Importance of NIST Calibration Services to the U.S. Army

Presentation to the NIST Visiting Committee on Advanced Technology

Larry Tarr, Director
US Army Primary Standards Laboratory
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Overview

- Army Metrology & Calibration Program
- NIST MetCal services utilized by the Army
- Leverage of NIST calibration services
- Impact of NIST calibration services on the warfighter
- Issues, comments and suggestions

Mission of the U.S. Army MetCal Program

- To execute the Department of the Army test, measurement, and diagnostic equipment (TMDE) calibration and repair support program in accordance with approved authority (AR 750-43)
- To ensure that all measurements made with calibrated TMDE are traceable to NIST, to fundamental natural constants, or to other approved sources
- To provide calibration and repair support for all Army systems and TMDE worldwide
- To serve as the principal resource of metrology expertise and technical support for all Army systems

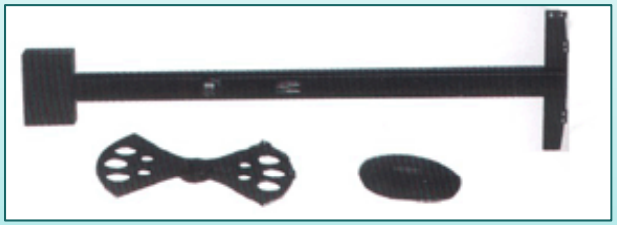
Rationale for Calibration and NIST Traceability

- **The Army's calibration support mission is the keystone of the Army TMDE diagnostic & maintenance program**
  - **Operation and maintenance manuals, schematics, troubleshooting flowcharts, decision trees, automated procedures & diagnostic software routines all assume that measurements are accurate and correct.**
  - **The best diagnostic tools on the battlefield, in the depot, and in R&D labs are useless if the detected measurements are incorrect.**
  - **Uncalibrated TMDE can provide false readings that lead to wrong diagnosis, incorrect troubleshooting paths, wasted time, incorrect parts replacements, extended weapon system downtime, and potentially faulty repairs.**
- ***Lack of, or faulty calibration can cause mission failure, injury, or death.***

