



presents

LIGHTNING PROTECTION 101

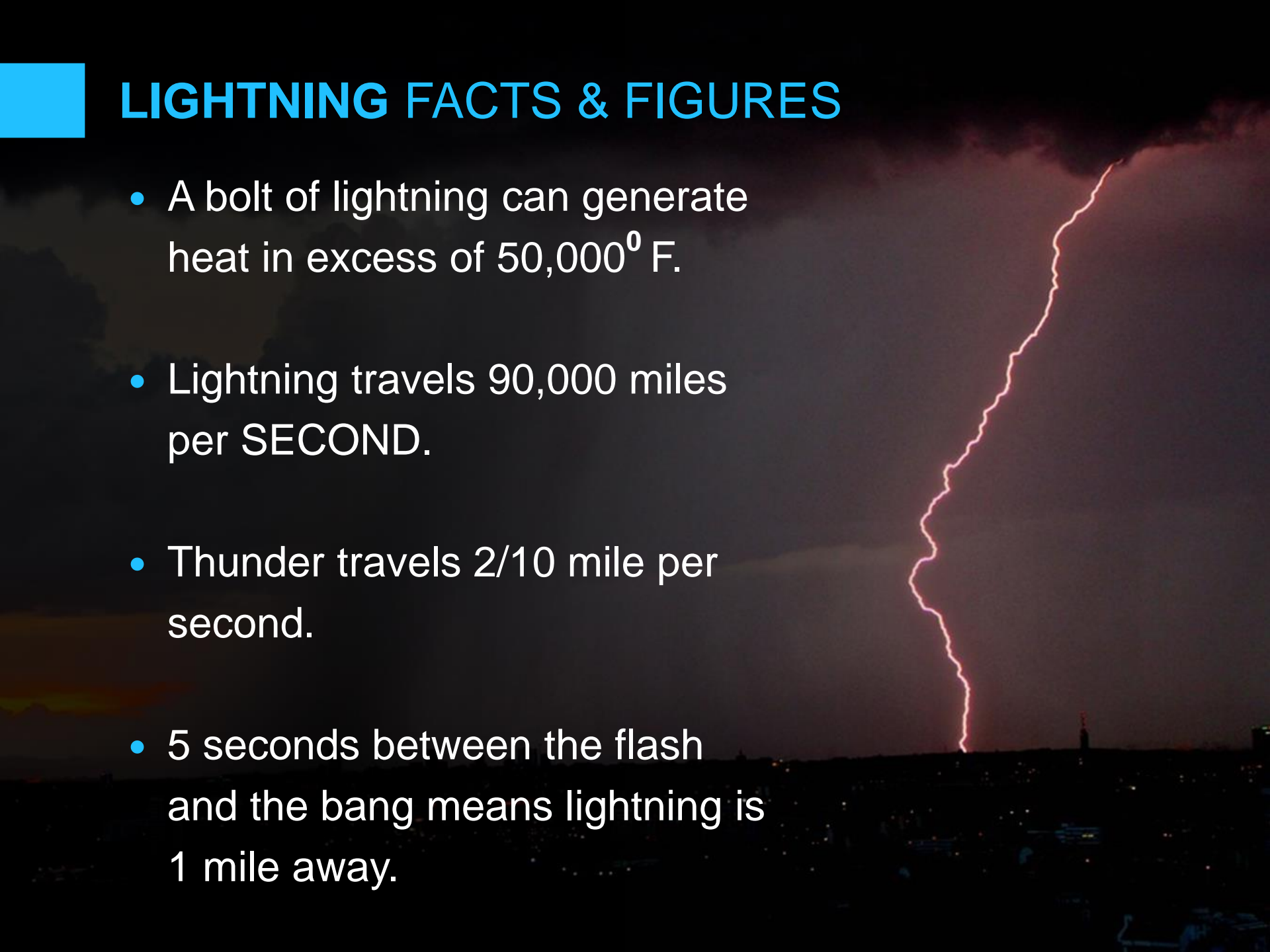
24 Lanson Drive, Winsted, CT 06098 - Telephone 860-379-5946
www.lightningsafetyalliance.org

OVERVIEW

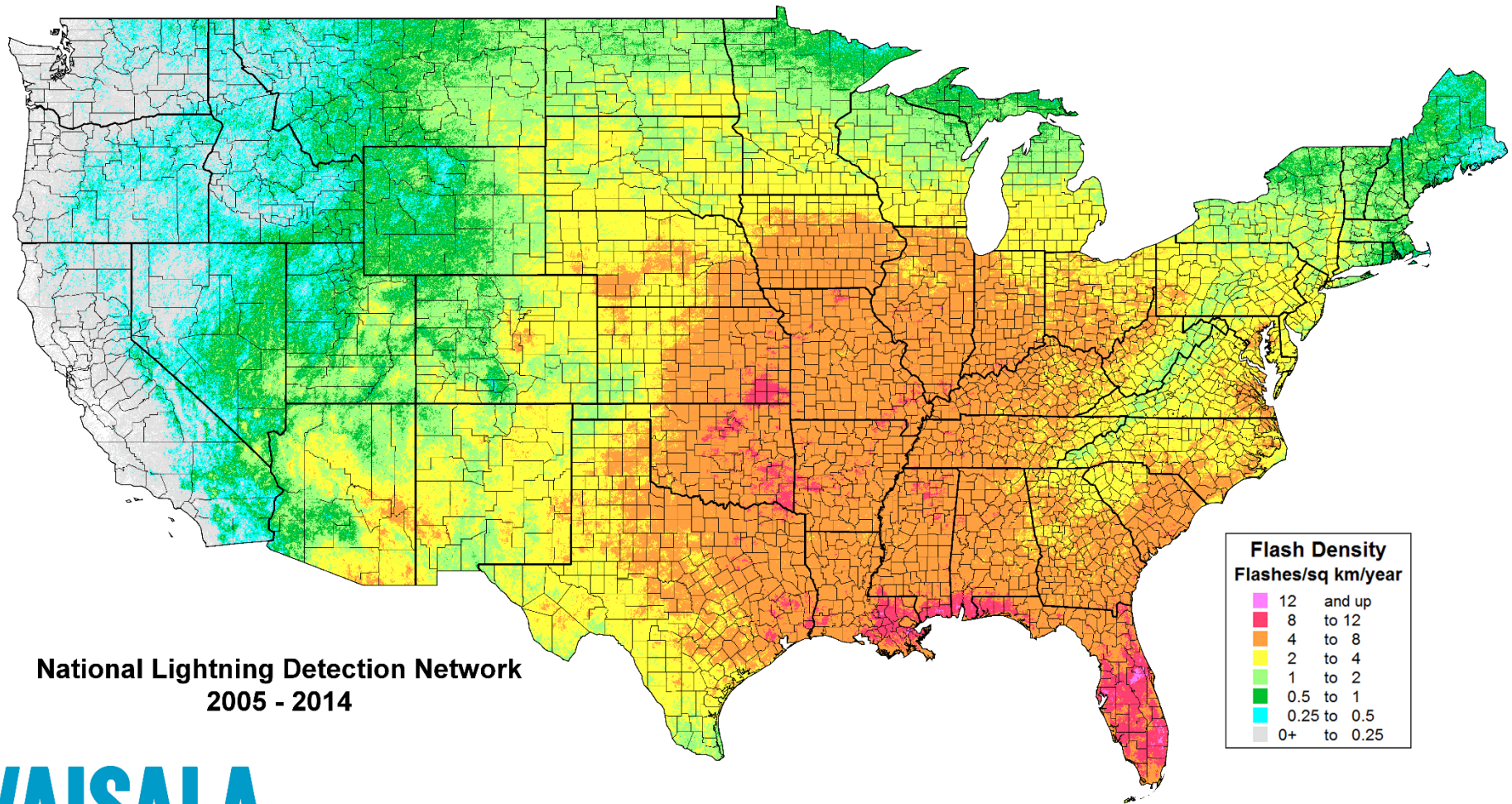
- Lightning Facts & Figures
- What is Lightning?
- Elements of the Lightning Protection System
- Standards & Requirements
- Quality Assurances
- Beware of Non-Conventional Methods

