NASPI Working Group Meeting
Control Room Solutions Task Team (CRSTT)
Breakout Session

Presenters: Mike Cassiadoro & Jim Kleitsch

October 19, 2016

Agenda

I. Introductions

II. Automatic Disturbance and Oscillation Detection at San Diego Gas & Electric (SDG&E) and Salt River Project (SRP)

III. Data Analytics Study of FNET/GridEye Measurement

IV. PJM Operator Training Simulator Update

V. Status Update on CRSTT Work Products and Industry Outreach

VI. Review of CRSTT Vision, Mission, Priorities and Goals

VII. Adjourn

Breakout Session Presentations

Control Room Solutions Task Team

- Automatic disturbance and oscillation detection at SDG&E and SRP – Jared Bestbreuer (Schweitzer Engineering Laboratories, Inc.), Tariq Rahman, Dan Eklund & Subburaman Sankaran (San Diego Gas & Electric) and Ellery Blood & Greg Zweigle (SEL)
- Data analytics study of FNET/GridEye measurement – Yong Liu, Yilu Liu, Ling Wu, Dao Zhou & Jiahui Guo (University of Tennessee Knoxville & Oak Ridge National Lab)
- PJM Operator Training Simulator – Emanuel Bernabeu
- CRSTT business

The above presentations will be delivered during the CRSTT breakout session and posted separately on the NASPI website.

Focus Area Documents

1. **System Islanding Detection and Blackstart Restoration – Posted in June 2015**
   - (Kleitsch – ATC, Cassiadoro – TRS)
2. **Using Synchrophasor Data for Voltage Stability Assessment – Posted in Nov. 2015**
   - (Farantatos – EPRI, Vaiman – V&R Energy)
3. **Using Synchrophasor Data for Phase Angle Monitoring – Posted in May 2016**
   - (Cassiadoro – TRS, Nuthalapati - ERCOT)
4. **Enhanced State Estimation Survey**
   - (Vaiman – V&R Energy, Kleitsch – ATC)
5. **Oscillation Detection**
   - (Dyer – EPG, Blevins and Rjagopalan – ERCOT, Patel - EPRI)
6. **Determining Disturbance Locations**
   - (Dyer – EPG, Zweigle – SEL Inc., Cassiadoro – TRS)
7. **Using Synchrophasor Data to Monitor Reactive Power Balancing**
   - (Cassiadoro - TRS, SCE –A.J, Peak RC – Zhang)

Collecting Data for Video Event Files

- Objective: build a video library of events to demonstrate the value of synchrophasor data when analyzing disturbances

Video
PMU versus SCADA Video Events Summary. Please refer to EPG's template and the Synchrophasor Data File Format .CSV when creating a video event.
Video 1 - Current and voltage oscillations observed on the 138 kV system during testing of new generator controls (65 MW gas turbine). RTDMS PMU vs. SCADA Video 1
Video 2 - Voltage oscillations observed on the 230 kV system when a water pump was taken offline. RTDMS PMU vs. SCADA Video 2
Video 3 - Voltage oscillations observed following the loss of a 345 kV line during a period of high wind generation. RTDMS PMU vs. SCADA Video 3
Video 4 - Real and Reactive Power oscillations observed on the 69 kV system during a period of high wind generation with the plant radially connected (i.e. one of two normal source lines out of service). RTDMS PMU vs. SCADA Video 4
Video 5 - Real and Reactive Power oscillations observed during a period of high wind generation. RTDMS PMU vs. SCADA Video 5
Video 6 - Real Power and voltage oscillations observed following the loss of a large generator. RTDMS PMU vs. SCADA Video 6
Video 7 - Wind farm Oscillation Detection and Mitigation using Synchrophasor Technology Wind Farm Oscillation Detection and Mitigation
Video 8 - A 230kV fault followed by a loss of a large generation plant caused system frequency to drop approximately 72mHz momentarily, while having an impact on nearby system voltages and online generators (Clip 1, Clip 2 , Clip 3)
Video 9 - Please be patient with the download, the video is very large. This video captures the actual synchronization of a large generator to the electric grid. The windows in the visualization tool capture frequency, output power, voltage angle, and voltage magnitude of the generator and at a reference point on the electric grid.

