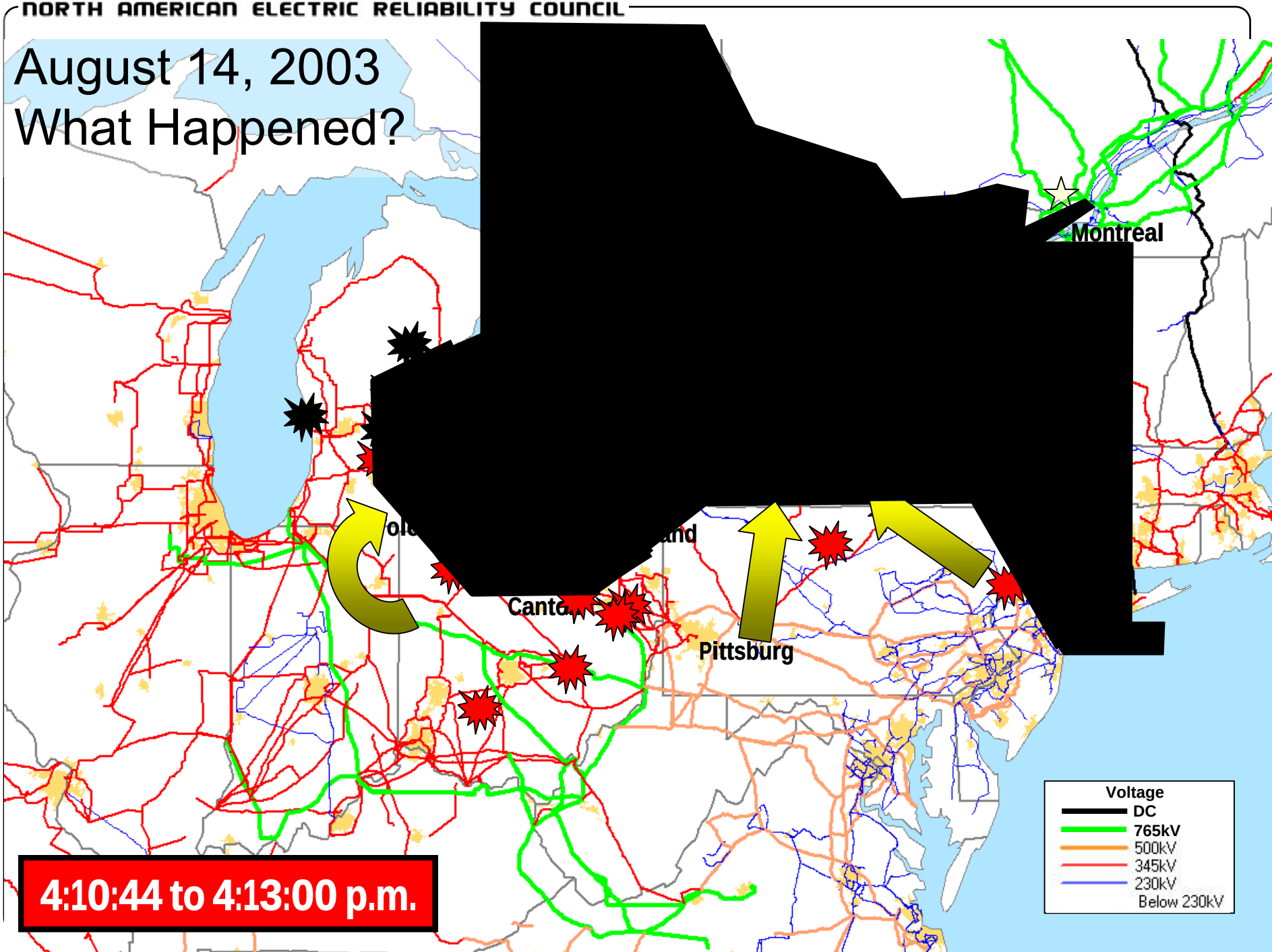
Electric Reliability Measures to Prevent and Mitigate the Impacts of Future Cascading Blackouts