LIGHTNING FACTS & FIGURES

- A bolt of lightning can generate heat in excess of 50,000⁰ F.
- Lightning travels 90,000 miles per SECOND.
- Thunder travels 2/10 mile per second.
- 5 seconds between the flash and the bang means lightning is 1 mile away.



Lightning strikes the US 20 millions times each year.



VAISALA

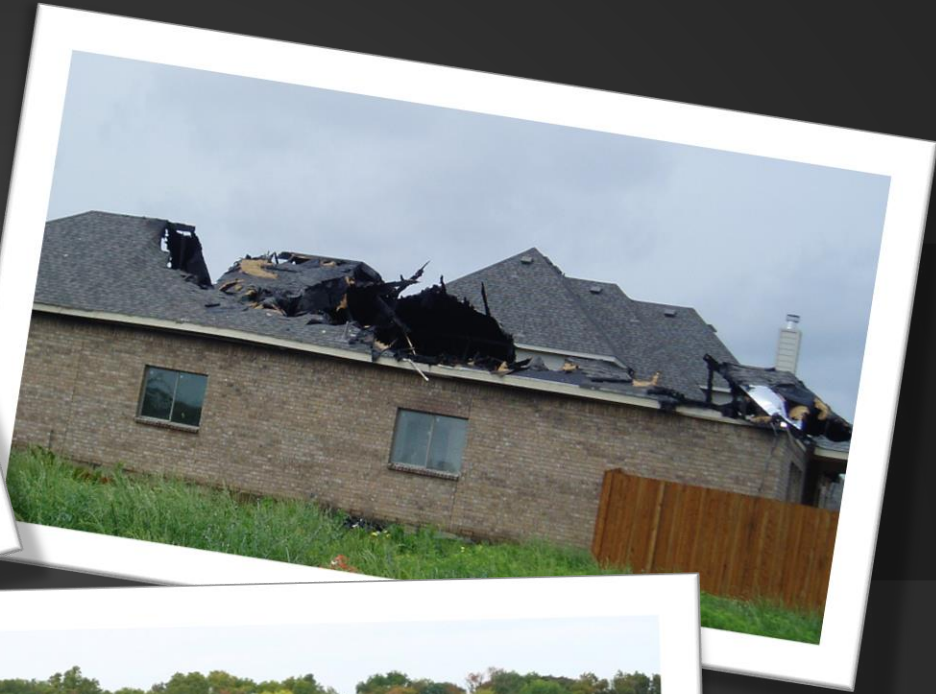
The background of the slide is a dark, semi-transparent overlay on a pattern of US dollar bills. The bills are mostly \$100 bills, with the portrait of Benjamin Franklin visible. The text 'SAFETY & ECONOMIC CONSEQUENCES' is written in a bright blue, sans-serif font. To the left of the text, there is a solid blue square.

SAFETY & ECONOMIC CONSEQUENCES

- 3-5% of all commercial insurance claims are lightning related.
- Annual property losses due to lightning in the United States exceed \$1 billion.
- The FAA estimates that lightning costs the airlines \$2 billion annually in operating costs and passenger delays.
- Lightning is the leading cause of all church fires.
- Lightning is one of the leading causes of weather related deaths.
- 250,000 insurance claims for lightning damage are paid every year. – Average claim is \$7400.



