Texas Power Line-Caused Wildfire Mitigation Project

Southwest Electric Distribution Exchange (SWEDE) 2016

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Forest Service helps with Oklahoma wildfire

Texas A&M incident management team assisting crews with tracking resources

By ELIZABETH KAMENICKY
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Courtesy of Roy Anderson, Oklahoma Highway Patrol

Flames burn across the 350 Complex Fire in Woodward County, Oklahoma.

An incident management team from the Texas A&M Forest Service has been called to Oklahoma to assist in a massive wildfire sweeping over the drought-stricken land.

Thirty-four members of the Lone Star State Incident Management Team joined the Oklahoma Forestry Services and the Woodward Fire Department on Wednesday to manage the fire in a unified command.

About 200 personnel are fighting the blaze.

With wind speeds up to 50 miles per hour, more than 57,000 acres of land have burned in the wildfire, called 350 Complex, located in Woodward and Harper counties. Sparked on Tuesday, 350 Complex is the result of arced power lines coming in contact with trees and grass.

Woodward is in the northwestern part of the state, about 50 miles from the Kansas border.

Melanie Karns, the public information officer for the management team, said the unit consists of members from all over the state who are employed with the A&M Forest Service. The squad is trained to assist in various aspects of a crisis, including logistics, finances, check-in, public information and safety officers.

After a perimeter evaluation conducted on Friday, Karns said the fire is now 45 percent contained — up from 20 percent recorded on Tuesday — because of a reduction in wind speeds. She said winds are expected to pick up this weekend, and all personnel must prepare for the dangers that could come with it.

"We have to really utilize the weather predictions to get ready for it," Karns said. "If those strong winds cause the fire to get out of the [perimeter] lines, then we have to be prepared for that."

According to Karns, the management unit does not fight the fires, but rather tracks resources by making sure "everyone is accounted for," whether it is community members or firefighters.

Four additional states have also been called upon for assistance: Tennessee, Arkansas, Louisiana and Kentucky.

For the latest information on the Oklahoma wildfires, go to forestry.ok.gov.

Wildfire in northwest Oklahoma now 70 percent contained

BY ASSOCIATED PRESS | SUNDAY, APRIL 10TH 2016

This April 5, 2016 photo provided by Landon Cates, volunteer firefighters from the Dewey County Task Force work a blaze southwest of Freedom, Okla. Oklahoma Forestry Services Director George Geissler says arcing power lines are to blame for the blaze in northwest Oklahoma, located about 170 miles northwest of Oklahoma City. (Landon Cates/Leedy Fire Department via AP)




VIEW PHOTO GALLERY
9 photos

A A A

WOODWARD, Okla. (AP) — Oklahoma Forestry Services says a wildfire burning in northwestern Oklahoma is now 70 percent contained.

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The fire being called the 350 Complex Fire has burned about 90 square miles since Tuesday. Investigators believe the fire was started by arcing power lines that touched the dry ground because of gusting winds.

has burned about 90 square miles since Tuesday.

y arcing power lines that touched the dry ground

Fox 25, Oklahoma City, 10 April 2016

http://okcfox.com/news/local/wildfire-spares-oklahoma-town-plant-but-still-not-contained

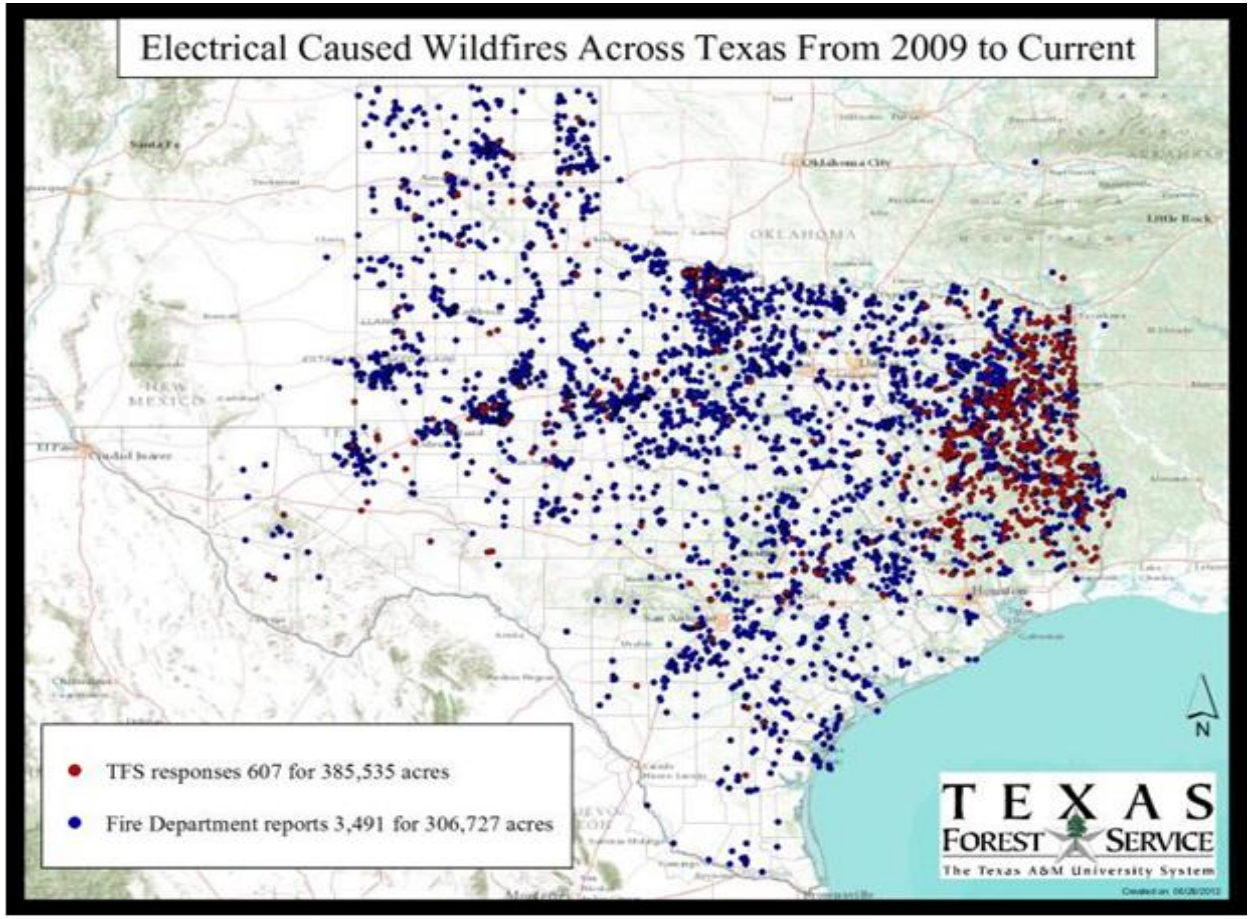
Texas Power Line-Caused Wildfire Mitigation Project

- Wildfires have devastating consequences:
  - Direct losses
  - Fire suppression costs
  - Disruption of commerce
  - Not to mention injuries and even fatalities
- Power line events can cause wildfires:
  - Downed conductors
  - Clashing conductors (direct arc + ejection of molten, possibly burning particles)
  - Exploding apparatus (transformers, switches, …)
  - Vegetation intrusion (electrical and mechanical effects)