NEMS/AEO Conference

March 23, 2004

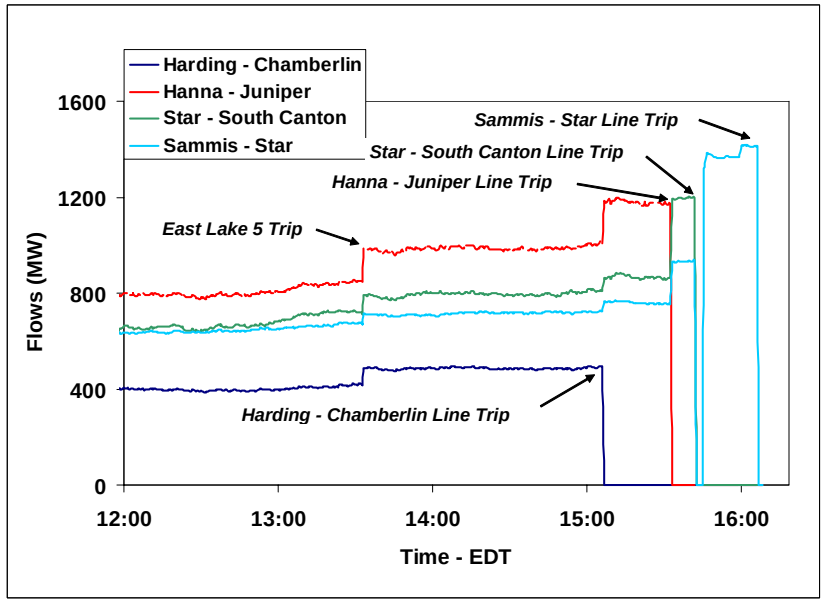

NORTH AMERICAN ELECTRIC RELIABILITY COUNCIL
August 14, 2003
What Happened?
Montreal
Pittsburg
Voltage
DC
765kV
500kV
345kV
230kV
Below 230kV
4:10:44 to 4:13:00 p.m.

NERC Steering Group

- Paul Barber
  - Facilitator
- Terry Boston
  - TVA
- Mark Fidrych
  - WAPA
- Sam Jones
  - ERCOT
- Yakout Mansour
  - British Columbia Transmission
- Dale McMaster
  - Alberta Electric System Operator
- Bill Newman
  - Southern Company
- Terry Winter
  - CAISO

Immediate Causes of the Blackout

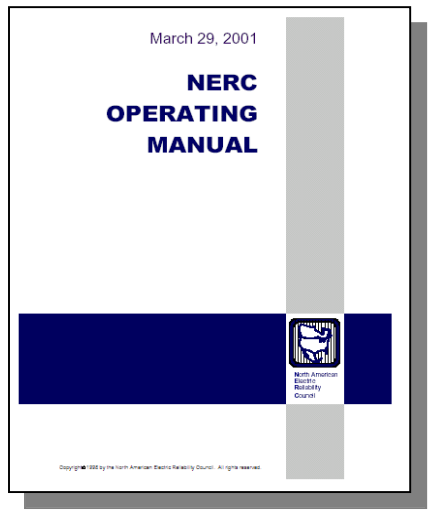
- FE lacked situational awareness
- FE failed to manage tree growth in ROWs



- MISO did not provide effective diagnostic support to FE

Violations of NERC Reliability Standards

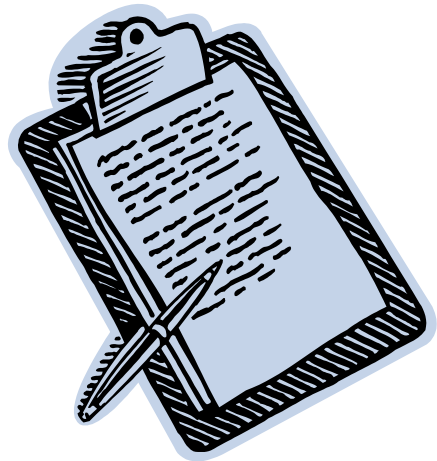
- FE did not return the system to safe operating state within 30 minutes (OP-2)
- FE did not notify others of impending emergency (OP-5)
- FE did not have effective monitoring capability (OP-5)