DEVASTATION



DEVASTATION



DEVASTATION

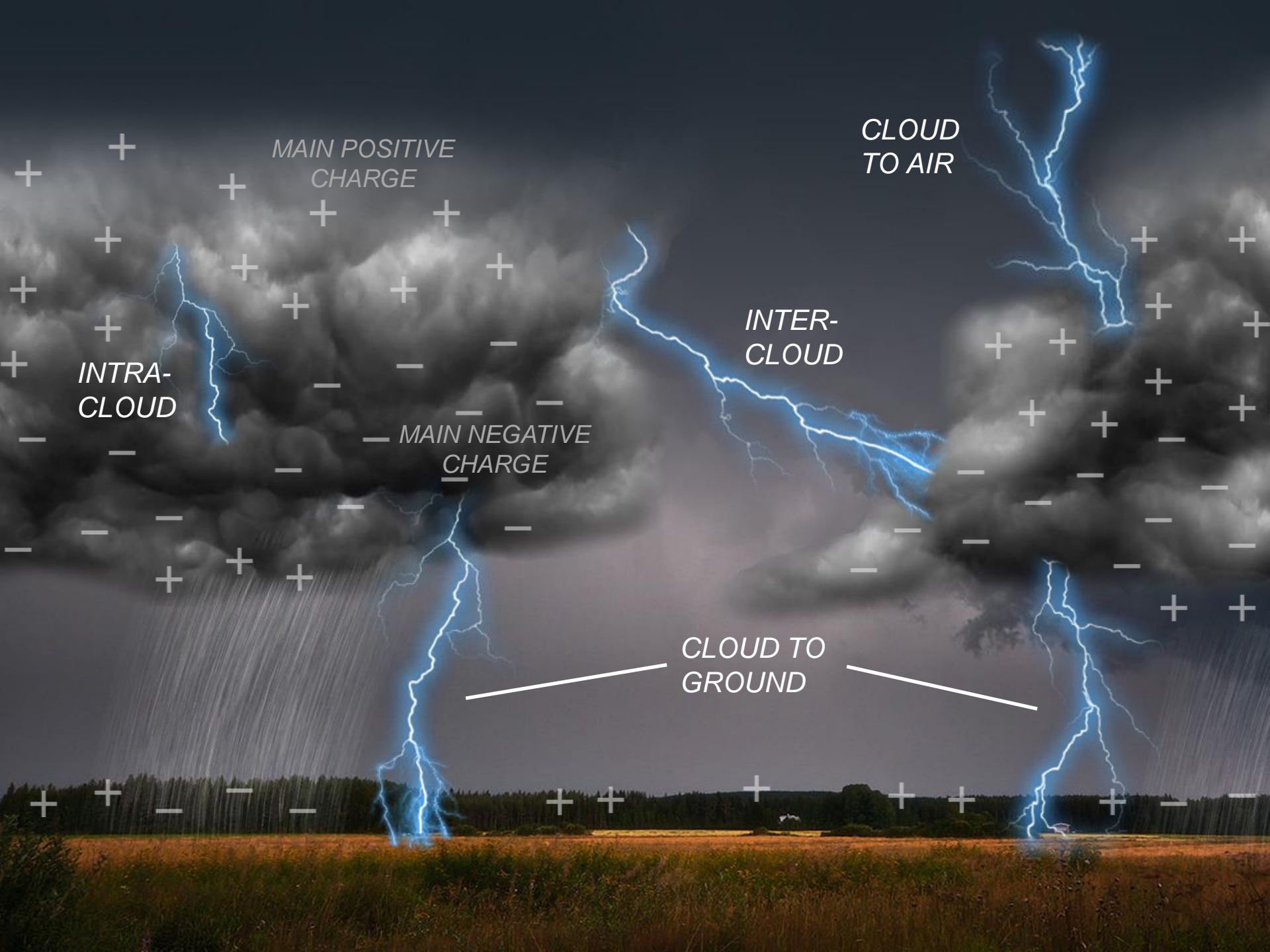
06-03-2014 05:14:57 PM

BOX OFFICE 2



WHAT IS **LIGHTNING**?





MAIN POSITIVE
CHARGE

CLOUD
TO AIR

INTRA-
CLOUD

INTER-
CLOUD

MAIN NEGATIVE
CHARGE

CLOUD TO
GROUND

HIGH SPEED VIDEO (5fps Playback)



HIGH SPEED VIDEO (5fps Playback)

51,500 feet elevation →

LMA Source Height
(meters)

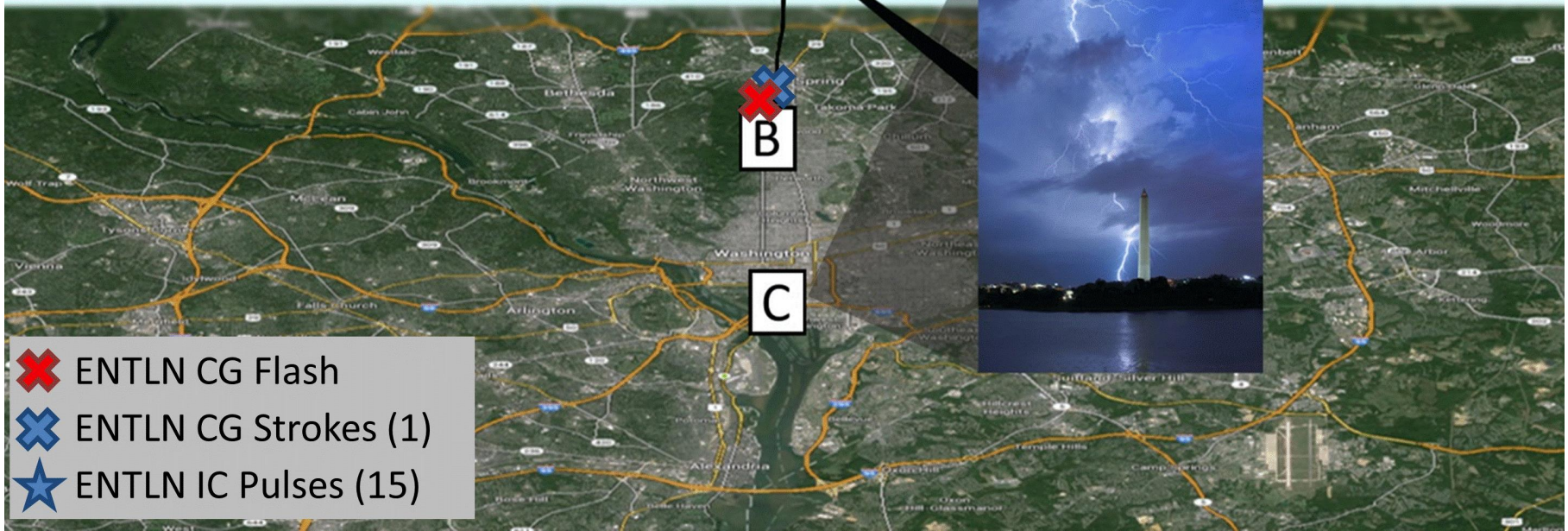
- < 4,000
- 4,000 - 5,000
- 5,000 - 7,000
- 7,000 - 9,000
- 9,000 - 11,000
- 11,000 - 13,000
- > 13,000

