



Changes to the Calibration Base Line Program

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March 13-17, 2017
Sheraton Hotel in Silver Spring, Maryland

What is a CBL? Why is it important?

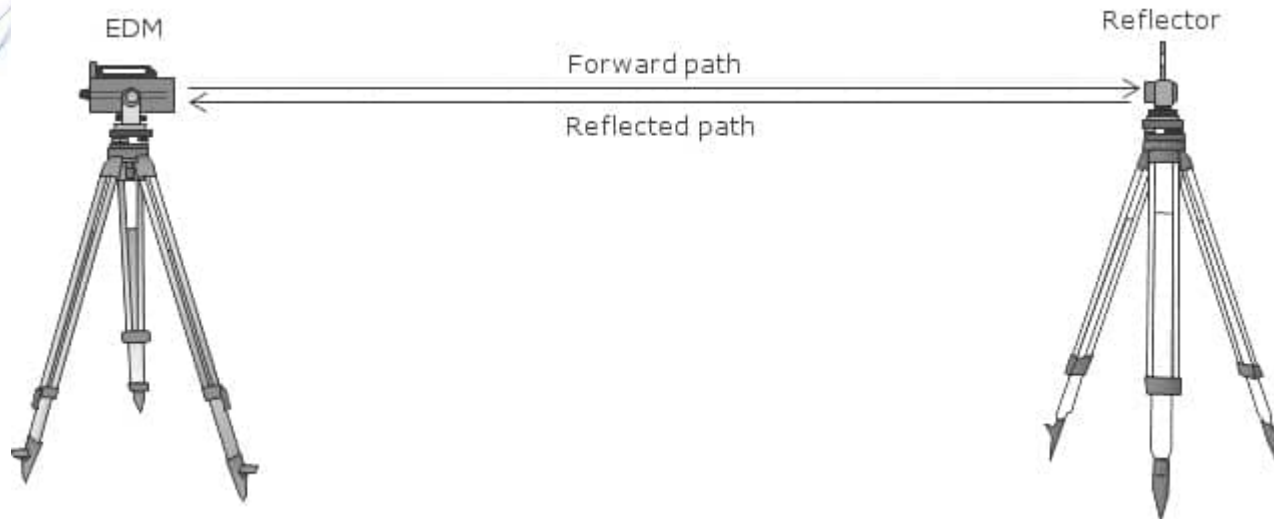


“the comparison of measuring devices to known values”



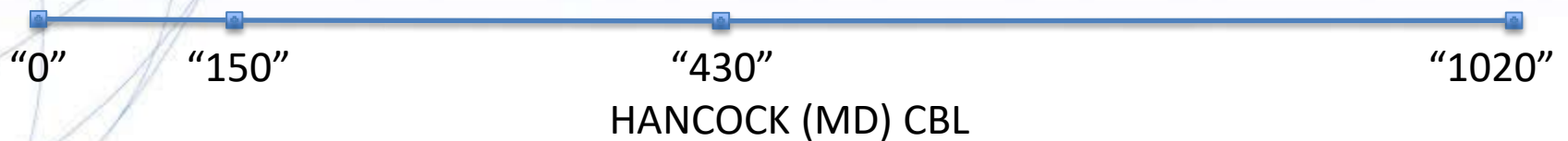
Paris, France - The public could bring meter rulers and check if they were accurate. A bar that just fit between the end stops was exactly one meter.

EDMI: electronic distance measuring instrumentation



Typical EDM configuration

How well does a set of EDM1 compare to known distances?



From	To	Horizontal Distance
"0"	"150"	150.0021 m
"0"	"430"	430.0786 m
"0"	"1020"	1020.0230 m
"150"	"430"	280.0765 m
"150"	"1020"	870.0209 m
"430"	"1020"	589.9444 m

NGS EDMC CBL Program (1974-1996)

- **NGS began establishing EDMC CBLs for internal use in the early 70s.**
- **By 1974, NGS began establishing EDMC CBLs for public use.**
 - CBLs of this time period included a “taped” section.
 - No other Federal agency was providing a mechanism for calibrating EDMC
- **The Corbin CBL was established in 1976**
 - Provided traceability to the national length standard
 - Provided a means of check calibrating instrumentation used to establish CBLs
- **NGS employees directly participated in CBL measurements.**
- **NGS partner set CBL marks and provided support during field measurements**
- **More of an NGS field activity than a program.**

