Boeing Perspective on NIST Measurement Service

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Boeing Perspective on NIST Measurement Service

- NIST measurement services Boeing relies upon
- Impact to Boeing for these services
- Capability Sought from NIST
- Issues related to NIST measurement services (e.g., timeliness, gaps, priorities)?
- Noted Improvements

Boeing Products

Boeing is the world's largest, most diversified aerospace company

- Design, assemble and support
  - Commercial jetliners
  - Defense systems
  - Satellites and launch vehicles
- Integrate large-scale systems; develop networking technology and network-centric solutions
- Develop advanced systems and technology

Boeing Products rely upon NIST traceability and support

- Boeing performs ~500,000 calibrations a year
- Supports both test and production environments
- All Parameters
  - Mechanical
  - Physical
  - Dimensional
  - Optics
  - Electrical/Electronic

NIST measurement services Boeing relies upon

Vacuum:

- We send our vacuum standards to NIST for re-calibration

Pressure:

- We are relying on the manufacturer's calibration for traceability to NIST

Mass:

- Very rarely do we send in a weight or weight set for mass measurement, we are now performing our own weighing calibration using weighing schemes and software provided by NIST

Photometry:

- Standard Radiometer and Color filter calibration
  - Calibrations of a meter used to calibrate the output and "color temperature" of lamps
  - Spherical Candlepower lamps
    - Calibration of lamps used to calibrate large integrating spheres
  - Surface Gloss
    - Calibrations of a black glass tile used to standardize our Gloss parameter

NIST measurement services Boeing relies upon

Radiometry:

- Heat Flux
  - Calibration of our primary calorimeter used for fire testing calibrations

Fiber Optics:

- Power meter – used to measure fiber optic power and attenuation

RF Frequency measurement and Analysis Service:

- RF power 100 kHz to 40 GHz
- Thermal Voltage converters to 100 MHz
- Gain and Polarization Calibrations of Standard Antennas using extrapolation range.
- Electromagnetic Field Strength
- S-Parameters Inter-comparisons

Time and Frequency:

Impact to Boeing for these services?

Mass:

- NIST provided software and training has allowed Boeing to become independent in supporting Mass calibration needs

Vacuum:

- Rely heavily on NIST support in this parameter

Dimensional:

- This parameter currently has 22 primary standards used to establish our traceability for a broad variety of measurement applications.
  - Half of these standards are measured directly by NIST on an established cycle
  - The other half are inter-compared through control processes within our labs using initial traceable measurements from NIST
  - When we see a drift or change beyond a control limit, we would go back to NIST to re-verify the initial traceable measurement.

RF Frequency measurement and Analysis Service:

- NIST provides us the lowest uncertainties for the services that we contract for

Capability sought from NIST?

Greater focus on calibration support:

- NIST decreased focus on calibrations in support of industry has caused us to seek other options for obtaining traceability
  - Often creates export control issues and long delays
  - NIST funding issue?
- Look to NIST data for resolution of disagreements in measurement results

NVLAP:

- Would like to see NVLAP accreditation parameter, range and accuracy by vendor as a searchable database or available data file.
  - We could really use that to highly automate the source qualification/selection process.
  - Probably need a data standard for the data, and a data service to get it.
  - Would be even better if all accrediting bodies used it as well

Pressure:

- An ILC could provide better confidence in our measurements
- Conducted several years ago with deadweight pressure gauges (testers) with favorable results

Capability sought from NIST?

Density:

- Traceability of density within the range of 1.3 - 1.7 density (specific gravity)

Torque:

- Currently obtain traceability for pneumatic through a German supplier

Calorimeter calibrations:

- NIST provides calibrations up to 5 W/cm2. We could use calibrations with maximum levels at least two times greater than this

LED calibration support:

- This is a newer field and we need some guidelines as to how to calibrate LEDs,
  - Equipment needed
  - How to provide LED calibration services for our internal customers

Flow:

- MCV calibrations
  - Currently use Vendor calibrations from CEESI
  - Accuracy needed - 0.1% to 0.5% depending on requirements

Thermistor Mounts:

- Linearity

Capability sought from NIST?

SCREW THREAD CALIBRATION

- **Situation:**
  - The ASME B1 standards, which were adopted from previous standards, have not fundamentally changed since the 1940's. Gage calibration and end product inspection requires much better definition than what is currently defined in the B1.
  - Threaded products are significant and are high volume
  - Gage tolerances need to be realistically aligned with measurement capabilities
    - A significant percentage of gages are rejected because their tolerance specifications are nearly the same as the measurement uncertainties
  - End product inspection costs are therefore impacted
- **Proposal:**
  - Provide thread gage calibration services so that traceable thread standards can be obtained.
  - Assist in establishing new thread gage tolerance standards (B1.2) that are realistic in relation to measurement capabilities.
  - Assess the impact on product threads if gage tolerances are increased, and redefine new product tolerances, if necessary, so that product safety and reliability are maintained.

Issues related to NIST measurement services

Turn Time:

- Turn time consistently >3 months
  - Other national laboratories average 10-20 days flow plus 20 for procurement and customs.
  - Perception that research takes priority over calibrations and turn time
- **Vacuum**
  - Ion gauge calibration took over 1 year
    - NIST standard was down due to the lab move
  - Set schedule during the year for certain type calibrations resulting in a small window to send in any vacuum work
    - Negative impact if there is only one lab with the capability
- **Gloss Tiles**
  - 4 total measurements
  - > 5 months from the time we shipped it to the time we received it back

Issues related to NIST measurement services

Cost:

- The intense cost pressure we are under really puts us in a squeeze when a supplier is slow or expensive.
- NIST cost for calibrations are high (e.g. RF/microwave, Pressure, Thread wires)
  - Pressure calibration for deadweight piston gauges (testers)
    - $6600 per piston/cylinder assembly at NIST and $1300 at OEM
  - Fiber Optics primary standards calibrated by other national standards laboratories
    - Drivers are cost and turn time

Billing:

- Billing may take greater than 6 months
- Impacts yearly budgets and planning

Communication:

- Most communication initiated by Boeing
- Changes in NIST processes that may impact our operations
  - Changes in the processes in the past have led to a systematic shifts in our processes and we were not made aware of the process changes

Improvements made to NIST measurement services

Turn Time:

- The calibration of our Optical Power Meter from NIST (Boulder) went very smoothly and quick – less than 2 months

Communication:

- The customer service focal program at NIST
  - allows customers to call or e-mail directly to them with issues or concerns
  - quick response to requests

Thank you!