Lightning Plot

June 25, 2014, 9:35 pm

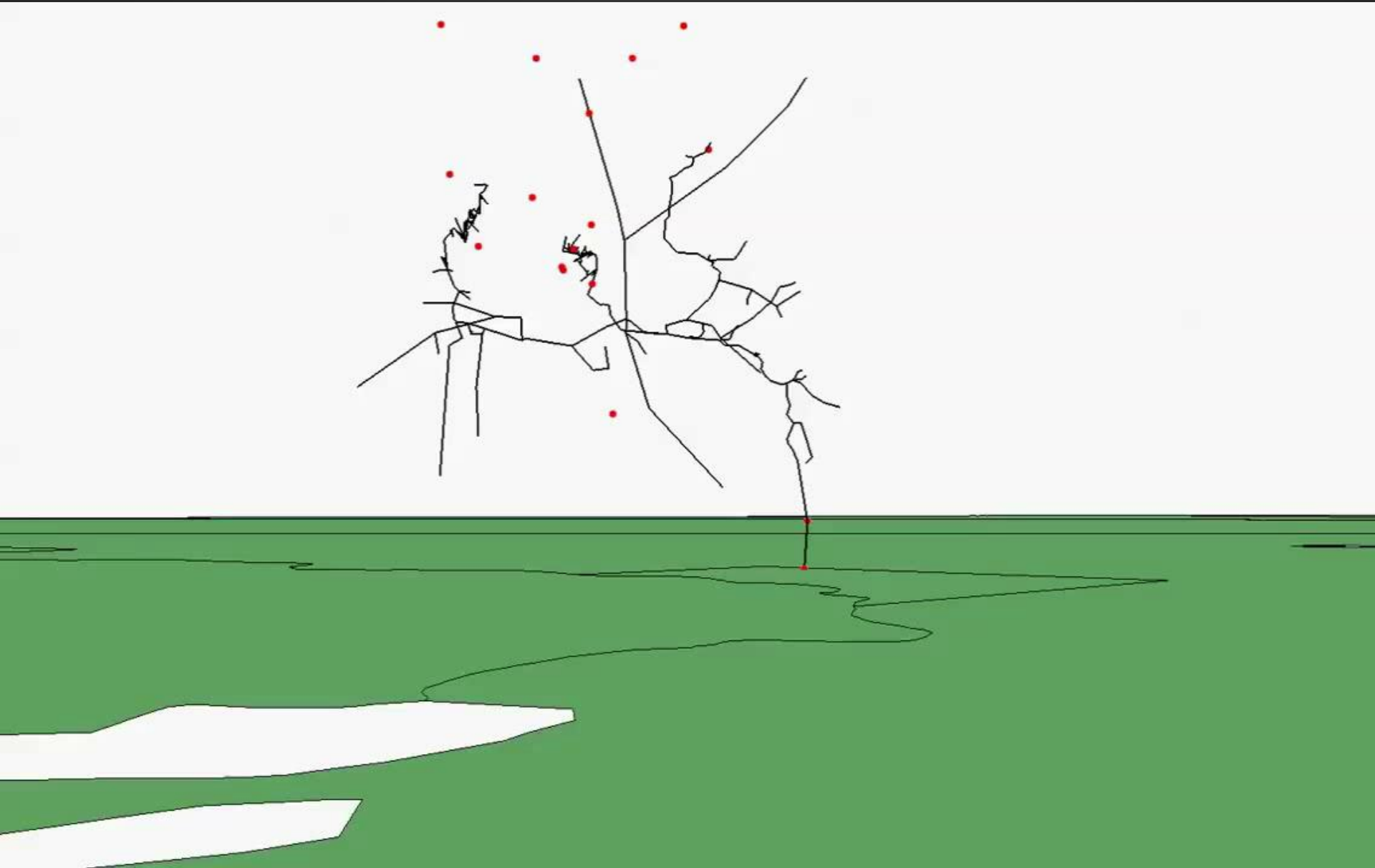
- A** Lightning Origin
(27,600 feet over Falls Church, VA)
- B** Struck Ground
(1 mile south of Silver Spring, MD)
- C** Photograph Location
(Jefferson Memorial)

Distance - Origin to Ground:
14.84 km, 9.22 miles

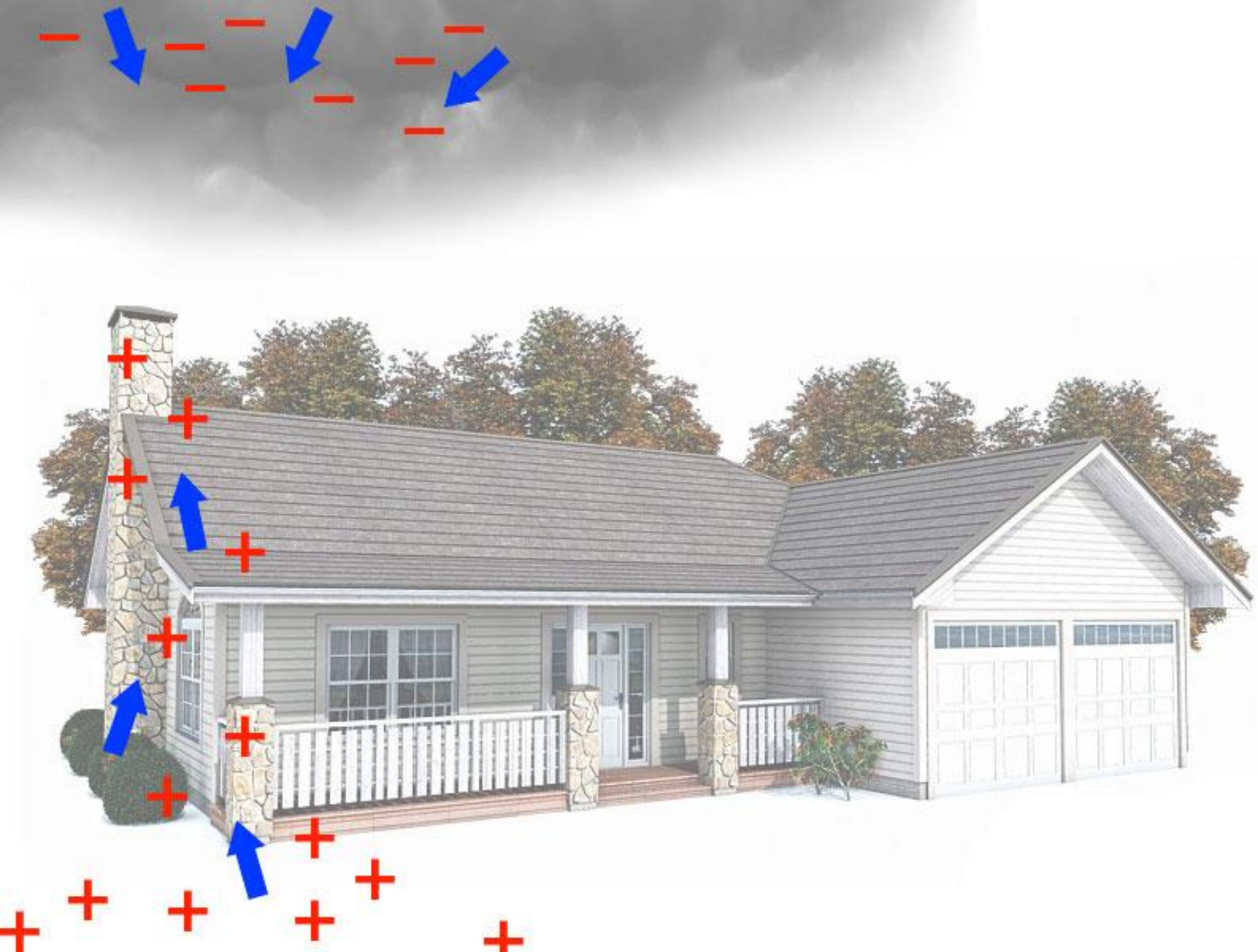


- ✖ ENTLN CG Flash
- ✖ ENTLN CG Strokes (1)
- ★ ENTLN IC Pulses (15)