Our Mission Depends Upon an Unbroken Traceability Chain

NIST Traceable Gage Blocks
Uncertainty: 0.0005 %

NIST Traceable Mass Standards
Uncertainty: < 0.001 %

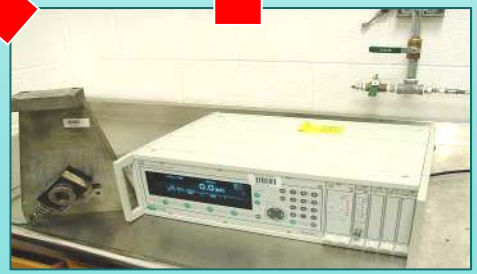


Reference Moment Arm Stds
Uncertainty: < 0.03 %

Reference Mass Standards
Uncertainty: < 0.01 %

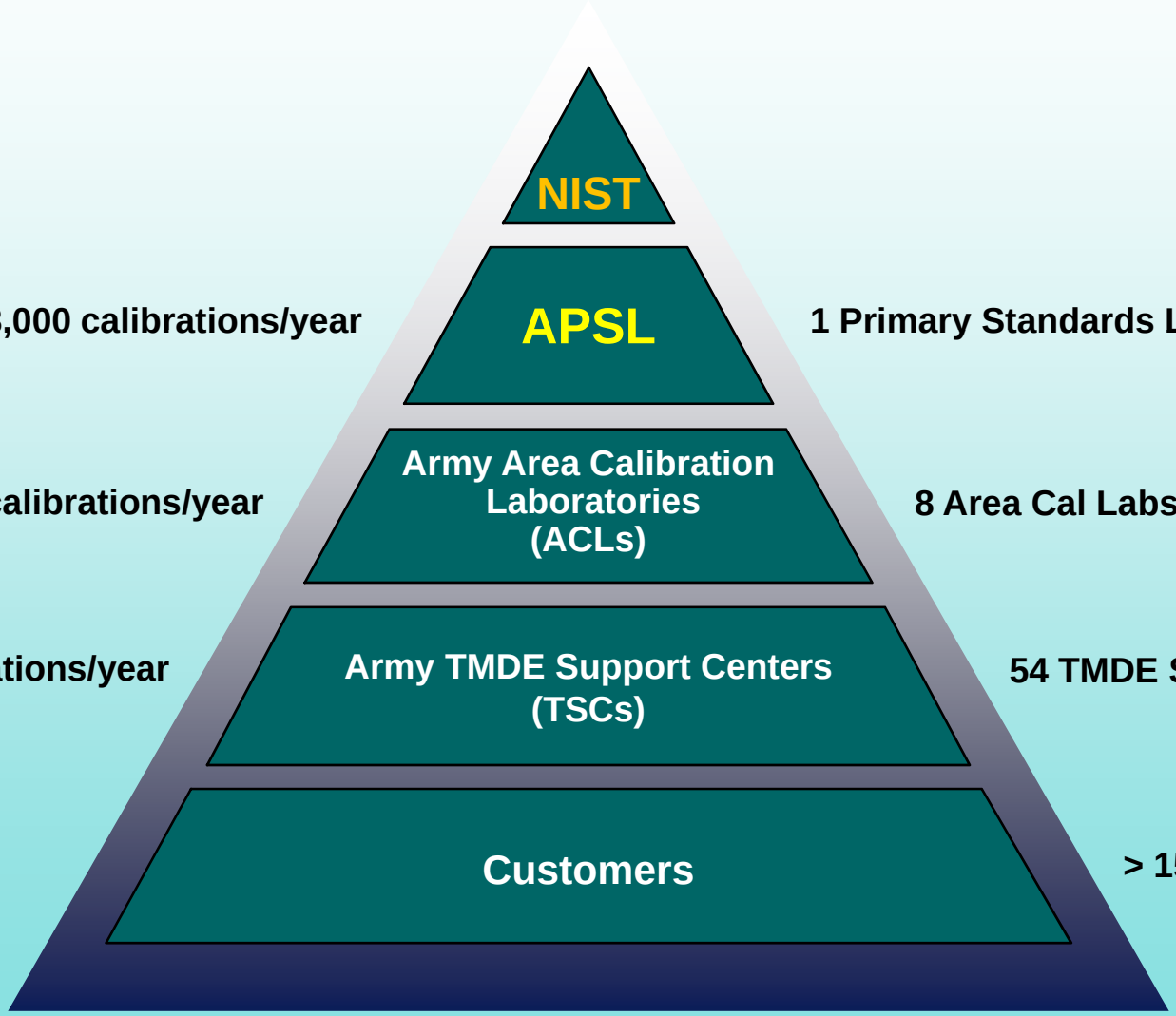
Fastener Torque Requirements
Throughout the Apache System

