

Vision for the NIST USMS Effort

A Briefing

for the NIST Visiting Committee on Advanced Technology

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Since your last visit,
NIST has adopted a fundamentally different
vision and approach to its assessment of
the nation's measurement system,
what it has been calling its USMS effort

As the leader of this new USMS effort,
I would like to introduce you to it
and to the progress we are making toward its objective

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- Project Organization and Responsibilities
- Plan and Progress
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Background

Prior to the appointment of our new NIST Director, NIST as you well know had begun work on assessing the nation's measurement system

NIST had told you - the members of the VCAT, Congress, and various of its constituencies that it was doing so

The new NIST Director came in, looked at the situation, and assigned me responsibility to rethink and lead the NIST USMS effort

I developed a vision for that effort, identified what I think is the most important near-term objective for NIST to pursue, and devised an approach to achieving that objective

The NIST Director and Senior Management Board have adopted that vision, objective, and approach

Objective of USMS Effort

To me to make an “assessment of the USMS” means
to take a look at the nation’s measurement system as a whole
and make a judgment as to the quality of the state that it is in

NIST had said that it would do such an assessment by next summer

To me that is a promise that we must deliver on

To that end I proposed and the NIST Director and SMB established
the primary objective of the NIST USMS effort at this time to be
*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 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 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

Logic of the USMS Effort and Report

Most of U.S. industry's most critical needs in measurements are linked to technological innovation

These measurement needs arise from measurement problems associated with the creation, production, marketing, and effective use of new product and process technologies

It is a primary function of the U.S. measurement system to deliver measurements that meet U.S. industry needs

Logic of the USMS Effort and Report

An assessment of the state of the USMS can well begin then with a broad survey of industry measurement needs relative to technological innovation

From the results of this survey, inferences may be drawn about the overall state of the USMS and an assessment made

The report is to provide the results of such a survey and the assessment based upon it

Fit with NIST of the Focus of the NIST USMS Effort on Technological Innovation

NIST as the National Institute of Standards and Technology was established by the Technology Competitiveness Act of 1988

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

The new NIST Director has stated the mission of NIST to be *to support U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology*

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

This NIST assessment of the USMS with its focus on *measurement barriers to technological innovation* is a principal element of that strategy

Output of the NIST Assessment of the USMS

The output of this NIST assessment of the USMS will be a June 2006 report to industry and other stakeholders that will include

- The specific technological-innovation-limiting measurement needs that it identifies
- Its findings on measurement needs, systemic problems, and the state of the USMS and
- The follow-up actions it will take to facilitate achievement of solutions
 - to the specific needs identified and
 - to any systemic problems discovered

Intended Benefits of Assessment Report

The intended effect of the Assessment report will be to:

- Allow potential providers of solutions to specific measurement problems to be engaged and mobilized
- Bring the attention of stakeholders to bear on systemic issues in the functioning of the U.S. measurement system as a whole
- Serve as a catalyst for the identification of other industry needs and other possible systemic problems

Basic Methodology of the Assessment

- Focus on measurement problems that pose technical barriers to technological innovation
- Use an economic model of technological innovation as the basis for specifying the measurement needs
- Survey the space of measurement needs from different perspectives
- Use industry-need workshops, industry technology roadmaps and other fact-finding techniques to identify measurement needs
- Draw inferences about the system from the identified needs
- Confirm results outside of NIST

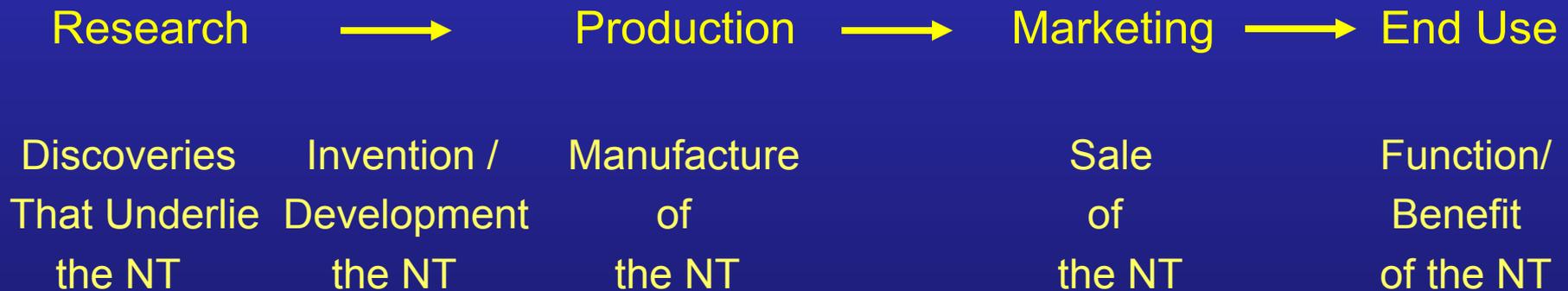
Economic Model of Measurement Problems as Barriers to Technological Innovation