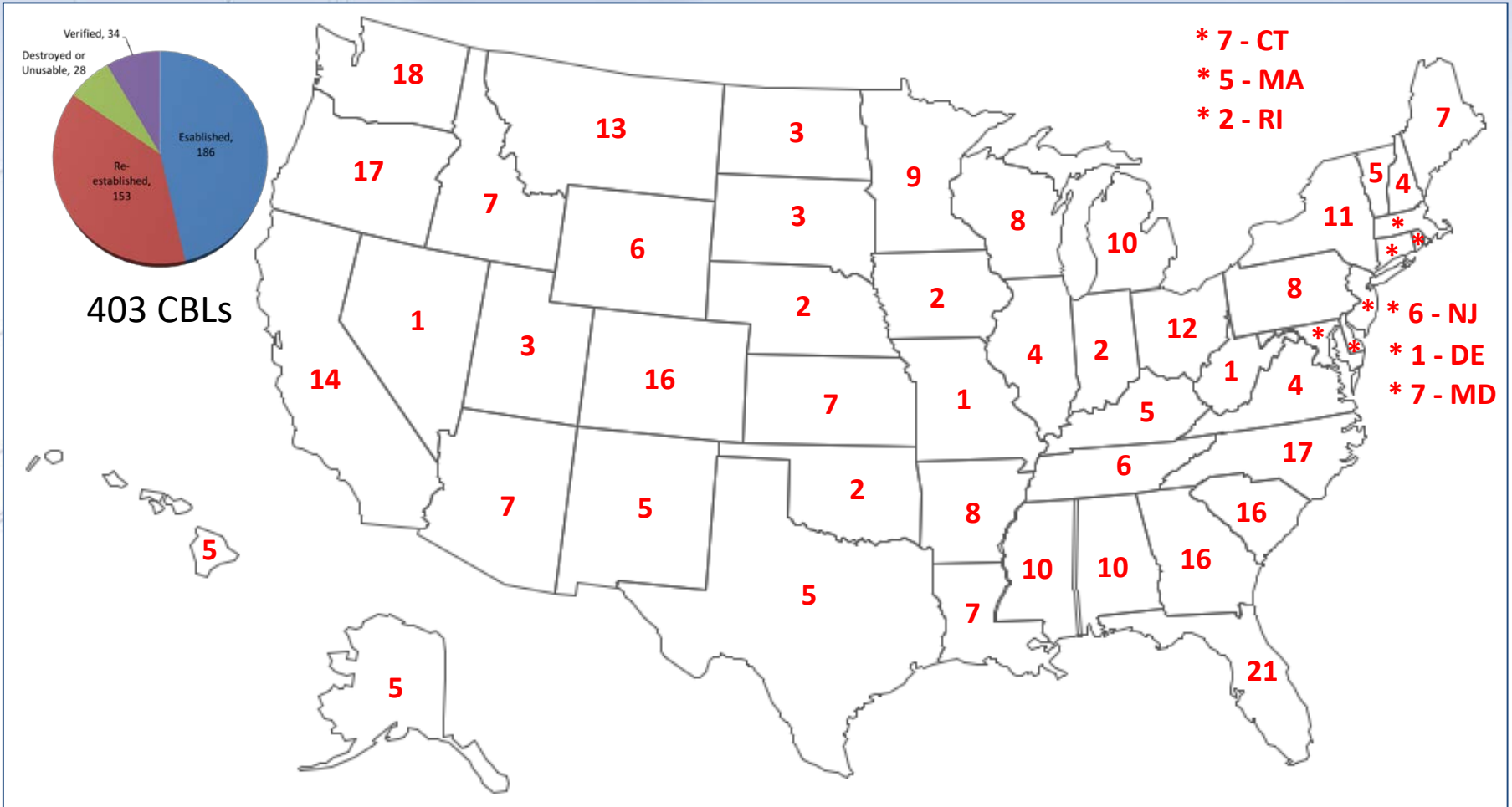
NGS EDMC CBL Program (1996-2010)

- **01/31/1996 the NGS ESC approved an NGS EDMC Calibration Base Line Policy.**
 - Partners wishing to establish or re-establish a local EDMC CBL entered into a cooperative agreement with NOAA/NGS.
 - The policy permitted NGS to be reimbursed for expenses associated with implementing the EDMC CBL program.
 - NGS no longer provided a taped segment of the CBL.
- **The NGS EDMC CBL program offered two ways to participate.**
 1. NGS would loan equipment to a qualified state society or government agency to make the field measurements - \$500 per CBL + shipping costs.
 2. NGS personnel would make the field measurements; \$2,500+ per CBL

NGS EDM I CBL Program (2010-2016)

- **10/2/2010 the NGS ESC approved a revised EDM I CBL Policy.**
 - The policy permitted NGS to be reimbursed for shipping and travel expenses associated with implementing the EDM I CBL program for those states without Geodetic Advisors.
- **The NGS EDM I CBL program offered two ways to participate.**
 1. If a state had a NGS Geodetic Advisor, then CBL measurements in that state would be overseen by the Advisor at no cost to State except for shipping of equipment
 2. If a state had no NGS Geodetic Advisor, then CBL measurements in that state would be overseen directly by CBL Program personnel, the interested party would pay for travel expenses and shipping costs.

