



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

Presentation to the NIST Visiting Committee
on Advanced Technology

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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.***



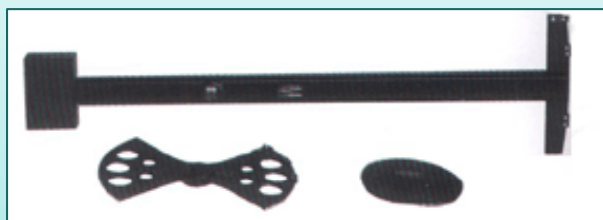
Our Mission Depends Upon an Unbroken Traceability Chain



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%

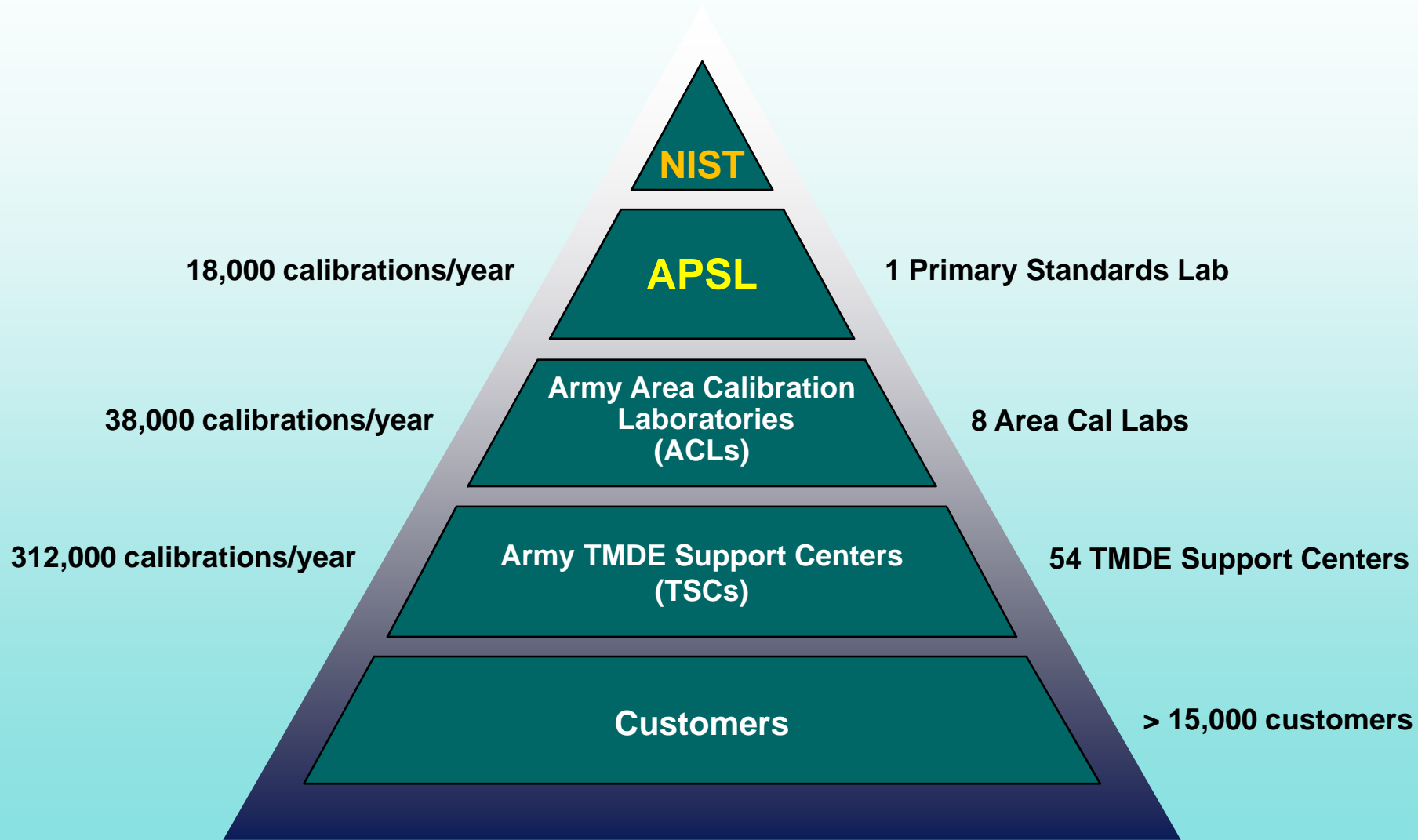


Transfer Lab MGC Plus Torque Readout & Cell
Uncertainty: 0.5 %





U.S. Army Calibration Traceability





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



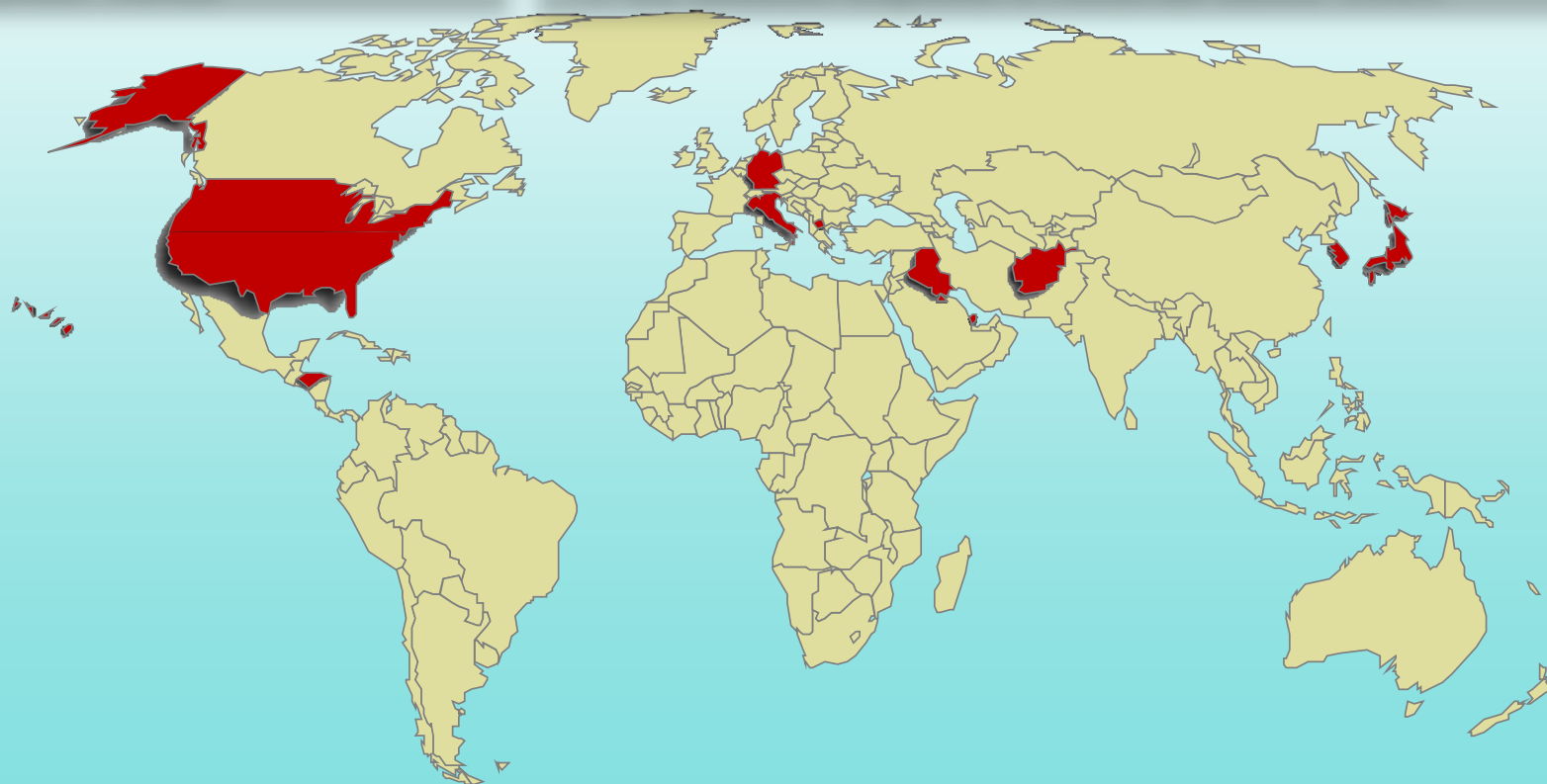
61 support activities
- 26 States
- 12 Countries

**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





NIST Measurement Services We Utilize



FY10 Army Requirements for NIST Calibration Services

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



NIST Services We Utilize (FY10 Details)



<u>Electrical Parameter Area</u>	<u>NIST Calibration Fees</u>	<u>Percent of Total</u>
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

<u>Physical / Dimensional Parameter Area</u>	<u>NIST Calibration Fees</u>	<u>Percent of Total</u>
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

<u>RF/Microwave/MMW Parameter Area</u>	<u>NIST Calibration Fees</u>	<u>Percent of Total</u>
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?

