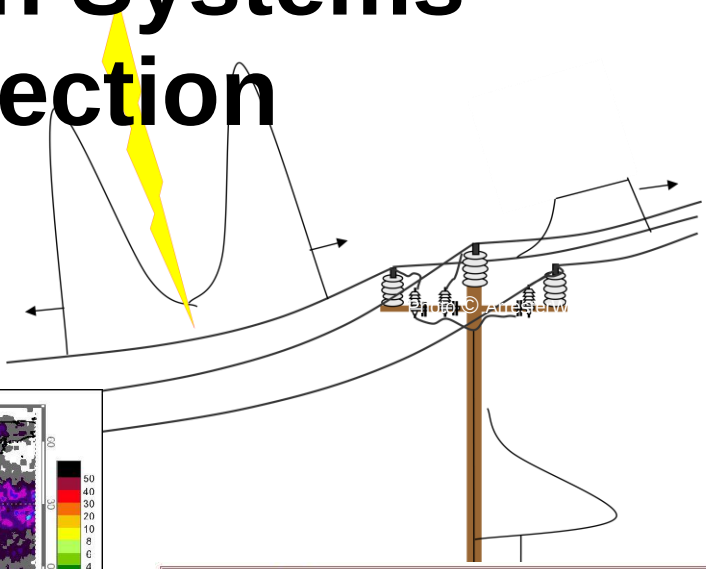
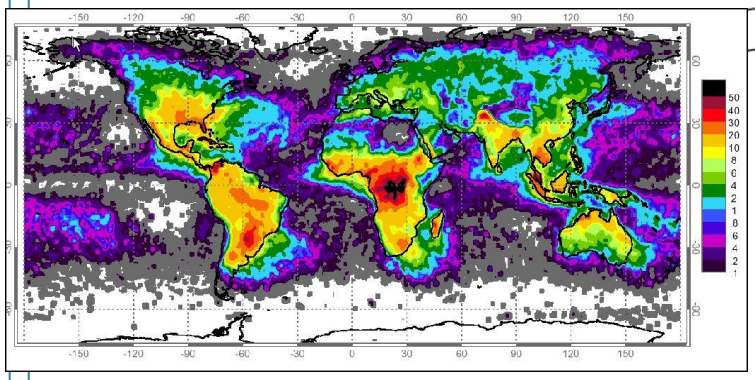
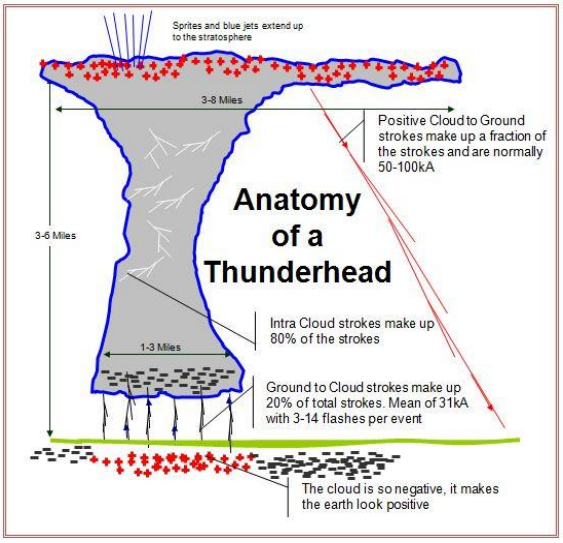
ArresterWorks

# Transmission, Substation and Distribution Systems Surge Protection Seminar





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| **Location:** | **Atlanta Georgia** |
| **When:** | **New Date**<br>**August 26-27 2010** |
| **Duration:** | **8:30am Thursday Aug 26 to Noon Friday Aug 27th.** |

## New Topics

- Optimal Thermal Imaging Temperatures
- How to determine the most cost effective location for Transmission Line Arresters and free software for the calculation
- New Arresters for Protecting Underbuilt Lines

## 1.5 Day Seminar Overview

Lightning is the second or third most significant cause of outages on most power systems. Mitigation of the effect of lightning is seldom understood and can often be improved. This in-depth course is designed for those responsible for the reliability of substations, distribution systems, and transmission systems. We will cover ways to improve the lightning performance of distribution and transmission lines by using arresters and other means.