Torque Wrench
Uncertainty: 4-5%



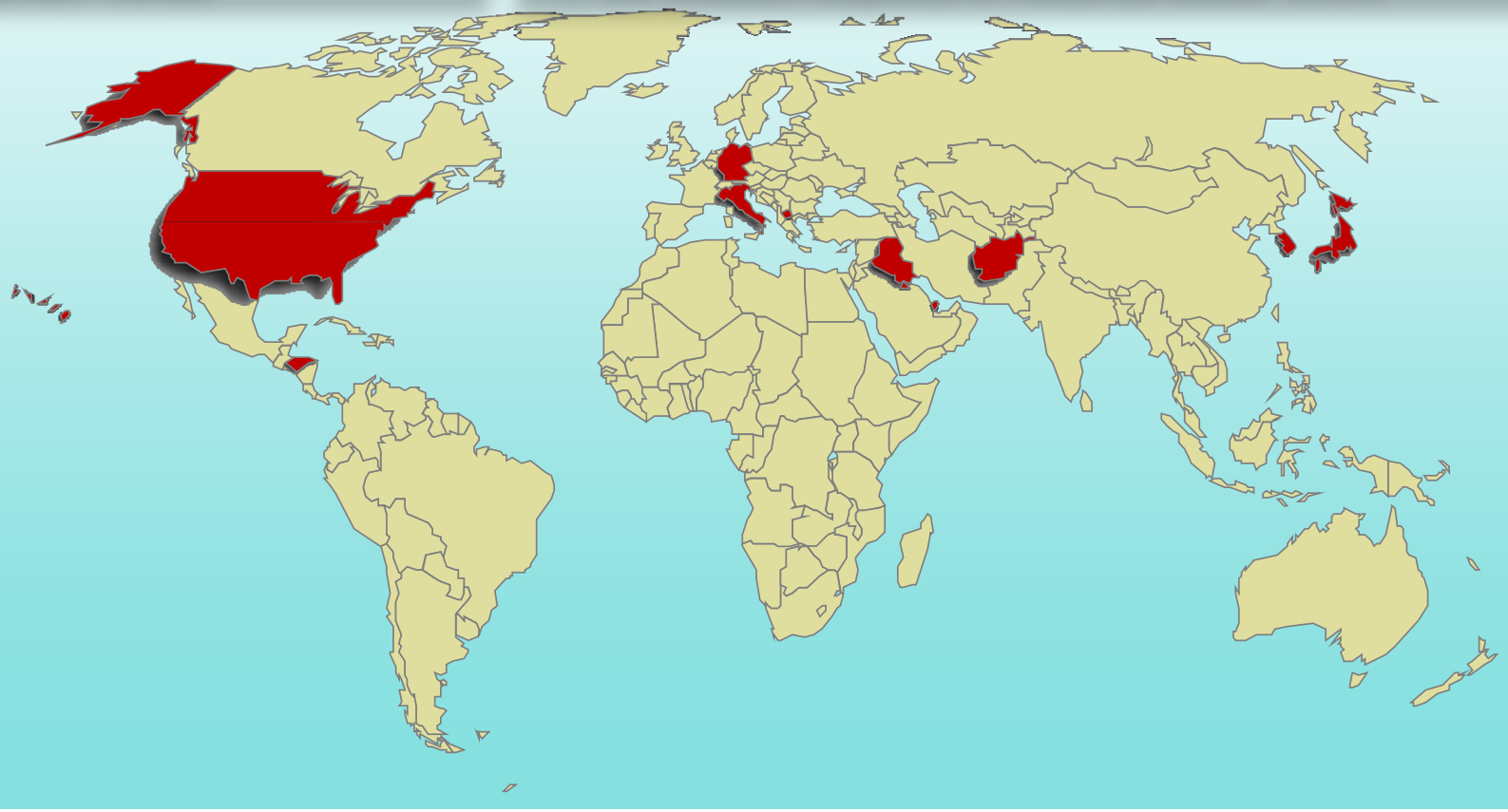
Transfer Lab MGC Plus
Torque Readout & Cell
Uncertainty: 0.5 %

U.S. Army Calibration Traceability



Scope of the U.S. Army Metrology & Calibration World

- 61 support activities
  - 26 States
  - 12 Countries
- 750,000 items of TMDE enrolled in the cal program (including National Guard)
- $84,000,000 Budget
  - 77 % Direct Army
  - 23% Reimbursable
- 650 employees
  - 35 different job series
  - 9 career fields
- Army Radiation Dosimetry Mission
  - 200,000 Dosimetry devices processed annually
  - > 12 million exposure records since 1954



Our Customers

- *ARMY CUSTOMERS*
- *OTHER DOD CUSTOMERS*
- *NON-DOD CUSTOMERS*
- *15,000+ CUSTOMERS*

NIST Measurement Services We Utilize

FY10 Army Requirements for NIST Calibration Services

Parameter Area	NIST Calibration Fees	Percent of Total
Physical/Dimensional	206,246	22.0
Electrical	153,763	16.4
Microwave/Millimeter-Wave	285,211	30.4
Radiation/Nuclear Counting	292,668	31.2
Total:	**937,888**	

NIST Services We Utilize (FY10 Details)

Electrical Parameter Area	NIST Calibration Fees	Percent of Total
AC Voltage	94,824	57.9
AC Current	34,610	21.1
Resistance	15,275	9.3
Fast Electrical Pulse Tr	10,000	6.1
Capacitance	6,788	4.1
VOR	2,266	1.4
DC Voltage	0	0.0
Inductance	0	0.0