Animation of a 3D map of a lightning strike over Washington, DC



Courtesy NOAA and NASA



ELEMENTS



- **Air Terminals**
- **Conductors**
- **Bonding Connections**
- **Grounding Terminations**
- **Surge Protection Devices (SPD)**

INSTALLATION STANDARDS



NFPA 780: *Standard for the Installation of Lightning Protection Systems*

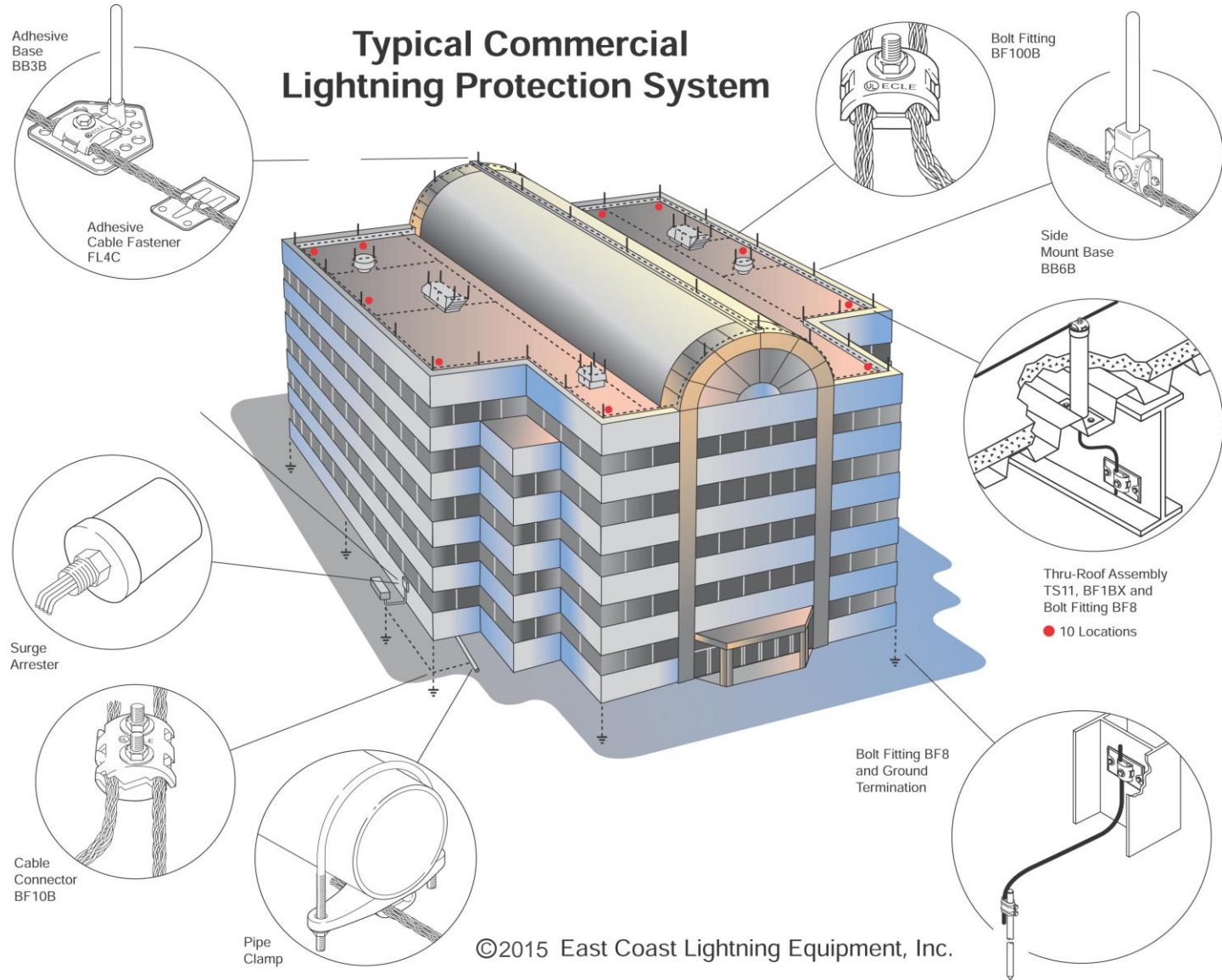


UL96A: *Installation Requirements for Lightning Protection Systems*

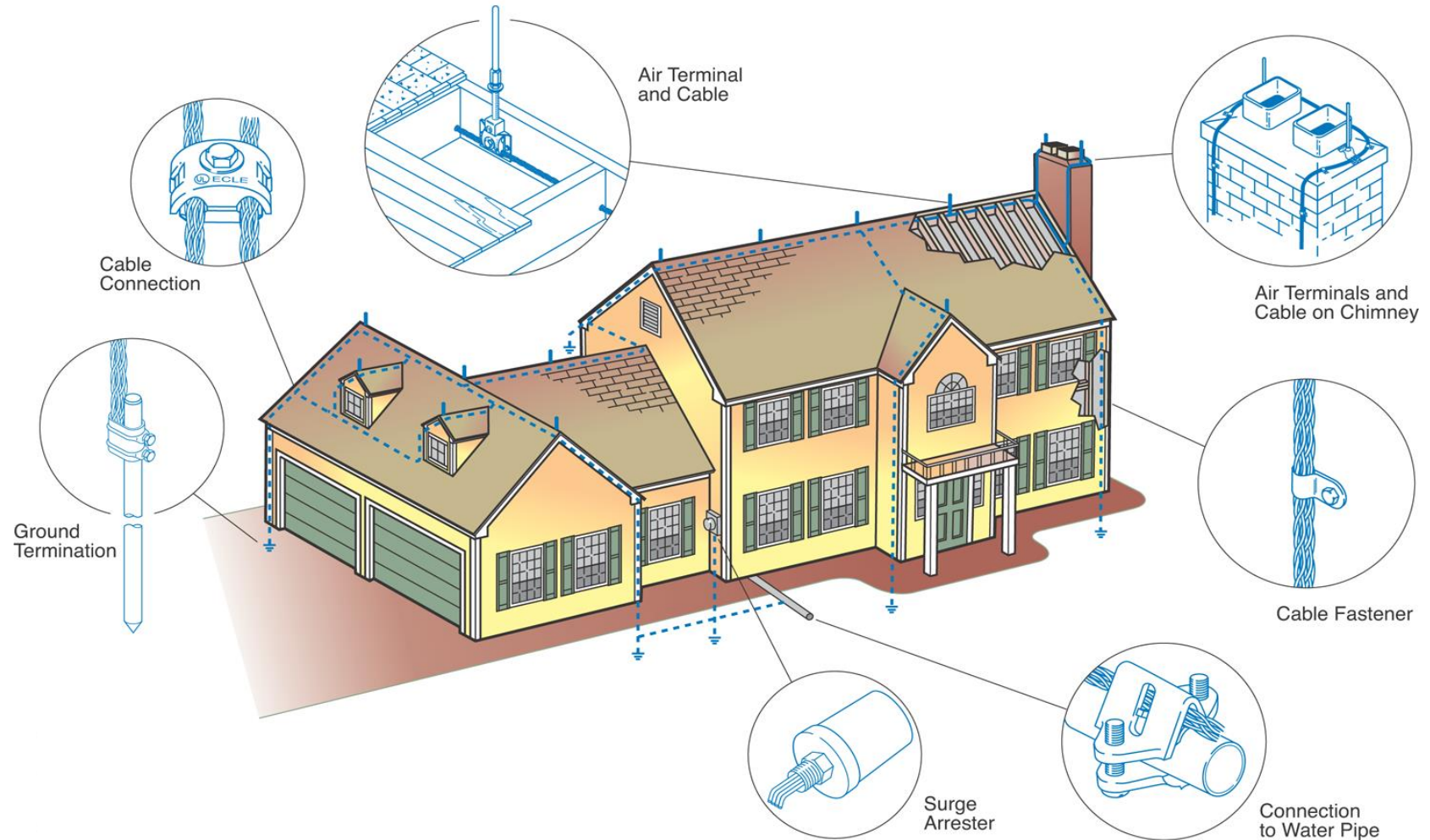