Power Line Fire Ignition Mechanisms

Texas Power Line-Caused Wildfires 2009-2012

Start Dat	Cause	County	acres	Hor
14-Apr-11	Pwr Lines	Andrews	80907	0
04-Sep-11	Pwr Lines	Bastrop	34068	1660
09-Apr-11	Pwr Lines	Garza	32000	1
11-Apr-11	Pwr Lines	Crockett	30814	0
09-Apr-09	Pwr Lines	Archer	21525	3
16-Feb-11	Pwr Lines	Lipscomb	15908	0
15-Apr-11	Pwr Lines	Wichita	11785	3
04-Apr-09	Pwr Lines	Wheeler	11000	0
01-Apr-09	Pwr Lines	Archer	8000	0
24-May-11	Pwr Lines	Deaf Smith	7600	0
11-Mar-11	Pwr Lines	Jack	7555	2
30-Aug-11	Pwr Lines	Palo Pinto	6555	39



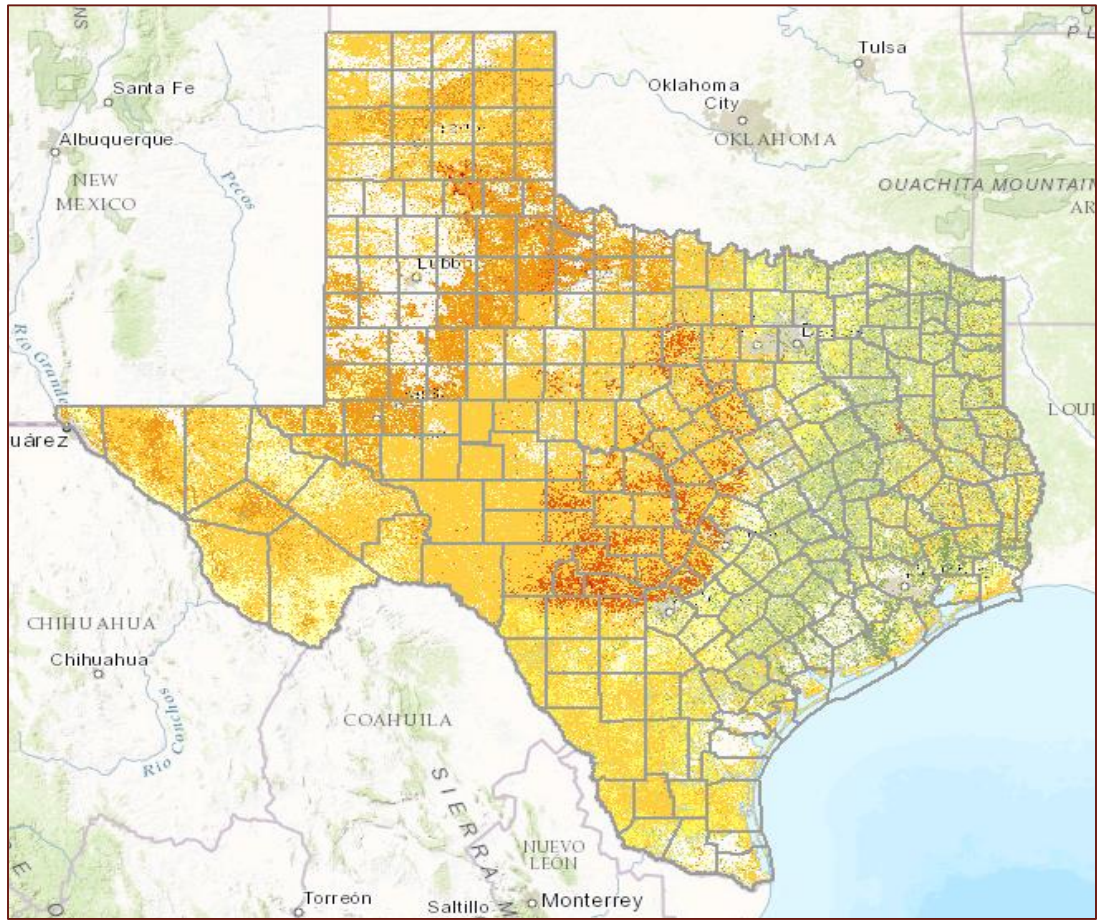
Texas Power Line-Caused Wildfire Mitigation Project (cont'd)

- Texas experiences wildfires annually and had a particularly bad year in 2011.
- Legislature is supporting Texas Power Line-Caused Wildfire Mitigation project.
- Participating Texas-based utility companies:

  Austin Energy
  Bluebonnet Electric Cooperative
  BTU (Bryan Texas Utilities)
  Mid-South Synergy
  Pedernales Electric Cooperative
  Sam Houston Electric Cooperative
  United Cooperative Services

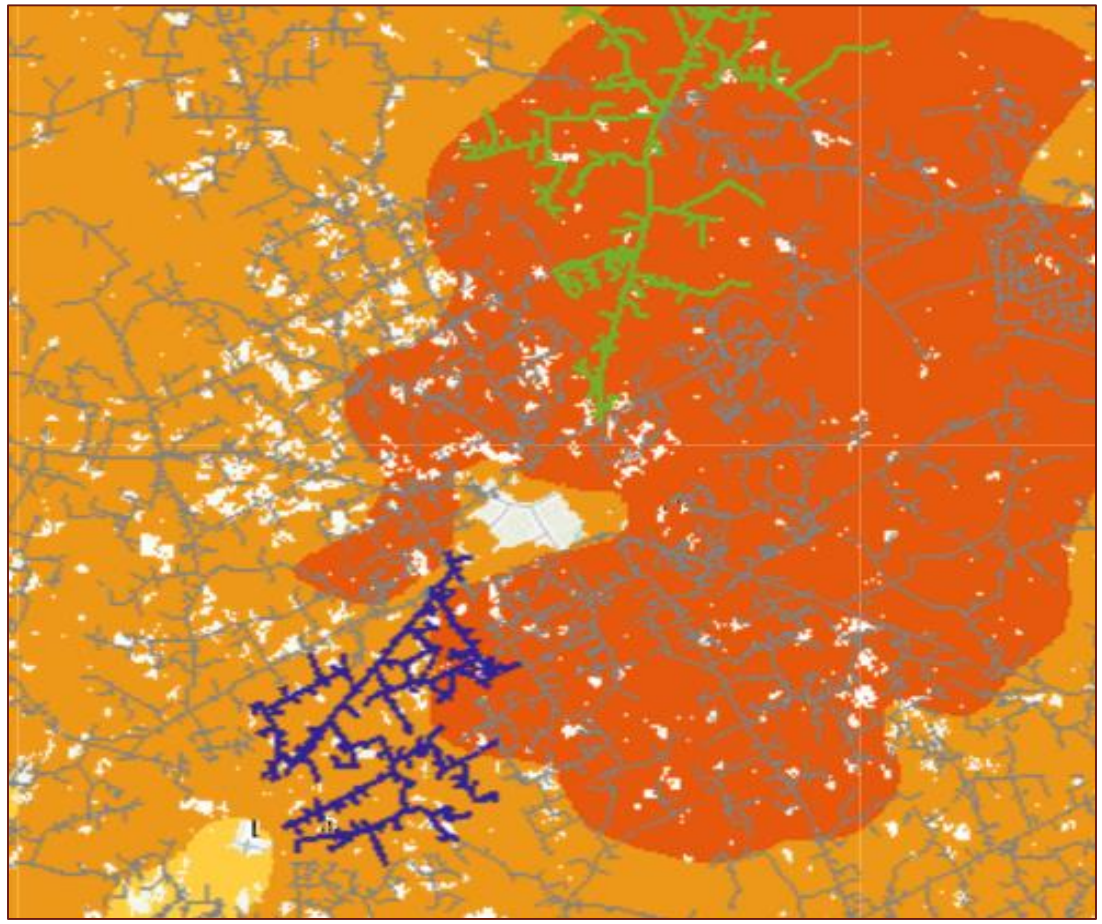
- Demonstration of Distribution Fault Anticipation (DFA) technology on 58 circuits
- Integration of wildfire risk profile from Texas A&M Forest Service
- Goal: To demonstrate reduction of wildfire risk through synergistic use of DFA, wildfire risk mapping, and other tools.

