Smart Grid and IDMS

IEEE PES 2009 General Meeting – Calgary, Alberta, Canada

Distribution Subcommittee

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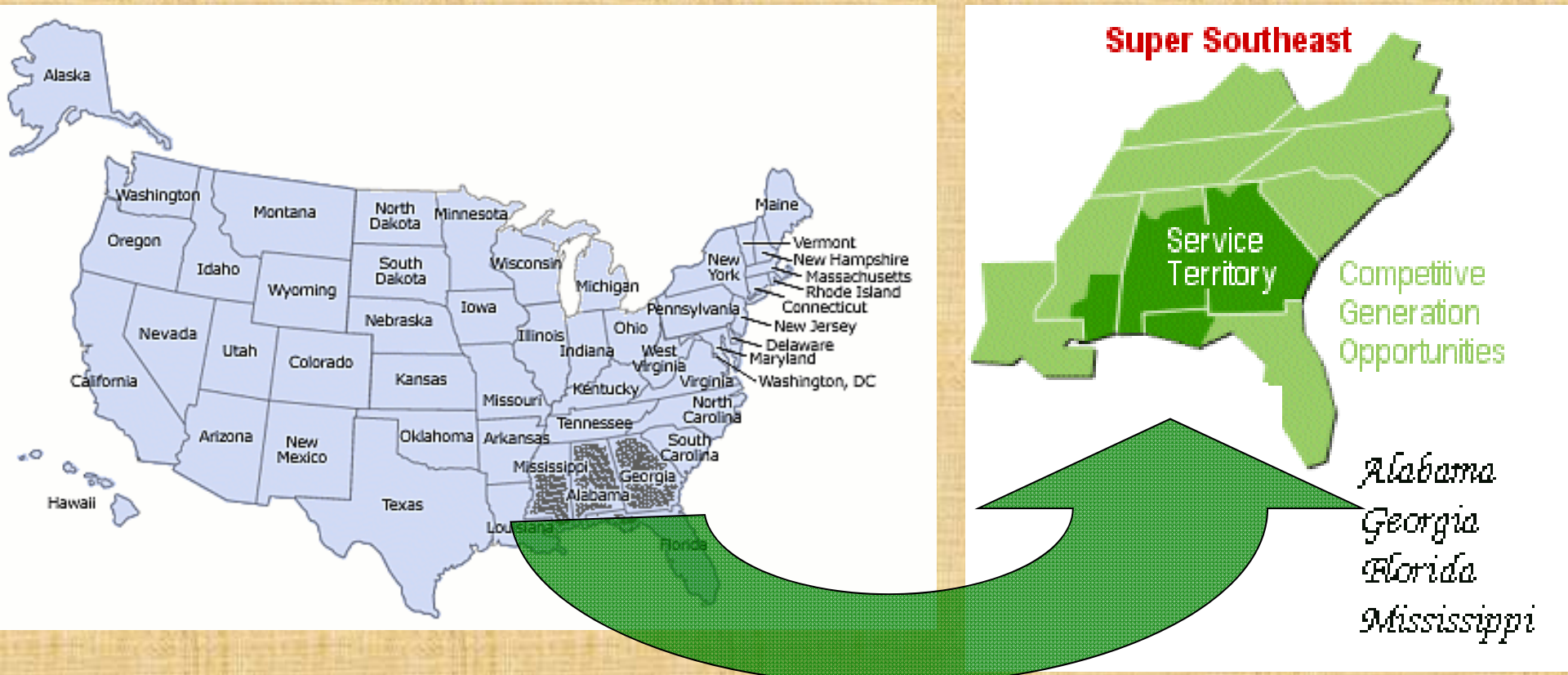
Presentation Agenda

- **Progression of Distribution Operations**
  - **Past**
  - **Present**
  - **Future**
- **Integrated Distribution Management System (IDMS) facilitates the Smart Grid**
- **Examples of AMI integration value**

The Southern Company



Serve 4.4 Million Retail Customers
Generating Capacity : 42,000 MW
120,000 Square Miles