## What Attendees Will Learn

• **Surge fundamentals**: lightning, switching, faults, ferroresonance, line drops, and others
• **How to select the most appropriate type of lightning protection**: Shielding, lightning rods, arresters, no protection, and possibly underground
• **What the ratings of an arrester really mean** and how to compare one manufacturer to another
• **Margin of protection fundamentals** along with insulation coordination fundamentals
• **Installation methods** of arresters: What is important about lead length and separation distance? What is a good arrester ground and what is not?
• • **NEW… Fundamentals of Transmission Line Arrester Application and Study**
• **Disposal and life cycle management** of arresters
• **What standards govern arresters** and system improvements?
• **Trends in the industry** in lightning protection
• **NEW…. Protecting the Underbuilt system with an Underbuilt Line Arrester**
• **NEW…. Arrester Condition Assessment Meters – An Overview.**

## Material

Each attendee will receive an Overvoltage Protection workbook based on the slide presentation that can be used as a reference for years to come.

## Who Should Attend

• Anyone new to the industry who wishes to learn the fundamentals of lightning protection
• Standards engineers responsible for maintaining system construction and equipment standards
• Reliability engineers and other reliability personnel responsible for continuous improvement
• Substation designers, distribution system designers, and transmission line designers
• Power system operations and maintenance supervisors
• Power engineering personnel who wish to broaden their scope of system understanding

## Instructor

**Jonathan Woodworth, Consulting Engineer, ArresterWorks,** started his career at Fermi National Accelerator Laboratory in Batavia, IL after receiving his Bachelor's degree in Electronic Engineering from The Ohio Institute of Technology in 1972. As an Engineering Physicist at Fermi Lab, he was an integral member of the high energy particle physics team in search of the elusive quark. In 1979 he joined the design engineering team at McGraw Edison (later Cooper Power Systems) in Olean, NY. Returning to school after many years in industry, Jonathan received his MBA from St. Bonaventure University in 1995. Jonathan was employed for 28 years at Cooper Power System where he served as Engineering Manager for 13 years. Additionally he held the position of Arrester Marketing Manager for 7 years. Jonathan is very active in the IEEE and IEC standard associations previously serving as Chair of the Surge Protective Devices Committee of IEEE PES, Chair of the NEMA High Voltage Arrester Section, and currently Co-Convener of the IECTC37 MT4 committee responsible for IEC Arrester Standards. Jonathan can be contacted at jwoodworth@arresterworks.com

## Seminar Fee

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|---|---|
| Before August 1st | $1099 |
| After August 1st | $1199 |

Send Questions or Registration Request to SeminarRegistration@ArresterWorks.com

## Seminar Location

**The Westin Atlanta Airport**
4736 Best Road, Atlanta, GA 30337
(404) 762-7676
Adjacent to Atlanta's Hartsfield-Jackson Airport, with courtesy shuttle 24-7.

## Seminar Schedule **New Dates**

Thursday Aug 26 830am to 500pm
Continental breakfast and lunch provided

Friday Aug 27 800am to 1200pm
Continental breakfast provided

# Register Now

# 1.5 Day Seminar Outline

**1.0 Power Systems Fundamentals as Related to Arresters**
- 1.1 What happens when lightning strikes a power system
- 1.2 Internally generated surges
- 1.3 Correlation of surge protection and system reliability
- 1.4 Overview of where lightning protection and arresters are used on power system