Texas A&M Forest Service Wildfire Risk Map



- Fire risk profile “heat map” provided as a public service of the Texas A&M Forest Service
- Long-term and short-term risk profiles
- Industry standard format and interface
- Accessible via web portal

Texas A&M Forest Service Wildfire Risk Map
(Zoomed, with Electrical Circuit Model Overlay)



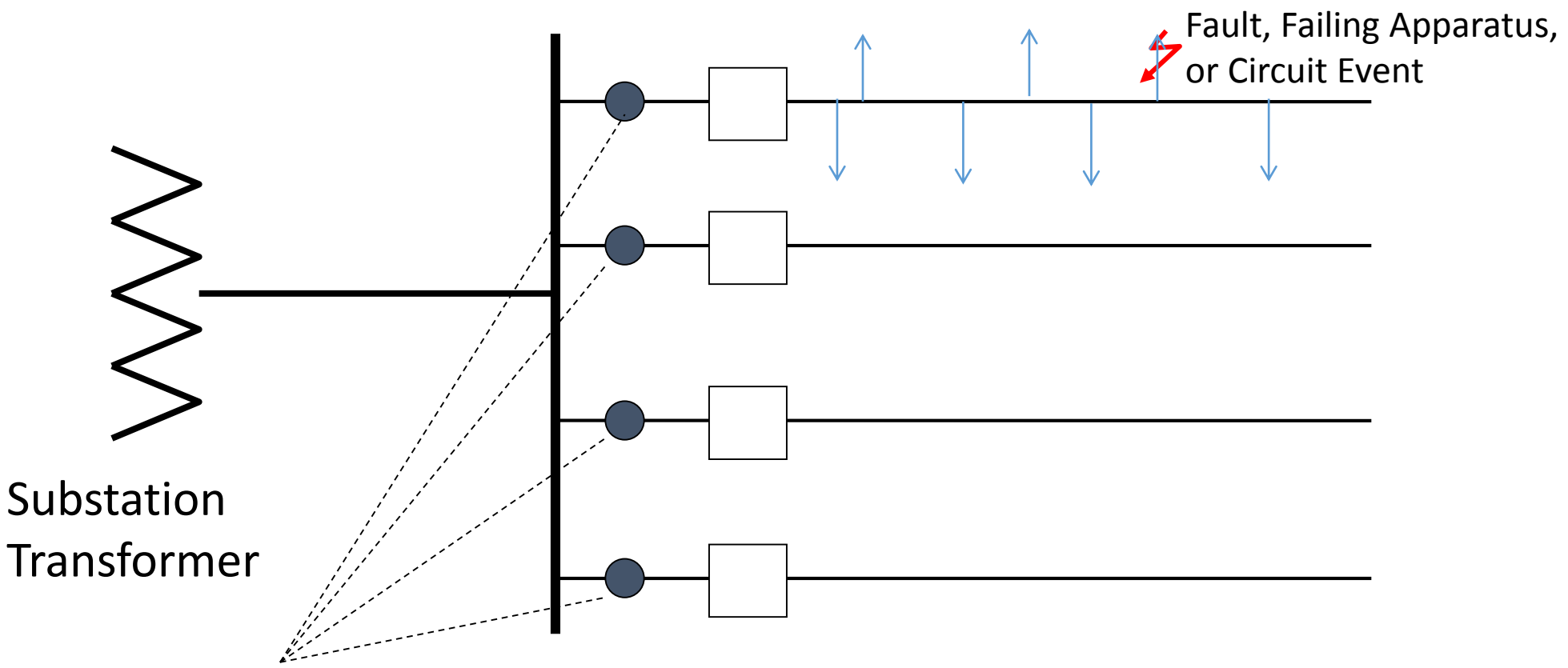
- Image shows small region with elevated wildfire risk.
- Utility circuit model information appears as overlay.
- DFA-monitored circuits are highlighted in color.
- Synergy of technologies combines electrical information with wildfire risk information.

Distribution Fault Anticipation (DFA) Technology

- Developed by Texas A&M Engineering in collaboration with EPRI
- Uses real-time monitoring to provide awareness of circuit health and events
- Substation-only installation
  - Conventional CTs and PTs
  - Communication to central master station server via secure Internet
  - No requirement for communications to reclosers, capacitors, or other line devices
  - Detection of events on whole circuit

KEY WORD: AWARENESS!!!