Operating Policies

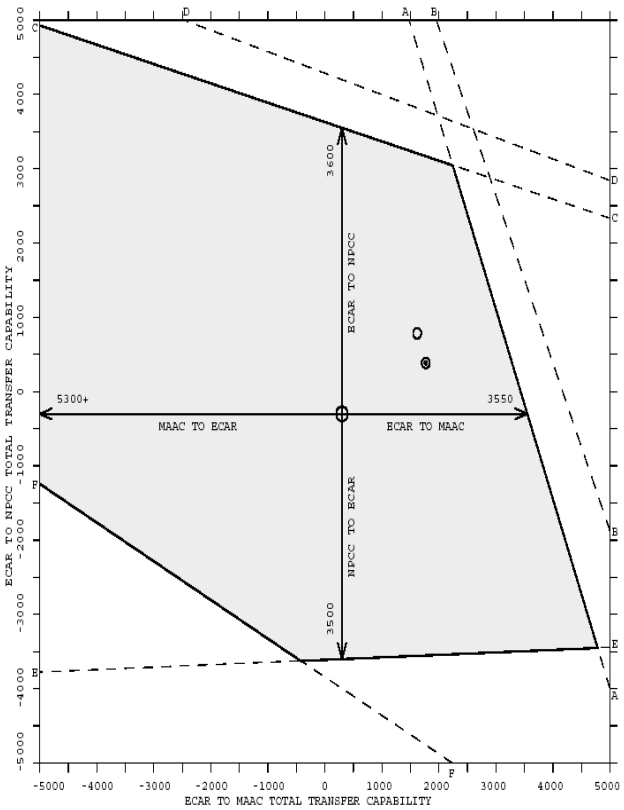
- FE did not adequately train operating personnel for emergency response (OP-8)
- MISO did not notify others of impending emergency (OP-9)

Other Key Findings of Investigation



- Compliance with reliability rules requires objective measurements and firm actions to resolve violations
- NERC policies were not sufficiently specific regarding reliability coordinator and control area functions, responsibilities, authorities, tools
- Problems from prior wide-area blackouts are being repeated: trees, operator tools, training

Other Key Findings of Investigation



- System planning and design studies, operations planning, facilities ratings, and modeling data accuracy were ineffective preparations for 8/14 event
- Power system in northeastern Ohio was being operated with insufficient reactive margins to meet NERC criteria
- Protection and controls could be more effectively used to slow or minimize spread of cascade

NERC Blackout Recommendations

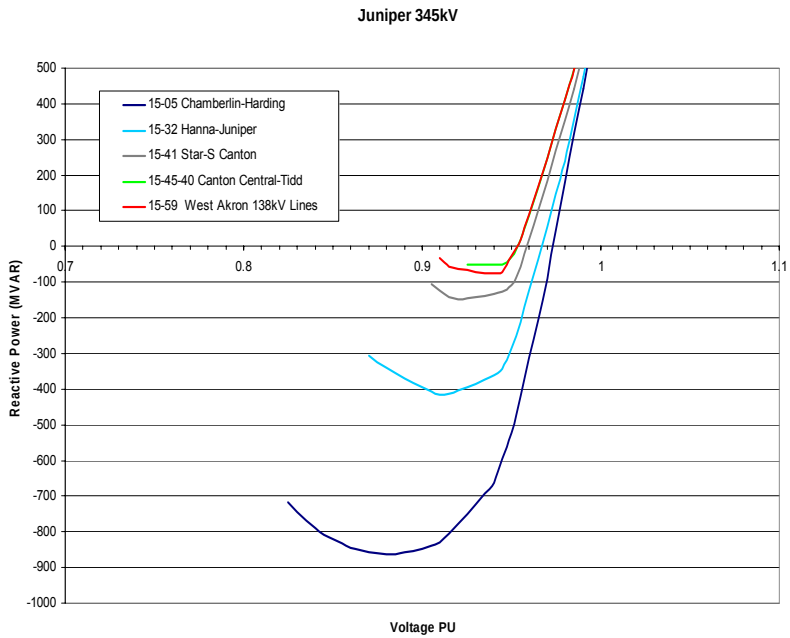
- Corrective Actions
- Strategic Initiatives
- Technical Initiatives

Steering Group Goals:

1. Correct cited deficiencies in root cause
2. Address all other contributing factors and deficiencies
3. State firm, objective and measurable actions

