NASPI Control Room Solutions Task Team Monthly Meeting

Presenters: Mike Cassiadoro & Jim Kleitsch

February 15, 2017

NASPI North American SynchroPhasor Initiative

Agenda

I. Introductions

II. Review Status of CRSTT Work Products

- Focus Area Documents
- Video Event Files
- Use Case Documents

III. Provide Update on CRSTT Industry Outreach Efforts

IV. Compare Institutional and NASPI Priorities

V. Review Proposed Changes to CRSTT Vision, Mission, Priorities and Goals for 2017

VI. Adjourn

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 – Preliminary responses received, more analysis needed.**
   - (Vaiman – V&R Energy, Kleitsch – ATC)
5. **Oscillation Detection**
   - (Nuthalapati – Peak, 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, Vaiman – V&R Energy)

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.

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.	

Next Steps – Work to develop a single 1-2 pg. use case summary doc to help educate end users then expand effort to other use cases once format has been defined.

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 & Jan. 2017 meetings to discuss issues impeding integration of synchrophasor technology into control room environment.
- **NERC Operating Reliability Subcommittee (ORS) –** CRSTT co-leads provided subcommittee with update on team work products during Nov. 2016 meeting. Must determine next steps.
- **IEEE PES Cascading Failure Working Group (CFWG) -** Marianna coordinating as team lead.

CRSTT Industry Outreach (Cont.)

NASPI CRSTT to participate in joint panel session with IEEE PES CFWG and other NASPI teams at IEEE Innovative Smart Grid Technologies Conference (April 2017)

Session Title: Industry Best Practices in Using Synchrophasor Technology

Session Scope: This session is jointly organized by the PMU Subgroup of IEEE PES CFWG and three NASPI Task Teams (CRSTT, DNMTT, EATT). The IEEE PES CFWG and NASPI task teams are bringing together a team of industry experts to share their experiences in deploying and using synchrophasor technology in order to improve reliability of the smart grid and enhance wide-area situational awareness. Our team includes BPA, ERCOT, IEEE PES CFWG, NASPI CRSTT/DNMTT/EATT, PJM, and SDGE.

Comparing Institutional & NASPI Priorities

INSTITUTIONAL priorities	NASPI activities
Get multiple vendor-supported, production-grade software applications that enhance reliability	• NASPI tool comparison workshops – now joint w/ SMS? • NASPI CRSTT technical papers
Move more synchrophasor applications into trusted use in control rooms & planning depts	• NASPI collaboration with NERC SMS and WECC JSIS • CRSTT white papers – more coming? • Support NERC SMS technical papers • CRSTT training initiatives
Get better sharing of PMU data among users and for research	• New DOE-NASPI data-sharing options investigation
Outreach to demonstrate value of synchrophasor technology for asset owners	• NASPI and NERC SMS technical papers • Support SMS, JSIS, SPP, other new regions and TOs as requested
Make it easier for new users to adopt synchrophasor systems	• Feature success stories and lessons learned in meetings • Synchrophasor Starter Kit – move forward? • Support others' training efforts

Comparing Technical & NASPI Priorities

TECHNICAL priorities	NASPI activities
Improve end-to-end quality of delivered PMU data and applications that can survive less-than-perfect data	• Phasor Applications Requirements Task Force & technical paper • NIST funding to test application sensitivity to data problems
Reduce synchrophasor vulnerability to GPS, timing system vulnerabilities	• New NASPI Time Synchronization Task Force (multi-agency, vendors) – many work products out 2016-17 • NIST timing workshop in 3/17
Use big data techniques on PMU data for pattern recognition and grid condition baselining	• NASPI Work Group presentations • EATT data mining initiative
Update NASPInet communications architecture	• PNNL NASPInet 2.0 study under way • Synchrophasor Signal Registry
Improve synchrophasor system cyber-security knowledge and use	• Synchrophasor network survey?
Start working on distribution-level synchrophasor applications	• New NASPI Distribution Task Team

More NASPI issues to consider

We don't need to discuss these in December, but please start thinking about these topics now for discussion and resolution in/by March 2017

- What else can we do to lower NASPI meeting costs w/o compromising meeting effectiveness?
- NASPI WG meeting frequency – is it appropriate to keep doing 2 NASPI WG mtgs/year STARTING IN 2018? Should we move to one 3-day WG mtg/year? What would we/the synchrophasor community lose or gain if we meet less often (e.g., Task Team membership and effectiveness)?
- How do we continue maximizing the value of our partnerships and coordination with other groups (SMS, JSIS, NERC, IEEE, etc.)? Are there activities or topics that NASPI should dial back, pass to other entities to work, or start fresh?

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CRSTT Vision & Mission (Review for 2017)

Share and review *Control Room Solutions Task Team Work Plan* that was distributed to members via email on 12/14/2016 and gather feedback.

Adobe Acrobat Document

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Next NASPI WG Meeting: March, 2017 in Gaithersburg, MD
Next NASPI CRSTT Conference Call: April 19, 2017