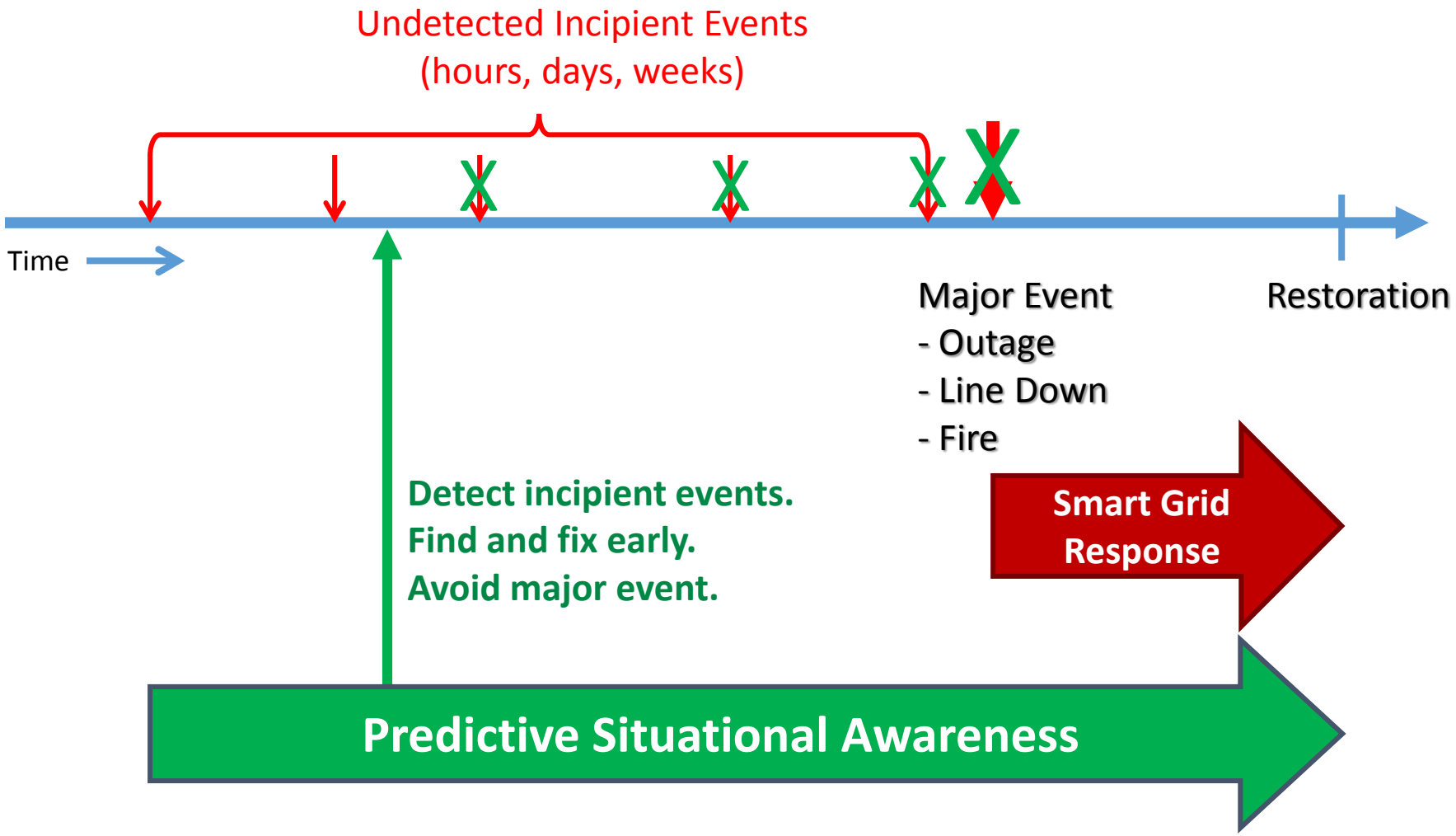
DFA Technology Monitoring Topology



High-fidelity DFA devices, connected to conventional CTs and PTs, one per distribution circuit.

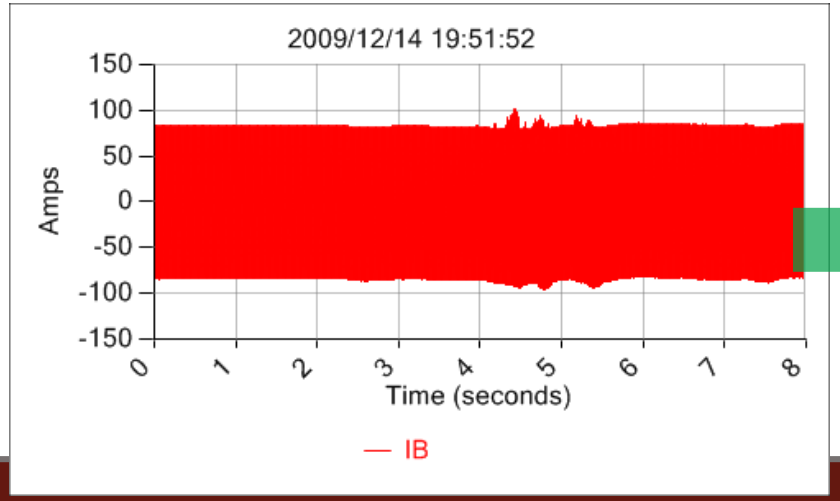
Situational Awareness or “Visibility”

(Conventional vs. Smart Grid vs. Predictive)



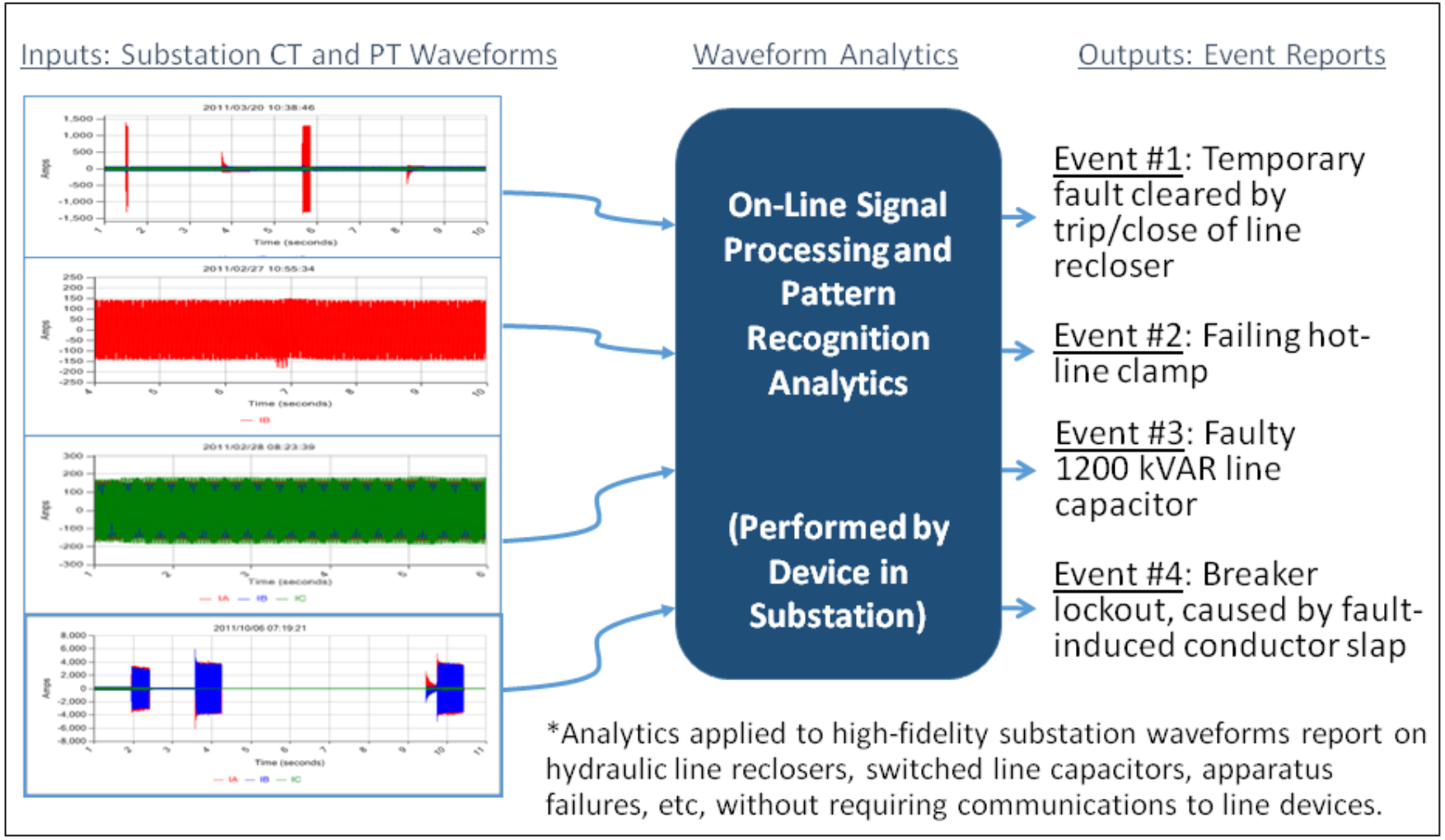
Illustrative Measured Example

- Graph shows phase current during “normal” circuit operations.
- DFA reports this as a failing clamp. Failing clamps can degrade service quality and, in extreme cases, burn down lines.
- Conventional technologies do not detect pre-failures such as this.