November 2016 - Status of CBLs



2017 – Need for CBL Program Revision

- **The program is not sustainable as-is.**
- **Website should be more user-friendly.**
- **Onus for data collection is on NGS; has created latency issues.**
- **In most cases, partners are required to pay NGS travel expenses.**
- **Recent changes to the NGS Advisor Program are not reflected.**
- **NOAA property policy restricts loaning of equipment.**
- **Policy document does not meet current NGS formatting specs.**

Making the program sustainable

Establishing new CBLs; Verifying or remeasuring existent CBLs

- The program must rely on greater partner participation.
- Partners are invited to establish/maintain Cooperative CBLs (CCBL) as well as Federal CBLs (FCBL).
- When partners share CBL data,
 - NGS will provide necessary guidance, QA/QC, improved software, IT infrastructure and technical support.
 - To encourage participation, no minimum specs for EDM1 will be required, however,
 - Contributors must provide basic information about their EDM1 and follow procedures before their work can be shared.
 - For any new distances to be shared, a reversible optical plummet must be used.

CCBLs

Establishing/Remeasuring/Verifying

CCBLs for sharing at our website:

- Open to anyone with one EDM1, tested and in good working order
- Tested EDM1 must meet or exceed manufacturer's specs; usually stated as +/- (mm + ppm)
- CCBLs supported by NGS must be publicly accessible.

Establishing a new CCBL

- CBLs currently at the NGS website will be classified as FCBLs
- New CCBLs descend directly from a FCBL.
- Test one EDM1 on any FCBL against manufacturer's specs.
- Measure between all marks (both EDM1) on the new CCBL, forward and backward (Calibrate software). 4 marks = 12 distances.
- Measure a second occasion.
- Each segment of the adjusted occasions must agree

$$\pm\sqrt{0.0015^2 + (D * 10^{-6})^2} \quad (\text{NOAA TM NOS NGS 8})$$

- Retest EDM1 at FCBL

Verifying an existent CCBL

- **Test your EDM1 on any existent CCBL.**
- **Send data/metadata to NGS via website.**
- **Allows NGS to monitor and share reports on conditions of CCBLs.**

FCBLs

Establishing/Re-measuring/Verifying

Reminder: NGS will classify current CBLs as FCBLs.

- FCBLs for sharing at our website:
 - EDM(s) must meet or exceed manufacturer's specs when tested at the NGS Primary CBL; usually stated as +/- (mm + ppm)
 - EDM must agree with each other throughout the process.

$$\pm\sqrt{0.0017^2 + (D * 10^{-6})^2} \quad (\text{NOAA TM NOS NGS 8})$$

- FCBLs supported by NGS must be publicly accessible.

Establishing/remasuring a FCBL

- FCBLs must descend directly from the NGS Primary CBL (Corbin).
- Open to anyone with two EDMIs who is able to test them at Corbin.
- Receive a day of training at Corbin while testing EDMIs.
- At the new FCBL:
 - Measure between all marks (both EDMIs) on new FCBL, forward and backward (NGS Calibrate software).
 - In other words, measure any which way you can
 - Four-mark CBL yields 24 independent distances per occasion.
 - Measure a second occasion
 - EDMIs must agree with each other throughout the process.
 - Adjusted occasions must agree

$$\pm\sqrt{0.0015^2 + (D * 10^{-6})^2}$$

(NOAA TM NOS NGS 8)

- Retest EDMIs at Corbin
- Share data/metadata

Verifying an existent FCBL

- **Test your EDM I on any existent FCBL.**
- **Send data/metadata to NGS via website.**
- **Allows NGS to monitor and share reports on conditions of FCBLs.**

EDMI Testing: What's involved?

- **Run your EDM** over an appropriate CBL using NGS's Calibrate.
- **Measure each segment at least once (4 marks = 6 sets of obs.)**
- **Use Calibrate to Analyze**
- **Calibrate will compute:**
 - a constant value (a.k.a. index error) in meters.
 - a scale value in parts per million (ppm).
- **To pass, these values must be within the range of the mfr's specs.**

- **Example: Mfr. claims a standard deviation of +/- (2 mm + 2 ppm)**
 - The computed constant value must be between -0.0020 meters and +0.0020 meters
 - AND the computed scale value must be less than 2.0000 ppm
- **Share your results**

Improved Software

- **Calibrate software written by Malcolm Archer-Shee**
- **Window 7 and 10 compatible**
- **Connect EDM1 to laptop or tablet**
- **Works with most major instrument brands**
- **Unsupported EDM1 may be added upon request**
- **Works in tandem with WinDesc description software.**

Improved Website

- **Interactive map for locating CBLs**
- **Pop up window instantly:**
 - shows status/condition of CBL
 - provides hyperlinks to data page, description and latest reports
- **CBL proposal form for partners**
- **Data/metadata files submitted to NGS via ngs.cbl@noaa.gov**
- **FAQs and downloadable docs**

Support

- **Downloadable guidance documents**
 - **Revised Program Policy and Procedures**
 - **Revised/updated NOAA Technical Memorandums**
 - NOS NGS 8, Establishment of Calibration Base Lines
 - NOS NGS 10, Use of Calibration Base Lines
- **Personal instruction when establishing FCBL**
- **QA/QC on all data before public sharing**
- **Technical support by phone/email for contributors**