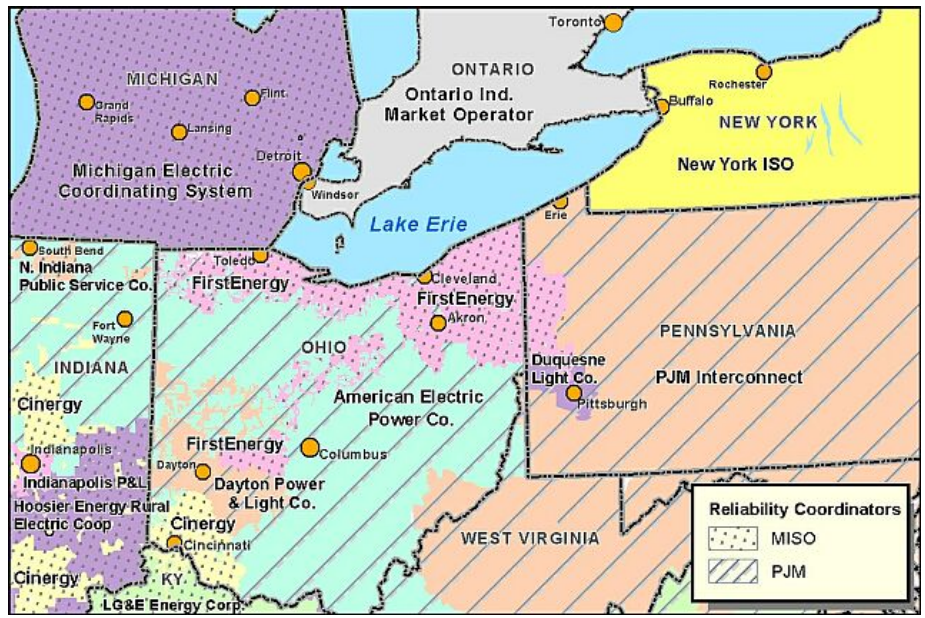
Corrective Actions - FE

- Voltage criteria and reactive resources
- Operational preparedness and action plan
- Emergency response capabilities and preparedness
- Control center and operator training

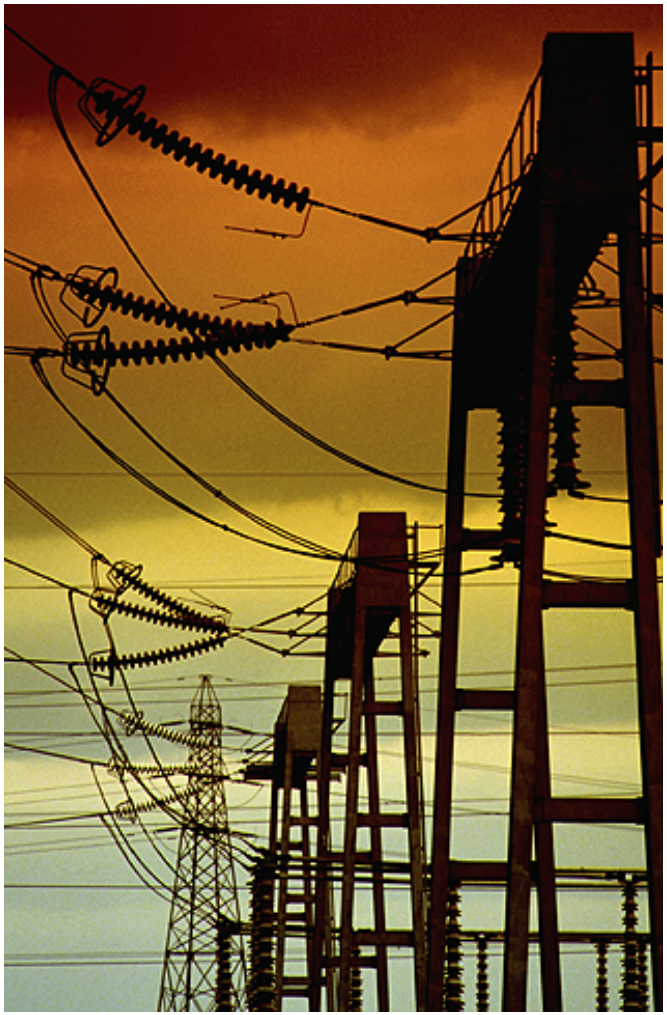


Corrective Actions – Reliability Coordinators

- MISO
  - Reliability tools
  - Visualization tools
  - Operator training
  - Communications protocols and procedures
  - Operating agreements
- PJM
  - Communications protocols and procedures