LPI – 175: *Lightning Protection Institute – Standard of Practice*

TYPICAL COMMERCIAL SYSTEM



TYPICAL RESIDENTIAL SYSTEM



AIR TERMINALS



The Rolling Sphere





ROOF TOP CONSIDERATIONS

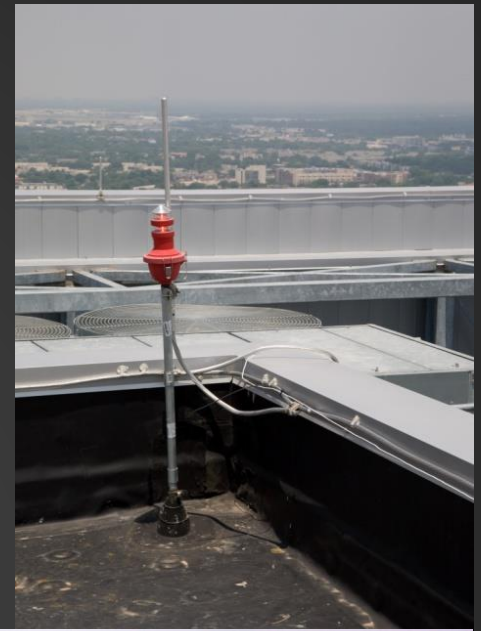
- Air terminals must be placed at regular intervals.
 - **Every 20' minimum**
 - **Within 24" of roof edges, corners and ridge ends**
- 50' intervals every 100' mid-roof
- Protect roof-top equipment
- More is more