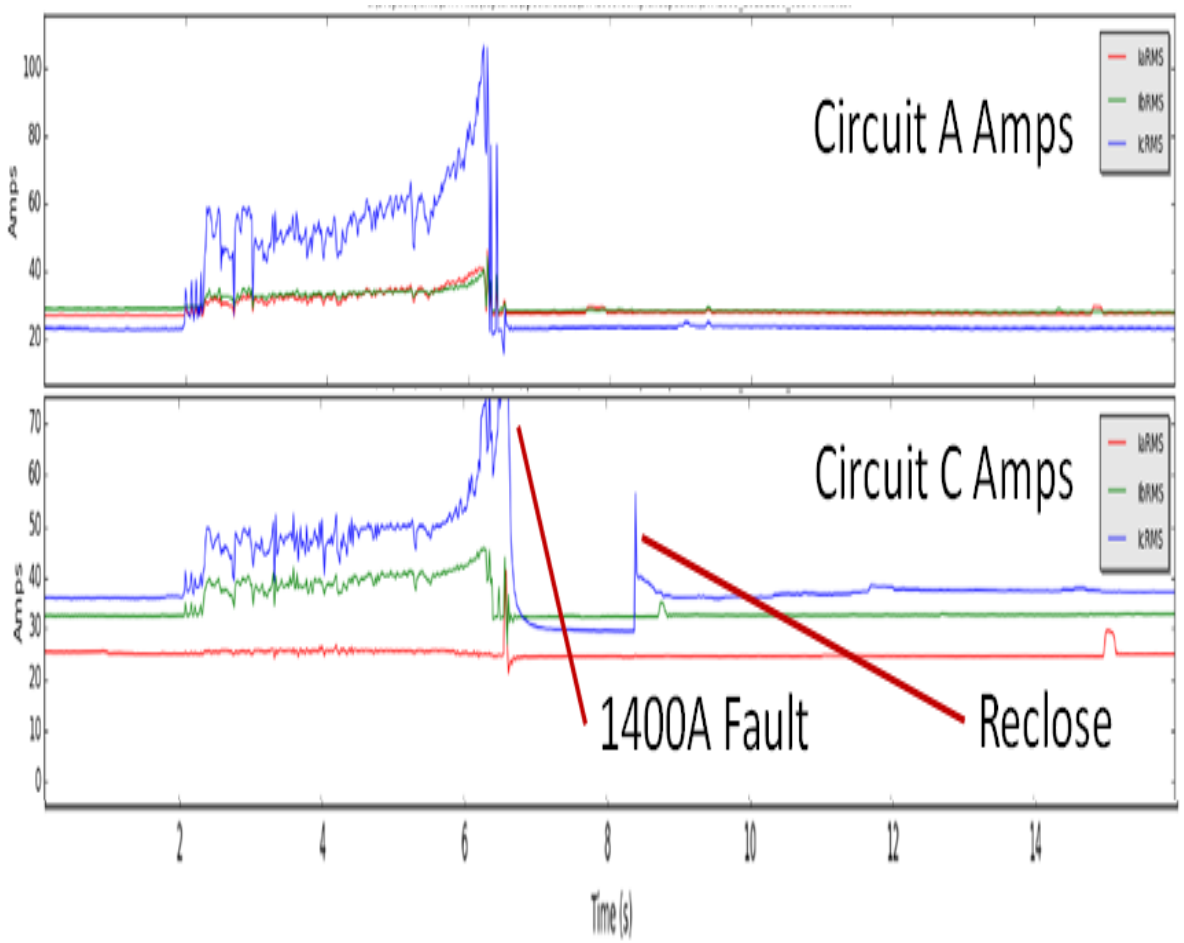
DFA On-Line Algorithms

DFA Processing Architecture



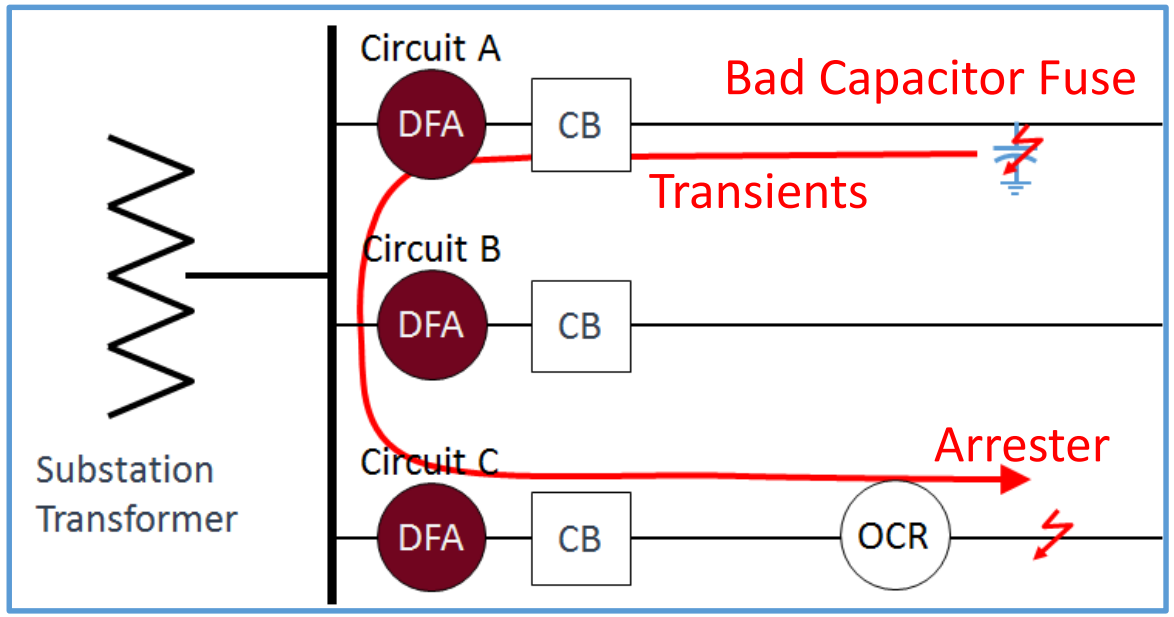
Selected Case Studies

Case Study: Capacitor Bank Cutout Failure



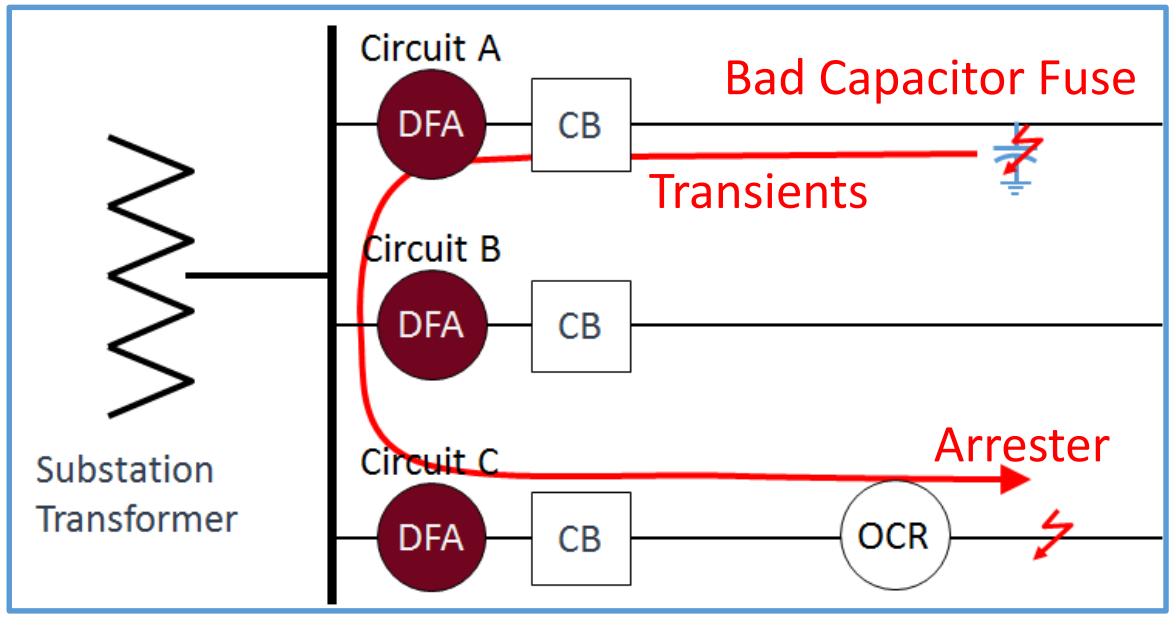
- Subject substation has three DFA-monitored circuits.
- All three DFAs simultaneously recorded severe transients for four seconds.
- DFA data from circuit A indicated an arcing 300 kVAR capacitor.
- Crew patrolled, inspected 300 kVAR capacitors, and found one with blown fuse and burned barrel.

Case Study: Capacitor Bank Cutout Failure



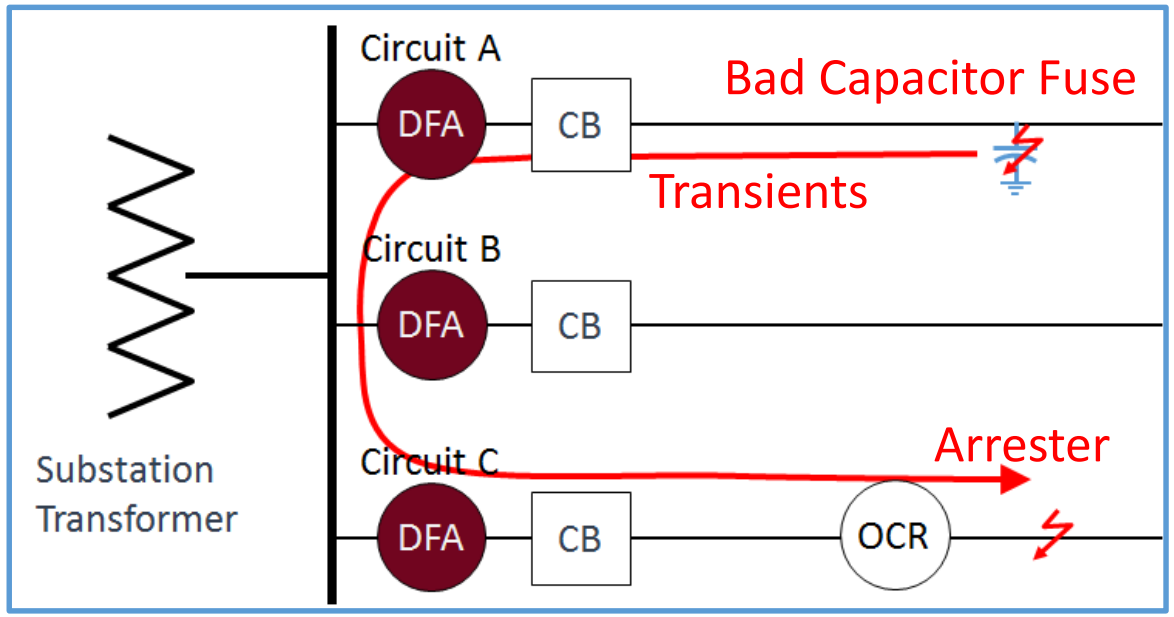
- Series arcing involving a capacitor (switch, connection, inside can) creates severe voltage transients.