Technological Innovation = Introduction into Marketplace of New Technology

Economic Model of Measurement Problems as Barriers to Technological Innovation

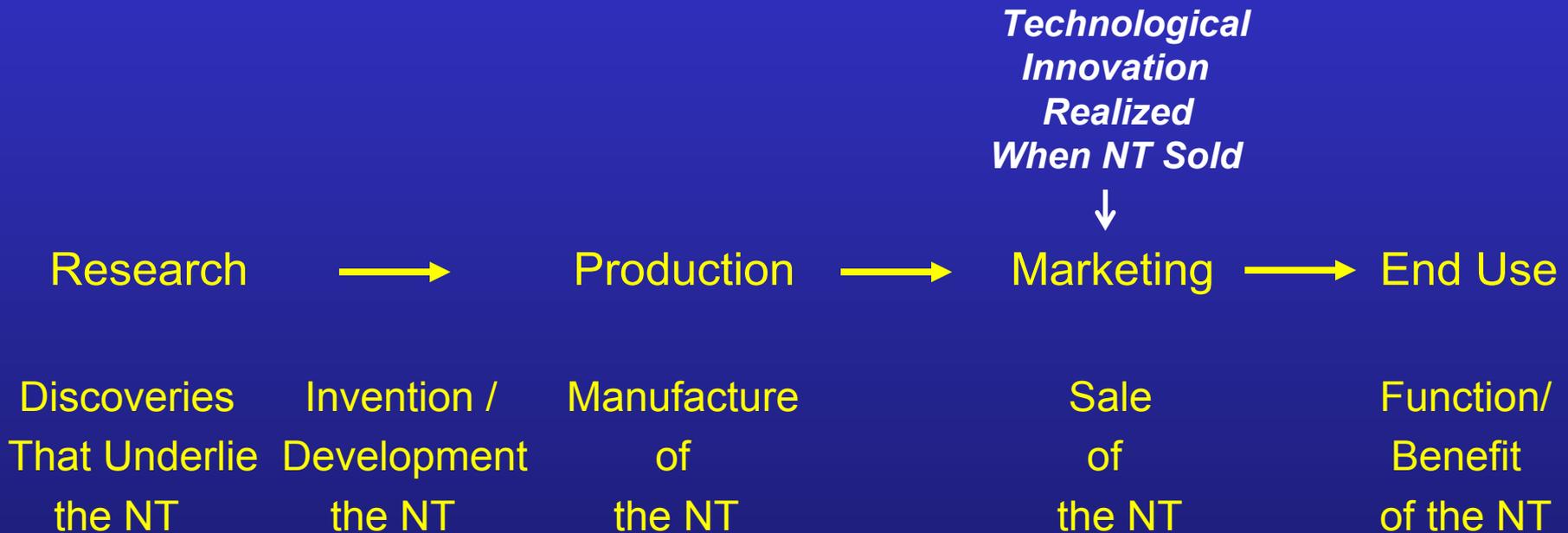
Technological Innovation = Introduction into Marketplace of New Technology
Moved from Research through Production and Marketing to End Use

*Technological
Innovation
Realized
When Sold*



Economic Model of Measurement Problems as Barriers to Technological Innovation

Technological Innovation = Introduction into Marketplace of New Technology
Moved from Research through Production and Marketing to End Use



The Datum of Input to the USMS Assessment An Industry Measurement Need (MN)

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, crafted, with documented support

Information Sources and Producers of USMS-Assessment Measurement Needs

Measurement Needs may be produced *from* information

- generated by a workshop, NIST-USMS or not, during or after the event
- synthesized from industry technology roadmaps, technology assessments, or technical reports
- compiled from surveys or interviews by any medium: letter, email, or phone

Measurement Needs may be produced *by*

- groups or individuals
- members of NIST
- agents of NIST, such as contractors, or
- persons not affiliated with NIST in
 - industry
 - universities
 - government

Authentication of Measurement Needs and Findings

To ensure the credibility of the Assessment report, each Measurement Need and each Finding derived from the set of Measurement Needs is to be authenticated

For MNs, authenticated means verified for fact and confirmed for significance by parties outside of NIST who are knowledgeable, representative, and can become backers of the follow-up actions to achieve solutions

For Findings, authenticated means similarly confirmed for soundness of judgment

Surveying the Space of Industry Measurement Needs

To achieve a broad survey of measurement needs,
the approach is to look at the overall space of measurement needs
from different perspectives, that is, from different bases,
at the same time in parallel

The Bases for the Survey of the Space of Measurement Needs

Sectors	Semiconductor, Automotive, Software
Technologies	Broad (including Nanotechnology, Bio-/Medical Imaging, Disaster First-Responder) and Discrete (including Workshop Topics)
Disciplines	Physics, chemistry, material science, electrical engineering, civil-mechanical engineering, manufacturing engineering, computer-IT sci-eng
SI Units	Mass, Length, Time, Electrical Quantities, Temperature, Amount Substance, Luminous Intensity