INSTALLATION EXAMPLES



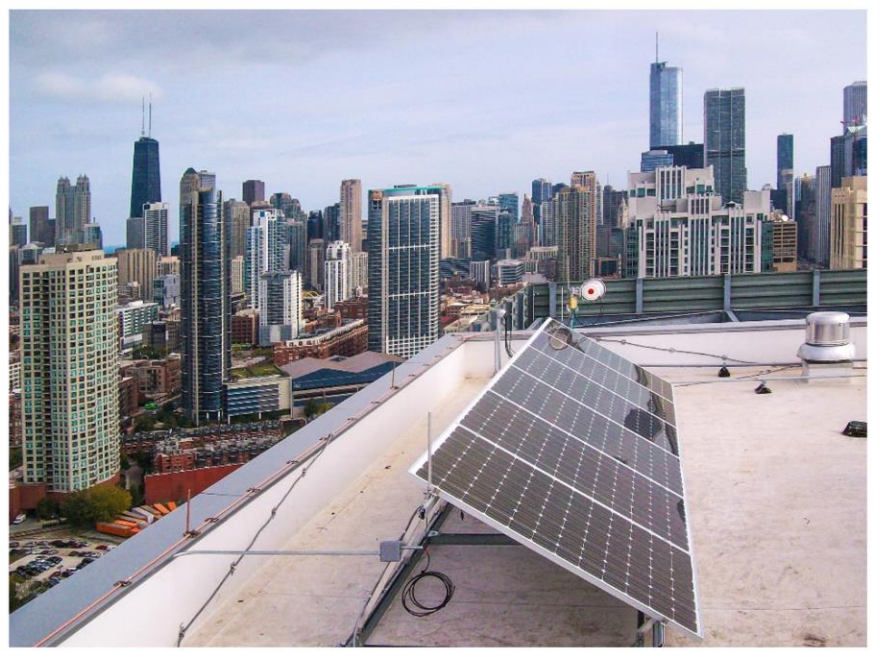
ROOF TOP EQUIPMENT



Utilizing Architecture



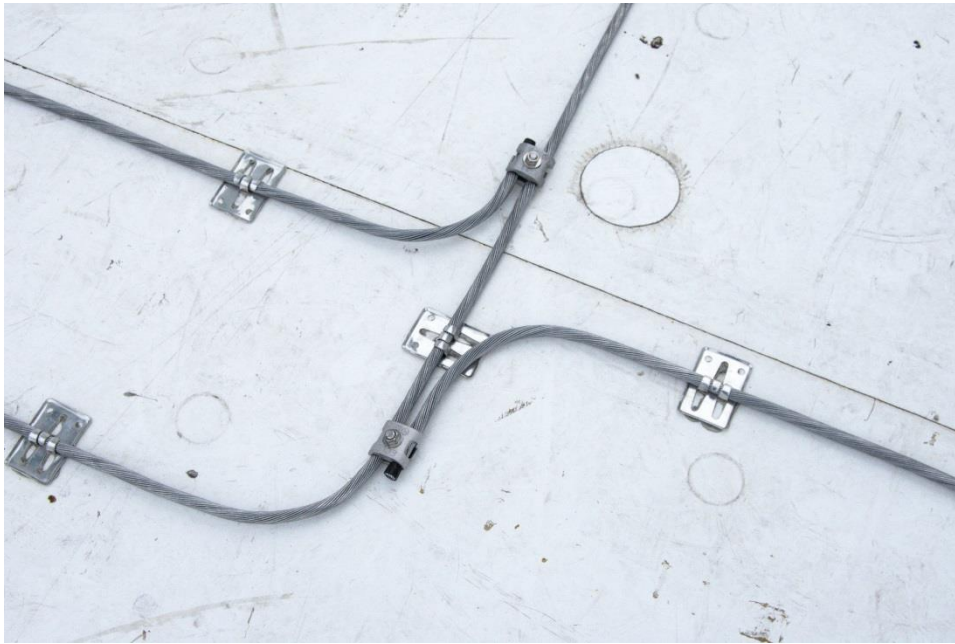
Green Roof and PV Applications



CONDUCTORS



CONDUCTOR COURSING CONSIDERATIONS



- Multiple paths to ground are mandatory
- Isolating the charge is not an option
- Using structural steel as the down lead

ROOF NETWORK CONNECTION TO STRUCTURAL STEEL



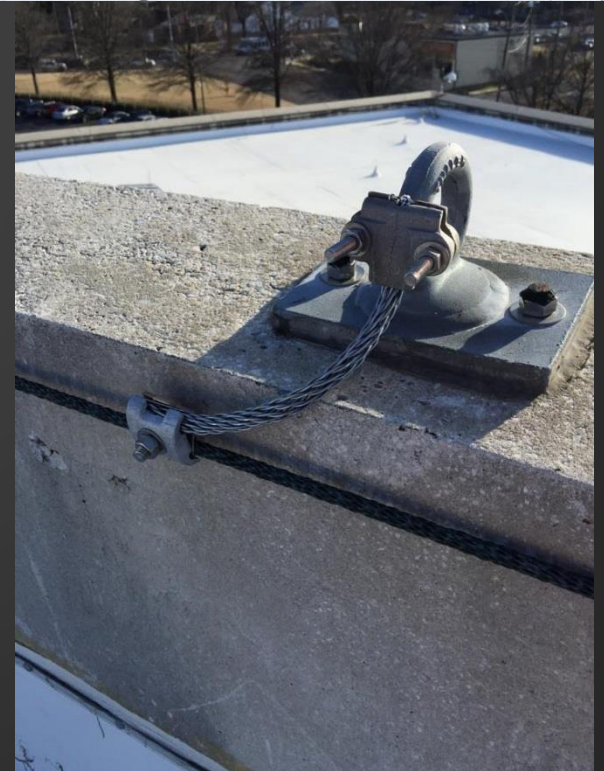
CONCEALED CONDUCTOR COURSING



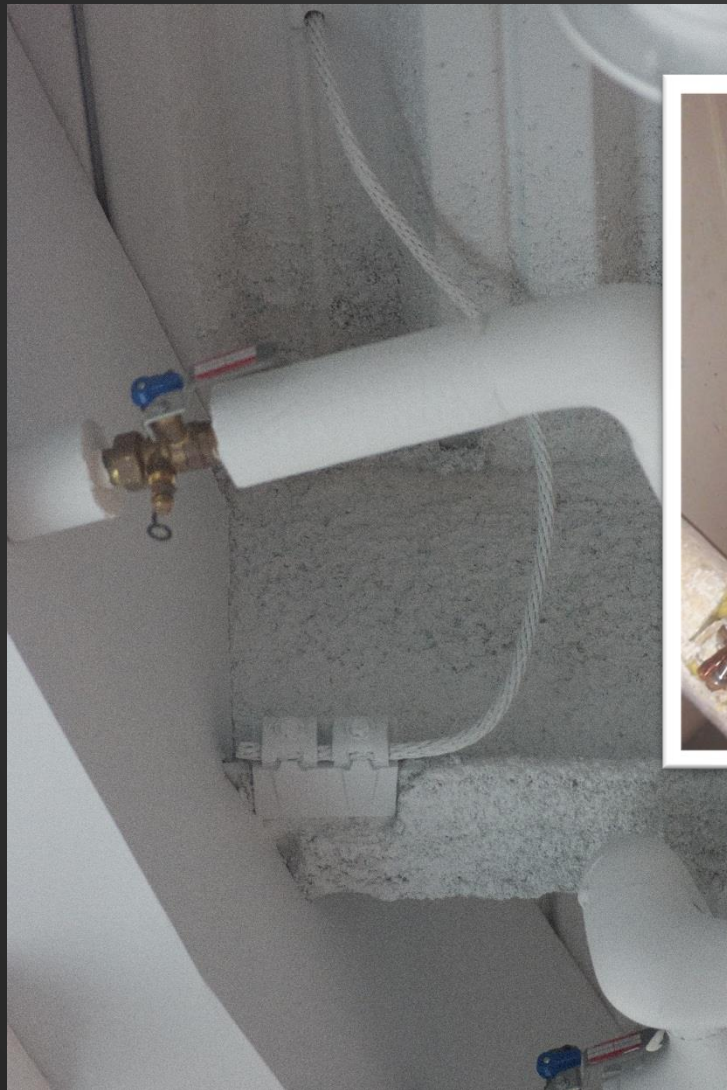
EXPOSED CONDUCTOR COURSING



EXTERIOR CONNECTIONS



INTERNAL CONNECTORS



GROUNDING TERMINATIONS

- Soil conditions are a major factor
- Buried ring versus individual rods
- Don't get hung up on Ohms of Resistance
- What does “Single Point” grounding mean?