CRSTT Support of NASPI Technical Papers

Three NAPSI Technical Papers released in March 2015:

- *Diagnosing Equipment Health and Mis-operations with PMU Data* – identifies ways to use your PMU data to monitor and protect asset health and system conditions
- *Model Validation Using Synchrophasor Data* – documents the details of established and developing practices for power plant and system model validation and calibration
- *Synchrophasor Maturity Model* – can be used for organizational self-assessment on synchrophasor adoption process, to evaluate the maturity of a class of synchrophasor software, or for organizational technology roadmapping.

Developing Uses Cases for NASPI Tech Paper

Event ID	Event	Event Category	Entities Involved	Event Description	Extended Description in Related NASPI Technical Paper	Safety Impact	Reliability Impact	Budgetary Impact
TE02	Failing potential transformer	Transmission Equipment	ATC	Abnormal voltage signature found while reviewing PMU data led to discovery of a failing potential transformer which was subsequently isolated and replaced.	p.38	The utility avoided safety risk to personnel that might have been in close proximity to the PT during its failure.		Utility avoided costs associated with customer minutes of interruption that would have resulted from the potential transformer's failure had the condition not been identified and a mobile transformer placed in service to facilitate the outages necessary for its replacement.
TE03	Loose connections in potential circuits	Transmission Equipment	OG&E	Fluctuations observed in positive sequence voltage data collected from PMUs led to discovery of a loose fuse connection in a CCVT safety switch. PMU data has been used in a similar fashion to reveal faulty terminations, animal-damaged conductor and contact corrosion.	p.40			Utility avoided costs associated with equipment damage and customer minutes of interruption that might have resulted had the issues not been addressed.
TE04	Failing voltage transformer	Transmission Equipment	Dominion	Sporadic voltage dips and fluctuations observed on a 500 kV line led to discovery of a failing CCVT which was subsequently isolated prior to its imminent failure.	p.42	The utility avoided safety risk to personnel that might have been in close proximity to the CCVT during its imminent failure.		Utility avoided costs associated with equipment damage that might have resulted from the CCVT's failure.
TE05	Identifying 69 kV arrester failure	Transmission Equipment	ATC	The details of a 69kV customer impact event were identified within two minutes by control room engineers reviewing PMU data. The fault could not be observed with SCADA data.	p.44		Utility able to identify and isolate the failed lightning arrestor shortly after relay operation occurred.	

CRSTT Industry Outreach

- **WECC Joint Synchronized Info Subcommittee (JSIS) –** Several team members attended Sept. 2016 meeting and provided update on CRSTT work products.
- **NERC Synchronized Measurement Subcommittee (SMS) –** CRSTT co-leads joined Oct. 2016 meeting to discuss issues impeding integration of synchrophasor technology into control room environment.
- **NERC Operating Reliability Subcommittee (ORS) –** CRSTT co-leads to provide subcommittee with update on team work products during Nov. 2016 meeting.

CRSTT Vision and Mission

- **Vision –** to fully integrate real-time synchrophasor applications into daily control room operations with clearly defined operating limits, policies and procedures that provide wide-area situational awareness and enhanced grid reliability.
- **Mission –** to work collectively with other NASPI task teams to advance the use of real-time synchrophasor applications for the purpose of improving control room operations and grid reliability. This team will utilize its experience and regional diversity to provide advice, direction, support and guidance to NASPI stakeholders and other organizations involved in the development and implementation of real-time synchrophasor applications.

CRSTT Priorities

1. Increase awareness of advance synchrophasor applications and their use in the control room.
2. Provide guidance on best practices.
3. Identify issues that impede implementation.
4. Ensure application training is available to end users and promote operational event analysis to demonstrate value.

CRSTT Priorities (Cont.)

5. Support the development of operating policies and procedures that relate to integration of synchrophasor data and information into the control room.
6. Encourage the integration of synchrophasor data with other control room data (e.g. SCADA) to enhance the information provide to real-time operations staff.

CRSTT Goals for 2016

1. Prioritize and complete remaining focus area documents.
2. Develop operational use case summary documents to support NASPI technical papers.
3. Create additional video event files for use cases and simulated events (includes data sharing).
4. Gather operator feedback on synchrophasor applications (best practices).
5. Identify available training materials.

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Next NASPI CRSTT Conference Call: November 16, 2016

Next NASPI WG Meeting: March, 2017 in Gaithersburg, MD