- Voltage transients couple to bus and to other circuits on bus.
- In the subject case, the capacitor problem on Circuit A caused voltage transients that caused an arrester on Circuit C to fault, thereby requiring a line recloser on Circuit C to trip/close.

Case Study: Capacitor Bank Cutout Failure



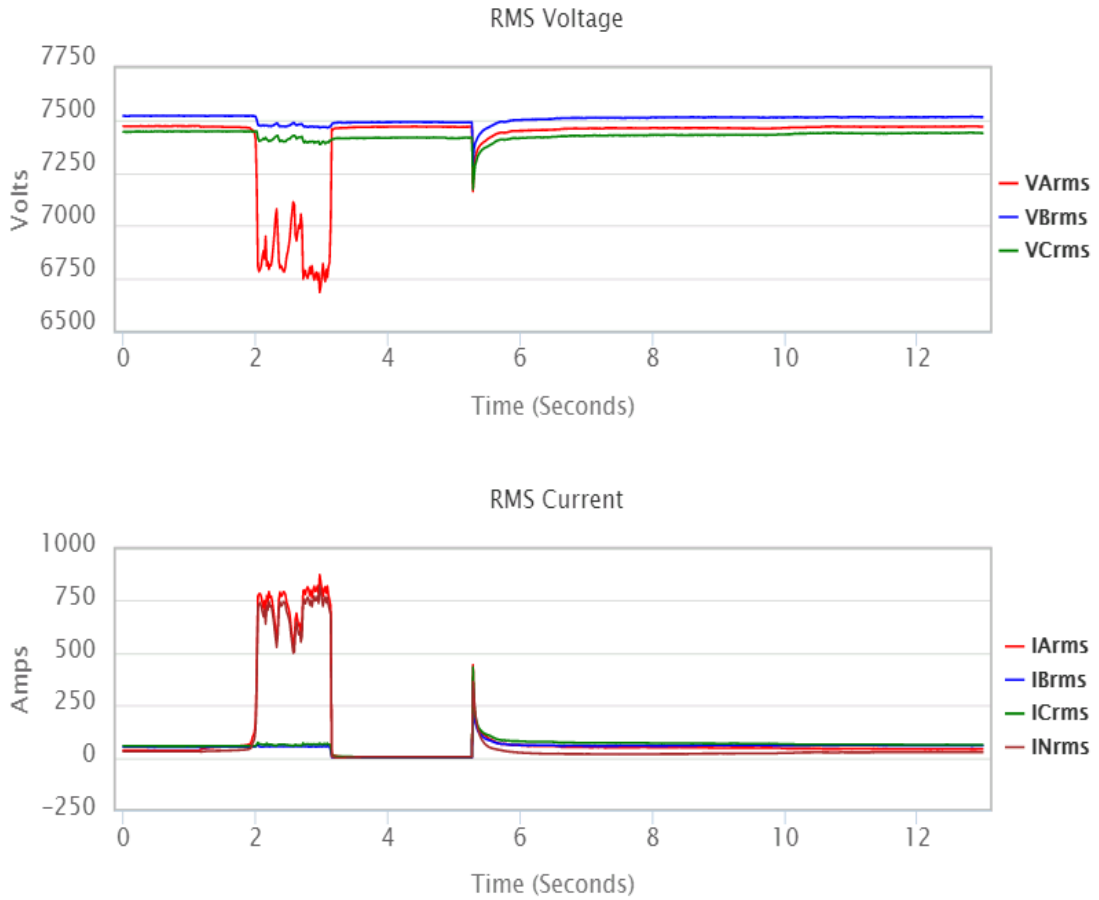
- This was a complex case: Failure on one circuit caused trip/close on another circuit.
- DFA has documented other cases where capacitor problems on one circuit cause failures elsewhere. Ex: Single capacitor switch failed capacitors in four banks.
- DFA records enable proper forensics, understanding, and response.

