

Electric Distribution R&D Peer Review 2006

Project Summary

YOUR ORGANIZATION:	EPRI Solutions
PROJECT TITLE:	Development and Demonstration of Advanced Monitoring Systems for Fault Location, Analysis, and Prediction
PRESENTERS:	Mark McGranaghan
FY 2006 FUNDING:	\$603,780
FY 2007 FUNDING:	\$370,846
START/COMPLETION DATES:	2/9/2006 – 9/30/2007

Overall Project Purpose and Objectives: The project is part of an overall objective to improve reliability and efficiency of operating electric distribution systems. Losses due to power quality problems and interruptions are on the order of \$120b per year in the United States. There are significant opportunities to improve reliability at the distribution system level and reduce these losses.

This project is developing and demonstrating automated approaches for identifying and locating problems that are a major part of the reliability equation – fault location, fault analysis, and fault anticipation.

The project objectives are focused on two areas:

1. Approaches for existing monitoring systems. There is a significant investment in monitoring of distribution systems. This includes power quality monitoring systems, digital fault recorders, intelligent relays, other IEDs, and high end meters. The project will develop a disturbance library that will help with development of intelligent algorithms that can work with these existing systems to identify, locate, and evaluate faults on distribution systems.
2. New monitoring technologies (Distribution Fault Anticipator). There has already been a significant investment in DFA technology by EPRI and participating utilities. This project takes advantage of that investment and is focused on developing and demonstrating improved commercial designs of the technology.

FY 2005 and FY 2006 Results and Accomplishments:

- Subcontracts are being finalized with Texas A&M University and with Power Solutions Inc. for the DFA development and demonstration parts of the project.
- Project kickoff meeting held in Dallas, TX on January 30, 2006 with participation of utility partners. The meeting was hosted by TXU Energy Delivery. The meeting included an overall project kickoff meeting as well as the inaugural meeting of the DFA focus group for the DFA development part of the project.
- Utility partners have been organized for monitoring data collection and documentation of distribution systems that will be the basis of the National Disturbance Library development.

Task 1 - Review Existing Technologies

- Initial literature search regarding existing fault location technologies has been started.

Task 2 - Design Monitoring Disturbance Library

- Components of the disturbance library have been defined and discussed with utility partners:
 - Monitoring Data (Events)
 - Electrical System Characteristics
 - Event Documentation
- A method of sharing data between the partner utilities and EPRI Solutions has been developed based on the PQView software. This will allow sharing of data from a wide variety of existing monitoring systems.
- Design of the databases to contain the disturbance and system information is under way.

Task 3 - DFA System Design and Development

- Inaugural meeting of the DFA Focus Group, hosted by TXU Electric Delivery, January 30-31, 2006, in Dallas, Texas. In that meeting, existing DFA capabilities were reviewed and discussions were held regarding some of the areas in which the DFA system needs refinement to allow it to be more useful in day-to-day utility operations. We solicited the group's input on industry- and company-specific needs and objectives.
- Compiled High-Level DFA Specifications, including form factor and functionality for equipment and planned communications capabilities for the pilot demonstration.

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- Led a discussion during the April 24, 2006, DFA Focus Group conference call, regarding expectations of utility participants prior to and at the next in-person meeting of that group. We followed that call with an e-mail summary of the information needed from utility participants by May 15, 2006. Requested information focused on identification of DFA stakeholders within each utility, identification of the type and format of data each stakeholder needs, and each participant's review and comments regarding High-Level DFA Specifications, which were provided as an attachment.
- In conjunction with TXU Electric Delivery, which has responsibility for leading the DFA Focus Group, we established a date and forum for the second in-person meeting of the group: May 23, 2006, TXU offices, Dallas, Texas. This venue was chosen to coincide with the IEEE/PES Transmission and Distribution Conference and Exposition, which a significant number of the focus group participants already planned to attend.

Task 4 - Develop Monitoring Disturbance Library

- Utilities will select example distribution systems for tracking performance and providing disturbance event data.
- Provide documentation about systems in standard formats
- Disturbance and trended data will be recorded by monitoring systems for these example distribution systems
- Utilities will provide documentation associated with the disturbance events
- Conference call was held on April 24, 2006 where the coordination issues associated with the data collection were discussed.
- Forms for describing events and the systems are being distributed to host utilities.
- Training of host utilities on collecting the measurement data is being organized.

Task 5 - DFA Pilot Installations

- Discussed with Southern company representatives the planned method for pilot demonstration of DFA capabilities at distributed locations (in contrast to the TXU pilot demonstration in the substation). The focus of that demonstration will be to determine and demonstrate the additional value gained from distributed DFA value, as compared to centralized (i.e., substation-only). It will focus on evaluation of capabilities and benefits, without regard for any specific platform that would be intended for installation in distributed locations in the long-term.

Task 6 - Evaluations of DFA Pilots and Advanced Algorithms

- Not started

Task 7 - Information Sharing Resource Center

- Initial design of web site for the information resource center is under way.

FY 2007 Plans and Expectations: FY 2007 will involve completing the National Disturbance Library, demonstrating the DFA in both substation and feeder applications, and organizing information in a web site for advanced monitoring information.

Public/Private Partnerships: The project work is being conducted by EPRI Solutions, Texas A&M University, and Power Solutions, Inc. Texas A&M and Power Solutions, Inc. are responsible for the DFA development and testing portions of the project. EPRI Solutions is responsible for overall project management and the coordination of utilities for developing the National Disturbance Library. Utility partners are making a major contribution to this project in the form of monitoring system implementations, DFA applications, data collection, data processing, system characterization, and focus groups to identify product requirements. The utility contribution for the project is \$1.8M. The partner utilities are:

- TXU Electric Delivery
- Southern Company
- American Electric Power (AEP)
- Tennessee Valley Authority (TVA)
- Consolidated Edison
- San Diego Gas & Electric (SDG&E)
- United Illuminating (UI)
- Progress Energy Carolina

The project results will provide a valuable resource for universities and other researchers around the country developing advanced applications for analysis of power system disturbance monitoring data.