2.0 **Surge Fundamentals**
- 2.1 Lightning Fundamentals
- 2.2 Anatomy of a Thunderhead
- 2.3 Cloud Electrification
- 2.4 Lightning Stroke and Flash
- 2.5 Lightning Indices
- 2.6 Stroke Parameters
- 2.7 Typical Flash Event
- 2.8 Stroke Becomes a Surge
  - 2.8.1 Direct Strike
  - 2.8.2 The Indirect Strike
- 2.9 Traveling Waves
- 2.10 Switching Surge
  - 2.10.1 Wave Shapes
  - 2.10.2 Current and Energy Content
- 2.11 Other Surges
  - 2.11.1 Capacitor Switching
  - 2.11.2 Temporary Overvoltage

**3.0 Lightning Protection Fundamentals**
- 3.1 Shielded Systems
- 3.2 Terminology
- 3.3 Estimating Lightning Collection Rate
- 3.4 Estimating Ground Flash Density
- 3.5 Method of Estimating Strike Collection Rate
  - 3.5.1 Example Calculation
  - 3.5.2 Shielding Factor
  - 3.5.3 Back Flashover
- 3.6 Arrester Protection of Overhead Systems
- 3.7 Arrester Protection of Underground Systems

**4.0 Insulation Coordination**
- 4.1 Terminology
- 4.2 Margin of Protection

**5.0 Arrester Fundamentals**
- 5.1 Brief History of Arresters
- 5.2 Pre Silicon Carbide Arresters
- 5.3 Silicon Carbide Arresters
- 5.4 MOV Arresters
  - 5.4.1 Basic Components of MOV Arresters
- 5.5 Design Considerations
  - 5.5.1 VI Characteristics
  - 5.5.2 Thermal Characteristics
  - 5.5.3 TOV Withstand Capability
- 5.6 MOV Disk Overview
  - 5.6.1 How it works
- 5.7 Design and Industry Trends

**6.0 Types of Arresters**
- 6.1 Arrester Types
- 6.2 Station
- 6.3 Intermediate
- 6.4 Distribution
- 6.5 Riser Pole Arresters
- 6.6 Elbow
- 6.7 Oil Immersed
- 6.8 Transmission Line
- 6.9 Externally Gapped
- 6.10 Internally Gapped
- 6.11 Secondary
- 6.12 Arrester Housing Considerations
  - 6.12.1 Porcelain
  - 6.12.2 Polymer
- 6.13 Installation Considerations
- 6.14 Lead Length

**7.0 Arrester Selection Procedure**
- 7.1 Estimate Arrester Type or Class
- 7.2 Estimate Arrester MCOV
- 7.3 System TOV and Arrester TOV Compatibility
- 7.4 Arrester Surge Durability vs System Requirements
- 7.5 Arrester Pressure Relief Level
- 7.6 Mounting Arrangement
- 7.7 Margin of Protection Level
- 7.8 Lead length or Separation Distance Effect

**8.0 Protected Equipment Considerations**
- 8.1 Protection of Transformers
- 8.2 Protection of Distribution Lines
- 8.3 Protection of Capacitor Banks
- 8.4 Protection of Regulators
- 8.5 Protection of Transmission Lines
- 8.6 Protection of Underground Cables
- 8.7 Protection of Gas-insulated Substations (GIS)
- 8.8 Protection of FACTS Equipment

**9.0 Mechanical Considerations**
- 9.1 Arrester Clearances
- 9.2 Cantilever Strength
- 9.3 Seismic Considerations
- 9.4 Animal Proofing

**10.0 Arrester Test Standards**
- 10.1 Standards Summary
- 10.2 Arrester Properties and Attributes vs Test
- 10.3 Most Significant Tests
- 10.4 Changes coming

**11.0 Field testing**
- 11.1 Infrared Thermography
- 11.2 Partial Discharge Detection
- 11.3 VI Characteristics
- 11.4 Leakage Current
- 11.5 Watts Loss

**12.0 Miscellaneous Topics**
- 12.1 Arresters in Wind farms
- 12.2 Arresters in Smart Grid Applications
- 12.3 Arresters for HV Line drop Protection
- 12.4 Market Trends