Case Study: Capacitor Bank Cutout Failure



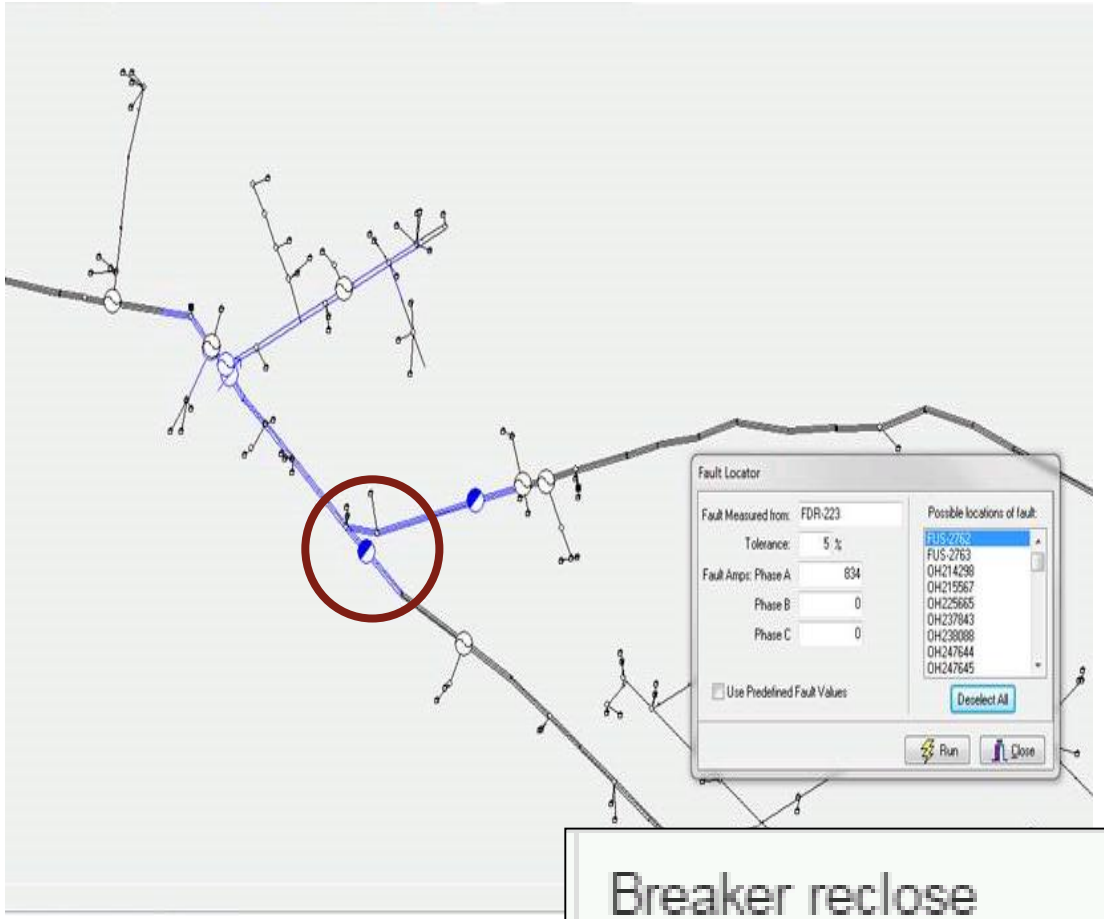
- Tracked/arced fused cutout represented ignition risk.
- Failed arrester represented ignition risk, at time of event and in the future.
- DFA provided awareness that enabled corrective action.

Case Study: Catastrophic Arrester Failure



- Single, successful trip/close of substation breaker.
- Occurred during storm.
- “Routine” fault cleared properly and ordinarily would warrant no further investigation or action.
- But, DFA recording indicated that the cause of this fault was a failed arrester.

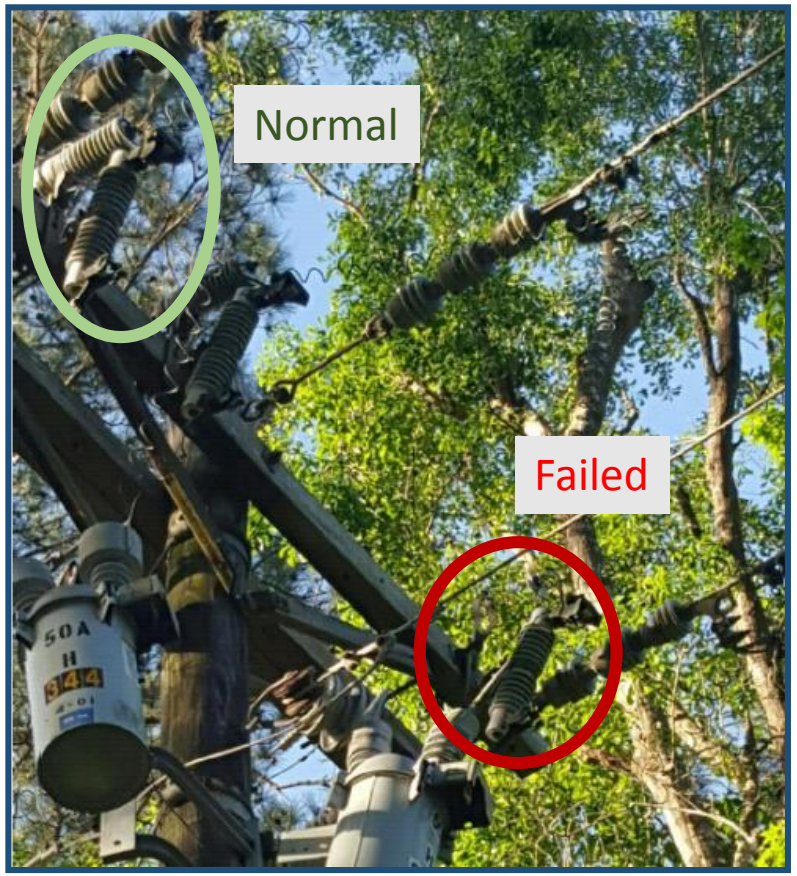
Case Study: Catastrophic Arrester Failure



- To aid location, DFA provided sequence of events and estimated fault current and duration (834 amps for 67.5 cycles).
- Utility put current magnitude in Fault Locator software program.
- Instructed crew to look 1) for a failed arrester 2) in a specific area.
- Brief patrol found failed arrester.