NERC Strategic Initiatives



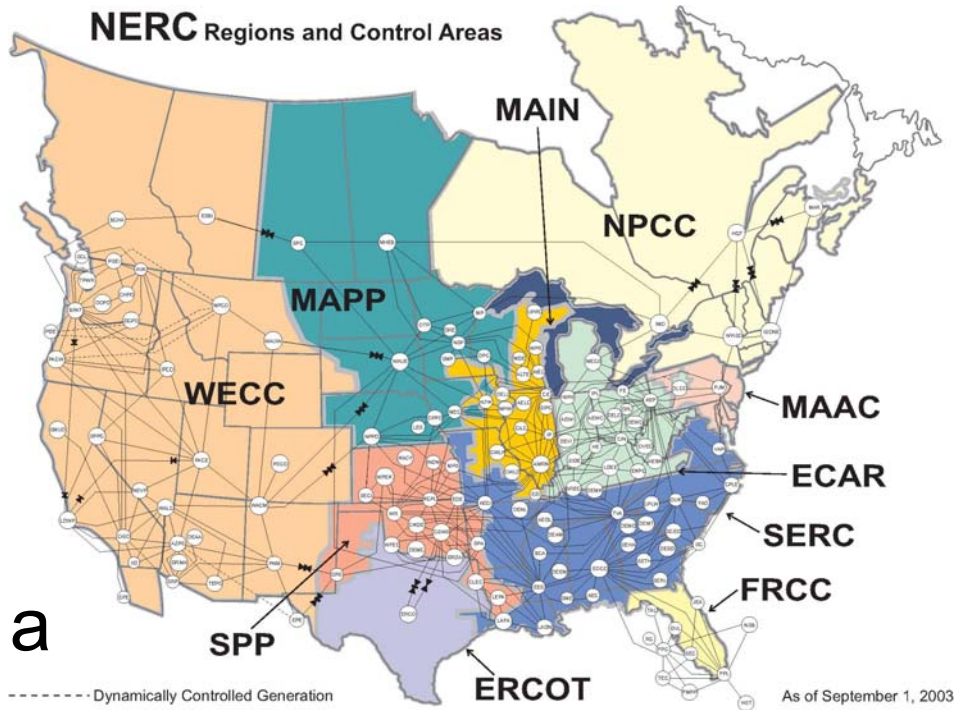
- Performance reviews
- Readiness audits
- Vegetation-related outage reporting
- Recommendations implementation tracking

Performance Reviews

- Strengthen NERC Compliance Enforcement Program
  - Regions to submit results to NERC
  - Provide list of non-compliant entities
- Regular *confidential* reports to the Board by NERC Compliance Director
  - Specific violations
  - Results of audits

Readiness Audits

- Audit all control areas and reliability coordinators
  - Based on ability to comply with NERC requirements
  - Based on existing programs
- Complete within 3 years and repeat on a 3-year cycle
- Reports to the Board



Vegetation-Related Outage Reports

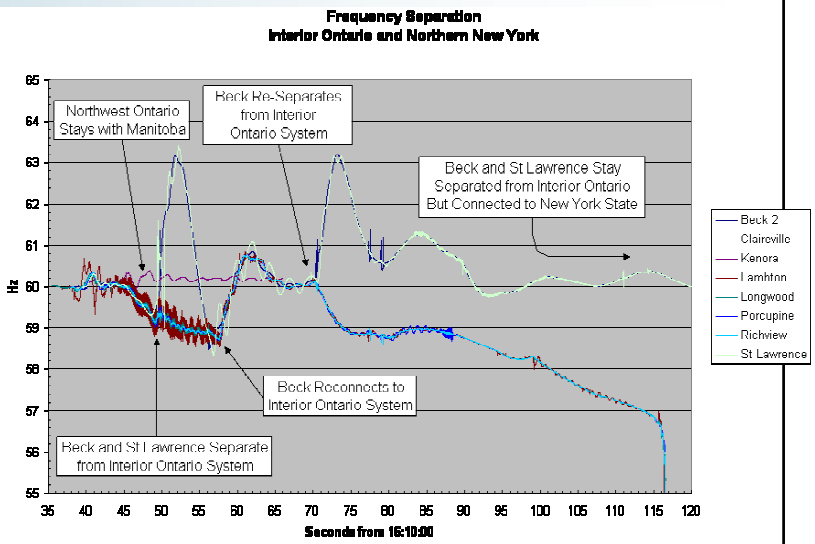
- Transmission owners to report tree contacts to the Regions (230 kV and above)
- Regions report to NERC
- Use WECC procedure as a model
- Regions to report annually on vegetation management surveys