Physical / Dimensional Parameter Area	NIST Calibration Fees	Percent of Total
Liquid/Gas Flow	61,963	30.0
Thermometry	41,226	20.0
Dimensional	33,460	16.2
Accelerometry	26,304	12.7
Force	17,400	8.4
Acoustics	17,256	8.4
Aerosols	5,000	2.4
Mass	3,700	1.8

RF/Microwave/MMW Parameter Area	NIST Calibration Fees	Percent of Total
Power	118,752	41.6
Attenuation (2-ports)	58,090	20.4
Mismatch (1-ports)	49,290	17.3
E-field Intensity	37,000	13.0
Airlines	22,079	7.7

Other NIST Services Critical to the Army & DoD

- **Metrology R&D projects**
  - **Coordinated through tri-service Calibration Coordination Group**
  - **Development of new / improved measurement standards, systems, and techniques**
  - **Solution of metrology problems critical to the military**
  - **More than 400 metrology R&D projects completed since 1970**
- **Consulting**
- **Measurement Assurance Programs**
- **Interlaboratory Comparisons**
- **NIST tutorials and training programs**

IMPACT OF NIST CALIBRATION SERVICES

- **Critical to maintaining operational readiness of EVERY Army system (aviation, missile, radar, communication, navigation, intelligence, etc.)**
- **Ensure compliance with mandatory traceability requirements for all calibrations performed by Army or contractor personnel**
- **Provide critical link in development of new and emerging technologies**
- **Directly connected to personnel and operational safety when systems requiring calibration are involved**
- **Serve as the critical first link in the traceability chain that is leveraged to support significant numbers of TMDE**

Impact of NIST Services (continued)

Examples of leveraged NIST calibrations:

4 – NIST calibrated weights

400 – APSL calibrated weight sets

4,400 – S/T level calibrated weight sets

16,000 – scales, balances, torque cells, and dead-weight pressure standards

> 200,000 – torque wrenches & pressure-indicating devices

Impact of NIST Services (continued)

Example:

1 – NIST calibrated HVA-100 high-voltage standard

22,006 – Air Force equipment items

Example:

1 – NIST calibrated DT72A inductive voltage divider

158,097 – Air Force equipment items

Impact of NIST Services (continued)

Example:

8 – NIST calibrated RADIAC standard artifacts

> 90,000 – Army & National Guard RADIAC instruments

Example:

1 – NIST calibrated RADIAC standard artifact

> 200,000 – TLD radiation dosimeters

- Issues -
First, the Kudos

- Quality of NIST metrology services is very good!
- Usually receive quick response to questions and inquiries
- NIST staff always professional, cordial, and genuinely care about the quality of the services they provide
- Continuous improvement is the norm, not the exception
- Greatly appreciate the willingness of NIST staff to take the time to address technical issues and questions

Issues and Concerns

- Long turnaround times
  - Sometimes many months (or longer)
  - Suggest notification of customer if delays are anticipated
  - Test reports sometimes lag equipment by months
  - Consider sending PDF reports (provisional or final) with equipment, if available
  - Consider greater use of batch scheduling

Issues and Concerns

- High cost of NIST calibrations
  - NIST calibration fees have risen significantly in the last few years (e.g., DC current shunts more than 2x other NMIs .. $45K NIST vs $20K NRC)
  - Would like to know of cost increases as far in advance as possible
  - When costs get prohibitive, we look for other NMIs and/or accredited labs offering comparable services, having MRAs with NIST
  - Consider greater use of non-senior metrologists for “routine” NIST calibrations

Issues and Concerns

- Discontinuation or cutback of NIST services
  - High voltage AC
  - VNA airlines
  - Inductance?
  - Consider off-loading NIST services to competent, accredited labs in the public and private sectors, retaining the traceability to NIST via MAPs, periodic surveillance, etc.

Issues and Concerns

- **Widespread concern about loss of key NIST personnel due to retirement, frequently not replaced**
- **Widespread concern about perceived funding shortages for NIST measurement services**
- **As a stakeholder in the Department of Defense, I believe that funding for NIST measurement services is inadequate to support the existing and emerging technologies utilized by DoD systems and TMDE.**

Questions?