NIST USMS Effort

Roles, Responsibilities, Funding, Planned Actions

Products for Different Bases That Provide The Basis for the Assessment

<i>Area</i>		<i>Task-Product</i>
Each Sector		In-depth analysis of sector Section of assessment report > 5 measurement-needs (MNs)
Each Technology	Broad	Preamble text to MNs characterizing handling of such wide area > 5 MNs
	Discrete	> 5 MNs
Each Discipline		Preamble text to MNs characterizing “disciplinary” base > 5 MNs
Each SI Unit		> 5 MNs
Projected Total MNs		Minimum 135, potential 300-400

Responsibilities for Products for Different Bases

<i>Basis</i>	<i>Area</i>	<i>Responsible for Delivering Product to USMS Project</i>
Sector	Semiconductor Automotive Software	EEEL-assigned analyst MEL-assigned analyst ITL-assigned analyst
Technology	Broad Nano Med/Bio Image First Responder Others Possible	Chair Nano SWG Chair Bio/HC SWG Chair HS SWG Major-topic-workshop Lead
	Discrete/Topical	NIST Contact USMS Workshop Other workshops: some principal

Responsibilities for Products for Different Bases (cont)

Discipline	Physics/App-Physics	Director PL
	Chemistry/ChemE	Director CSTL
	Materials Sci&Eng	Director MSEL
	Electr-Electronic Eng	Director EEEL
	Mechanical-Civil Eng	Director BFRL
	Manufacturing Eng	Director MEL
	IT/Computer S&E	Director ITL
SI Unit	Mass	Director MEL
	Length	Director MEL
	Time	Director PL
	Electrical Quantities	Director EEEL
	Temperature	Director CSTL
	Amount of Substance	Director CSTL
	Luminous Intensity	Director PL

Milestones and Timeline

NIST Director Reviews DAS Vision / Objective / Approach	Oct 3
NIST SMB Adopts V / O / A	Oct 5
OUs Send Assigned Staff to 1 st USMS Task Group Mtg	Oct 12
OUs Produce 1 MN for Each Discipline and SI Unit	Oct 27
Task Group Produces Implementation Plan	Nov 1
Initiate Series of Training Workshops for Producers of MNs	Nov 18
Initiate Executive-Outreach-USMS to ~100 Orgs	Dec 2
<u>VCAT Briefing on USMS</u>	<u>Dec 13</u>
Assigned-Min-Number MNs from OUs, SWGs, Sectors Due	Jan 6
Initial Analysis of MNs Carried Out and First Findings Made	Feb 1
Finalized MNs for All But Late-Date Workshops Due	Mar 1
Authentication of Findings and MNs Completed	April 17
Report Drafted and Submitted to NIST Editorial Review	May 26
Report Delivered to NIST Director	Jun 14
<i>Report Distributed and Follow-Up Actions Initiated</i>	<i>Summer</i>

Conclusion

NIST has adopted a new vision for its USMS effort

It is based upon the NIST Director's strategic vision of the role of NIST in technological innovation

It builds upon of the solid legacy of prior NIST USMS work under then Acting NIST Deputy Director, Rich Kayser

It is being implemented through the effort of many talented people across NIST working with others like themselves in industry

It benefits immensely from the support, commitment and engagement of the NIST OU Directors

As a result, I am confident that our June objective is a worthy one, that we will meet it, and that it will yield substantial benefit

Hope you agree. Thank you for your attention and I'll be happy to address any questions you may have

Members of NIST USMS Task Group

Dennis Swyt, *Project Director*

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Workshop Coordinator

David Hermreck, ATP

Economists

Gary Anderson, ATP

John Nail, ATP

Stephanie Shipp, ATP

Grey Tasse, DO-PO

MSDCG Chair

Al Parr

Responsibilities, Organization, Funding of Centralized Activity of NIST USMS Effort

The USMS Task Group is responsible for the planning and coordination of the NIST USMS effort and production of the assessment report that is its current primary objective

Each of the NIST OUs contributes and pays for a fractional-time, other-duty-as-assigned representative to the TG

Three OUs also contribute nominally-full-time sector analysts, two paying salary and one, due to special circumstances, half

The projected \$1100K centrally-funded budget for the USMS project pays for the salaries of the Project Director, part-time administrative support person, and half of one sector analyst and for support of USMS-sponsored workshops, travel, and contractor support to analysis of technology trends, measurement needs, and the state of USMS

Examples of Measurement-Problem Barriers to Technological Innovation

- Barrier at Marketing A U.S. instrumentation company develops a digital multi-meter with linearity and precision that it believes, but cannot prove to customers, far beyond anything else commercially available
- Barrier at Mfg U.S. producers of integrated-circuit photomasks cannot reproducibly establish the widths of the new-generation features on the masks they are making because of mysterious discrepancies in measured widths
- Barrier at R&D U.S. developers of carbon-nanotube based materials are stymied in getting predictable results by inability to define the composition of the nanotube additive in terms of purity, count and distribution of lengths of nanotubes