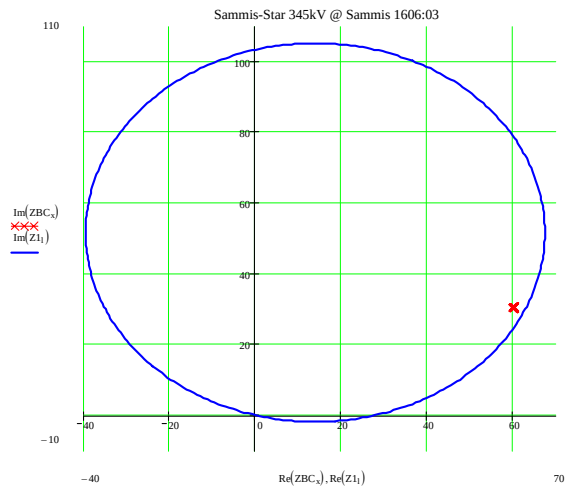
Recommendations Tracking

- NERC and Regions will track:
  - Implementation of recommendations
  - Compliance audits
  - Lessons learned from system disturbances
  - Use regional processes as model (e.g. WECC or NPCC)

NERC Technical Initiatives - 1

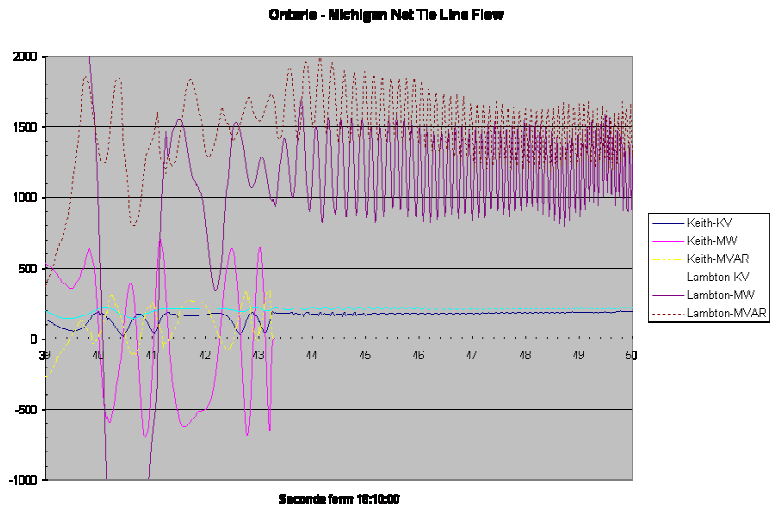
- Operator and reliability coordinator emergency response training
- Reactive power and voltage control
- Cascade mitigation
- Reliability coordinator and control area functions, authorities, and requirements
- Real-time operating tools
- Restoration review





NERC Technical Initiatives - 2

- Time-synchronized measurements for disturbance analysis and operations
- Reevaluate system design, planning and operating criteria
- System modeling and data exchange standards



Final Comment on Recommendations

Recommendations were developed by NSG with inputs from investigation teams, NERC committees, and public technical conferences on the blackout. Diverse views have been expressed and the final recommendations attempt to effectively accommodate and balance those views.

- Paul Barber
  - Facilitator
- Terry Boston
  - TVA
- Mark Fidrych
  - WAPA
- Sam Jones
  - ERCOT
- Yakout Mansour
  - British Columbia Transmission
- Dale McMaster
  - Alberta Electric System Operator
- Bill Newman
  - Southern Company
- Terry Winter
  - CAISO