the space of measurement needs from different perspectives (sectors, technologies, SI units, disciplines)
- Use [industry-need workshops such as this ISCD-NIST Workshop](#), industry technology roadmaps, interviews, and other fact-finding techniques as input
- Compile and analyze measurement needs
- Generate findings
- Authenticate measurement needs and findings outside NIST
- Distribute the report widely to stakeholders
- Carry out follow-up actions

The Bases for the Survey of Measurement Needs

Sectors	Semiconductor, Automotive, Software
Technologies	Broad (including Nanotechnology, Bio-/Medical Imaging, Disaster First-Responder) and Discrete (Workshop Topics ; e.g., bone health , data storage, nano-systems, flexible electronics, nanoimprint lithography)
SI Units	Mass, Length, Time, Electrical Quantities, Temperature, Amount Substance, Luminous Intensity
Disciplines	Physics, chemistry, material science, electrical engineering, civil-mechanical engineering, manufacturing engineering, computer-IT sci-eng

Inputs to the USMS Assessment: Industry “Measurement Needs” (MNs)

Information	Technological innovation at stake Economic significance of the innovation Technical barrier to the innovation Stage of innovation at which technical barrier appears Measurement-problem part of the technical barrier Potential solutions to the measurement problem Potential providers of these solutions Government role, if any, in these solutions
Format	One page, well-crafted, with documented support

When Writing MNs . . .

DO

- Do limit the entry under Technology to two or three words
- Do tell what the Technological Innovation, the new technology, does functionally new or better
- **Do quantify the benefits / impacts in the Economic Significance**
- Do view Potential Solutions to the Problem as solutions to the *MEASUREMENT* problem
- Do list all potential Solution Providers, **including international providers**
- Do give specifics and be concise!
- Do follow the prescribed format!!
- Do seek guidance from NIST if you have questions or problems

DON'T

- Don't assume that what the Technological Innovation does for the end user is self-evident
- Don't state unsupported generalities for impacts
- Don't force-fit several issues into one MN — consider splitting broader issues into discrete MNs
- **Don't list NIST as the only Solution Provider** — even if NIST is the best choice in your view
- Don't submit a rough draft — craft and rework until it shines!
- Don't submit more than 1 page of text!!

<http://usms.nist.gov/workshops/BoneHealth.htm>

If you would like to complete a one-page Measurement Need Input or Datum please send an email to any of the following people at NIST:

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Output and Intended Effect of NIST Look at the USMS

The June 2006 NIST USMS report will include

- the industry measurement needs identified
- findings on measurement needs and systemic problems
- follow-up actions to achieve solutions to those needs and problems

The intended effects of the report are that it will

- engage providers of solutions in the measurement problems ID'd
- bring the attention of stakeholders to bear on systemic issues
- catalyze identification of other measurement needs

ISCD-NIST Workshop Objectives

- Involve all who assess bone health to discuss needs and solutions.
- Identify current and future standards and measurement infrastructure needs associated with technologies for assessing bone health.
- Identify systemic gaps and weaknesses in standards and supporting data for technologies used to assess bone health.
- Establish, if possible, agreement on priorities for addressing needs, in technologies for determining bone mineral density.
- Provide NIST with about 5, well crafted authenticated measurement need inputs, one-page each in length.

Conclusion

- This has been a brief look at the on-going NIST assessment of the U.S. Measurement System.
- It is a challenging task that we think will provide real benefits.
- **We need YOUR help.**