DOE/OE Transmission Reliability Program

GPS Issue Management

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27/28 June 2013

Washington, DC

CERTS
CONSORTIUM FOR ELECTRIC RELIABILITY TECHNOLOGY SOLUTIONS

Project objective

- Develop a plan to explore the implications of issues on electricity systems infrastructure caused by dependence on Earth-based and Space-based Timekeeping and Navigation (ESTN) systems
- Addressing two key questions:
  1. How and for what do energy systems (electric and pipeline) use ESTN systems (distinguishing between the timekeeping, locational and navigation functions)? Which of these uses are mission-critical and/or real-time and/or important but slower?
  2. How are telecom systems (wireless and wireline, fiber and satellite, internet) vulnerable to local and system ESTN failures?
- In parallel we will also investigate:
  - Developing a real-time test to identify suspect GPS signals as data are being time-stamped
  - Determine motivation for and develop a process for phasor data applications to develop data quality indicators and handle data triage.

Major Technical Accomplishments

- **Task 1:** Develop a roadmap to address issues identified in "GPS Vulnerabilities and Timing Issues" 10 questions
- **Task 2:** Assess Energy Systems Applications That Use Earth-based and Space- based Timekeeping and (ESTN) Systems
- **Task 3:** Investigate Telecom System Vulnerabilities To Local and System-level GPS Failures
- **Task 4:** Develop Approaches to ESTN Systems Signal Management

Milestones and Deliverables

- **Task 1:** Develop a roadmap to address issues identified in "GPS Vulnerabilities and Timing Issues" 10 questions
  - Roadmap to address timing issues/impacts

- **Task 2:** Assess Energy Systems Applications That Use ESTN Systems
  - Report on findings including an organized assessment (taxonomy or matrix) of energy system applications categorized by the elements above.

Milestones and Deliverables

- **Task 3:** Investigate Telecom System Vulnerabilities To Local and System-Level GPS Failures
  - Executive briefing document and/or powerpoint presentation.
  - Full report on findings including an organized assessment (taxonomy or matrix) of telecom system vulnerabilities to local and system GPS failures.
  - Identify effects of telecom vulnerabilities on energy system applications.[FUTURE]
- **Task 4:** Develop Approaches to ESTN Systems Signal Management
  - Executive briefing document and/or powerpoint presentation.
  - Full report.

Risk Factors

- *Risk factors affecting timely completion of planned activities as well as movement through RD&D cycle*
  - There are no technical, fiscal, logistical, or organizational risk factors. While work was late in starting, the team is now in place to achieve the objectives of this project.

Follow-on

- *Early thoughts on follow-on work that should be considered for funding in FY14*
  - *Assessment of synchrophasor accuracy on applications to continue work begun in "Advanced Synchrophasor Metrology" project.*
  - *More detailed modeling of the electric grid's dependence on the telecom network.*
  - *Follow-up to Task 3 on better modeling "Telecom System Vulnerabilities"*

EXTRA SLIDES

GPS Vulnerabilities and Timing Issues

These questions were posed by Alison Silverstein, NERC Project Manager for NASPI, at a NASPI Working Group meeting:

1. How can we tell if signals from a ESTN system are or are not trust-worthy?
2. If you determine that the timing signal is untrustworthy, can the PMU or PDC fail over to a back-up time source?
3. If we use SONET or other network time sources or on-board clocks as a back-up or alternate time source, how long will that time source remain accurate or drift to an unacceptable time offset?
4. Once we have multiple PMUs and PDCs operating on distributed time sources, how do we coordinate time and synch data across these devices on dispersed time sources?

GPS Vulnerabilities and Timing Issues (cont.)

5. For real-time phasor data applications, how do we treat data from PMUs with potentially compromised time stamps?
6. If a signal becomes untrustworthy, how do we tell when the ESTN system time signal is trustworthy again?
7. When ESTN system signals are trustworthy again, how do we resynch timing from multiple PMUs and PDCs?
8. Does GPS have so many vulnerabilities that the utility industry should use other timing systems or methods (rather than GPS) for electric industry mission-critical applications?
9. Should we be asking North American PMU and PDC manufacturers and buyers to design and procure devices that offer a back-up or alternate timing system in addition to GNSS?
10. Since telecom networks depend on GPS, what can the utility industry do to reduce our vulnerability to communications network GPS dependence?