INSTALLATION OF GROUND TERMINATIONS

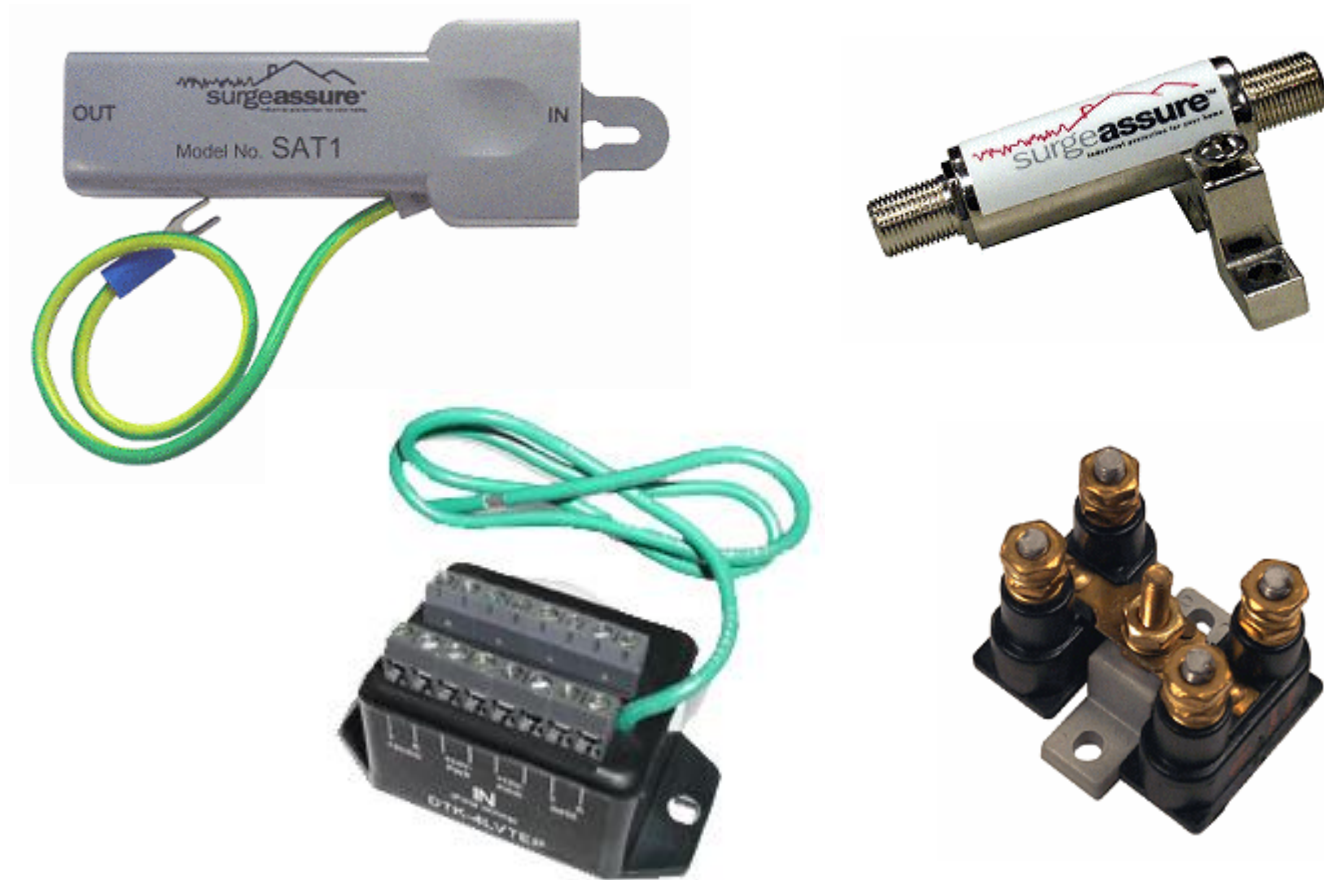


SURGE PROTECTION DEVICE (SPD)



Electrical Service - UL 1449 Revision 3 Compliance

SURGE PROTECTION DEVICE (SPD)



UL 452, 497, 498C Compliance

ELECTRONIC PROTECTION



CSI Master Format Section 26 4123

RESEARCH

Air Terminals &
Down Conductors



**University of Florida,
International Lightning Research Test Facility**



ROCKET TRIGGERED LIGHTNING EXPERIMENT, ICLRT, FLORIDA

REPORTS

- AMS 2003 Bulletin
- 2001 Federal Interagency Lightning Protection Users Group Report
- 1997 State Farm Homeowner Technology Report on Lightning & Surge Protection
- Dept. of Defense Explosives Safety Board Statistics
- FAA Doppler Radar Installation Statistics
- 2005 GAO Report



THE SPECIFICATIONS

- CSI Electrical Section 26 4113
- References to NFPA, UL, and LPI Standards
 - NFPA 780
 - UL96A
 - LPI 175
- Require Third Party Certification
 - LPI-IP Master Installation Certificate
 - UL Master Label Certificate





LIGHTNING PROTECTION INSTITUTE

INSPECTION PROGRAM

- LPI-IP Master Installation Certificate
- LPI-IP Reconditioned Master Installation Certificate
- LPI-IP Limited Scope Inspection Report

Lightning Protection Institute – Inspection Program, Inc.
14048 W. Petrossella Drive, Suite 104
Libertyville, Illinois 60048

Master Installation Certificate for Lightning Protection Certification

This is to certify that the lightning protection system installed on the following named property has been duly reviewed and found to be in compliance with the _____ Standard. All required documents, duly signed, and necessary inspections have been received and placed on file.

(Description of Property) _____

(Installation Contractor) _____

Signed and sworn to this _____ day of _____

Attest: _____ Notary Public

_____, Administrator

This certificate expires on the date below. Any changes to the lightning protection system and/or structure may compromise the integrity of the lightning protection system and may result in determination, at the sole discretion of the LPI-IP, that this certificate has been voided prior to the expiration date.

Certification Number #1234-1234-1234 Engineering Review Date 01/01/2011 Expiration Date 01/01/2014

QUALITY ASSURANCE

- Installing Contractor should be UL listed and LPI certified with minimum five (5) years experience in lightning protection.
- Materials and methods should comply with safety standards of UL, NFPA and/or LPI.
- Ask about certification and industry affiliations.
- Check references.



LIGHTNING PROTECTION SYSTEMS



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Bristol Tower Condominiums



City Place Tower



Coconut Grove Residences



Altamira Condominiums



Alhambra Place Condominiums



Carron House Condominiums



Regency Highland Condominiums



TRENDS OF THE INDUSTRY

- Lightning Protection Commonly Included in Green / LEED Certified Buildings
- Insurance non-renewals/discounts
- State of Florida Building Code requirements
- Agencies customizing lightning protection standards for specific needs
- Lightning protection litigation



presents

The End. Thank you for your time.

24 Lanson Drive, Winsted, CT 06098 - Telephone 860-379-5946
www.lightningsafetyalliance.org

Contact Information

Cole Newman

cnewman@bondedlightning.com

Office: (561) 746-4336

Cell: (662) 617-0444



Protecting People, Property & Assets