Breaker reclose	A	F-(67.5c,834A,AN)-T-2.2s-C

Case Study: Catastrophic Arrester Failure

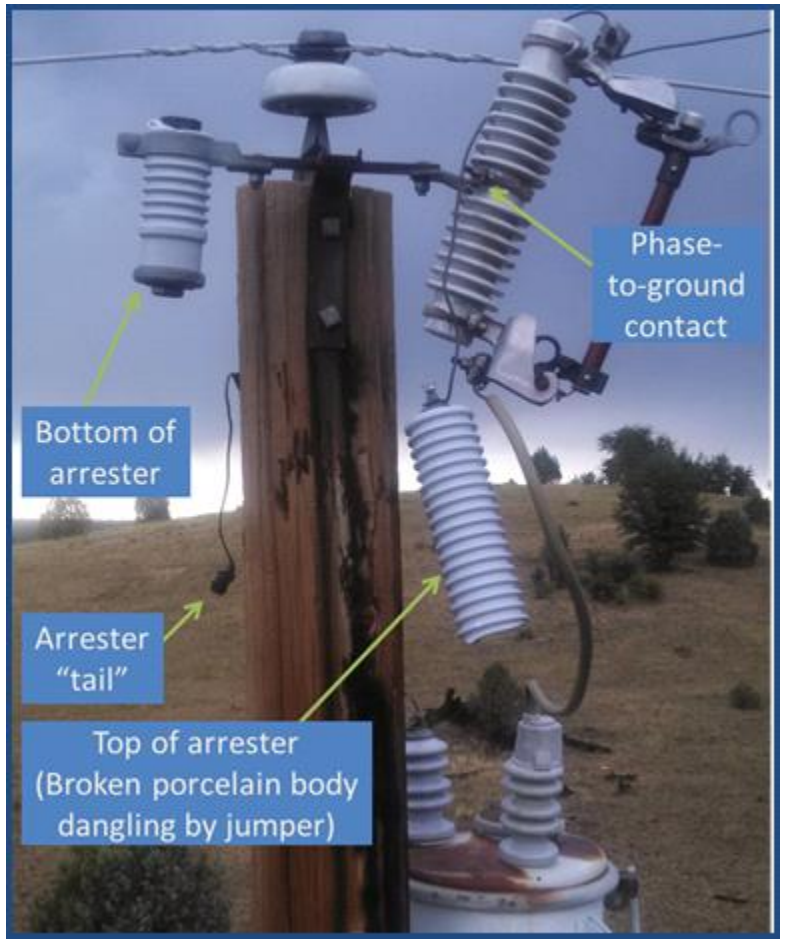


- Failed arrester, as found.

Case Study: Catastrophic Arrester Failure

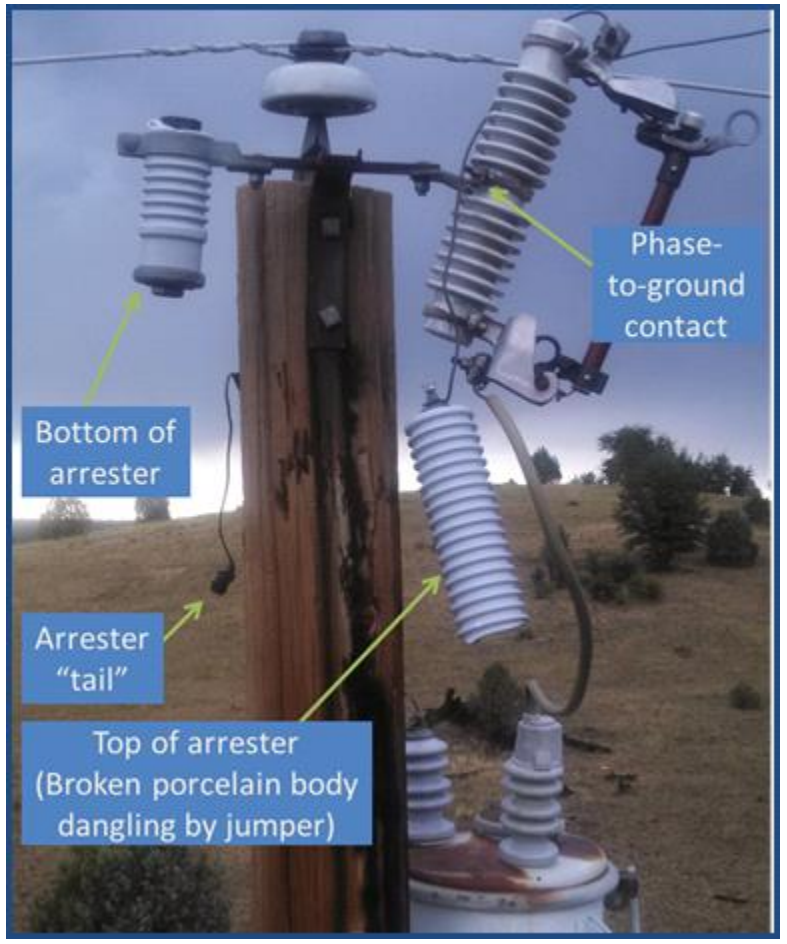
- Photo shows pieces of failed arrester porcelain on ground.
- During periods of elevated fire risk, arrester debris could start fire.

Case Study: Catastrophic Arrester Failure



- Catastrophically failed arrester from a different case.
- Top of arrester still connected to phase conductor and free to swing in wind.
- Grounded arrester tail also still free to swing.

Case Study: Catastrophic Arrester Failure



- Free-swinging conductors represent potential future faults.
- Faults affect customers and stress line equipment (transformers, switches, conductors, …).
- Faults also arc and can eject molten and/or burning particles.
- During periods of elevated fire risk, arcing or particles can start fire.
- Knowing that an arrester has failed, and being able to find it, enables corrective action.

138 kV Arrester Failure (Pre-Event)

138 kV Arrester Failure (Event)

138 kV Arrester Failure (1.5 Minutes Post Event)

Summary and Conclusions

- Power line issues cause many wildfires.
- Conventional operation of distribution is reactive. “Smart grid” remains mostly reactive.
- DFA technology, developed by Texas A&M Engineering, provides awareness of line conditions and events, enabling better line management.
- Supported by the Texas legislature, six Texas utilities are demonstrating DFA technology, coupled with with Texas A&M Forest Service risk mapping.
- The first several months at six utility companies already have documented multiple potential fire risks detected solely by DFA technology.

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