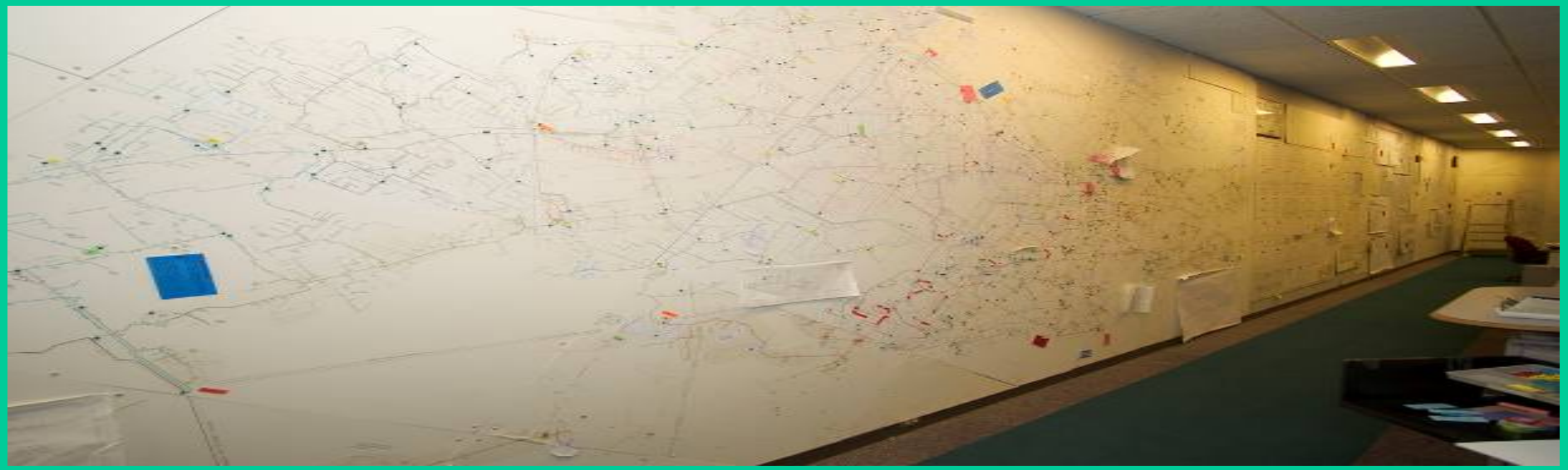
Alabama Power Company

- **APC serves 1,403,203 customers**
- **10,163 Miles Transmission**
- **76,137 Miles Distribution**
- **44,500 Square Mile Service Territory**

Past Distribution Operations

Prior to 1988

- **Less than 5% of Distribution Substations were automated**
- **No devices on the Distribution Feeder were automated**
- **Distribution System was operated manually with AutoCAD wall-mounted switching diagrams from 55 locations**
- **No OMS / WFMS in place to support operations**



Present Distribution Operations

- Distribution Automation program initiated at Alabama Power Company in 1991
  - •98% of substations automated
  - •3600 RTU sites
  - •230,000 points scanned (6s status / 12s analog)

Automation Technologies

- **Substation**
- **Line Monitoring**
- **Line Recloser**
- **Sectionalizing Switch**
- **Automatic Transfer Switchgear**
- **UG Network Relay**
- **Standby Generators**
- **Switched Capacitors**
- **Power Measurements**
  - **Per Phase basis**
  - **MW, MVAR, volts, amps**
  - **Calculate MVA, pf**
- **Remote control**
- **Fault Detection**
- **Power Quality**
  - **Harmonics to 15th**
  - **% THD**

Present Distribution Operations

Applications integration by operator

- **Distribution SCADA**
- **Switching Management**
- **Outage Management**
- **Crew Call Out System**
- **Work Force Management**

Why Change?

Improve distribution operation capabilities to address:

- **System loading, maximize assets utilizing connected model**
- **Predicting, locating, isolating, and analyzing faults with or without operator intervention – self healing systems**
- **Autonomous application systems**
- **Reliability and asset maintenance – Condition Based**
- **Demand Management – system losses and demand reduction programs**
- **Distributed generation**
- **Operator Training**
- **Enable active customer participation through AMI**

Less of this

RAW DATA

More of this

INFORMATION

Future Distribution Operations

Integrated Distribution Management System (IDMS) Project

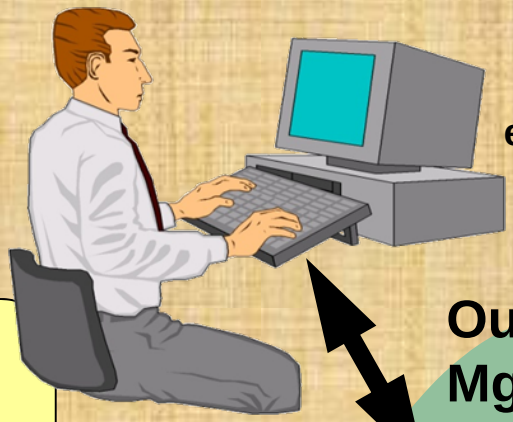
SCOPE of IDMS PROJECT

- **AREVA T&D product that achieves seamless integration of operating applications – combines OMS, SCADA, AMI, and Distribution Management into a single user interface for operator efficiency gains**
- **Utilizes ESRI GIS as the source for a connected and "intelligent" model**
- **GIS topology and attribution facilitates the use of advanced network analysis applications to enhance operational decisions**
- **Improve distribution system efficiency and expand demand management programs**
- **Distribution Operator Training Simulator**

IDMS Facilitates Smart Grid Operations

Advanced IDMS Applications Enabled from GIS

- **Unbalanced load flow analysis**
- **AFISR (Automatic Fault Isolation and Service Restoration)**
  - **De-centralized**
  - **Centralized**
- **Fault detection and location**
- **Volt/Var control / minimize distribution losses / demand management**
- **System coordination and protection analysis**
- **Contingency analysis**
- **Switching Management**
- **Advanced Crew Management**
- **Dynamic Deration of Power Equipment (Harmonic loading)**



e-terra*browser*

Call Center
(Call Handling Front End)
IVR

CIS
(Customer Data and Electrical Address)

AMR/AMI
(Customer Energization and Consumption)

CIM based Adaptor

Outage Mgmt

Planned Work Management
- Maintenance Planning
- New Construction
- Return to Normal
- Seasonal Reconfigure

Customer Notification

CIM based Adaptor

Network Operations
- Connectivity visualization
- SCADA
- Network Analysis/Opt
- Geographic & Schematic
- Outage Extent & Cause
- unPlanned & Planned Outage Lifecycle
- Performance Indices
- Historical Archive

e-terra*distribution*

Integrated Distribution Management System

Switching Operations

Crew Monitor &Assign

CIM based Adaptor

Resource Management
- Mobile Data System
- Crew Callout
- Crew Optimization

CIM based Adaptor

Asset Data (GIS, Subs, etc.)

T&D

IDMS Facilitates Smart Grid Operations

DOE and EPRI Support

- **IDMS project being co-funded by US Department of Energy's GridWise Program and the Electric Power Research Institute (EPRI)**
- **Demonstration project completed in June 2008**
- **Implementation at Alabama Power Company in 2010**

IDMS Facilitates Smart Grid Operations

IDMS and AMI Integration

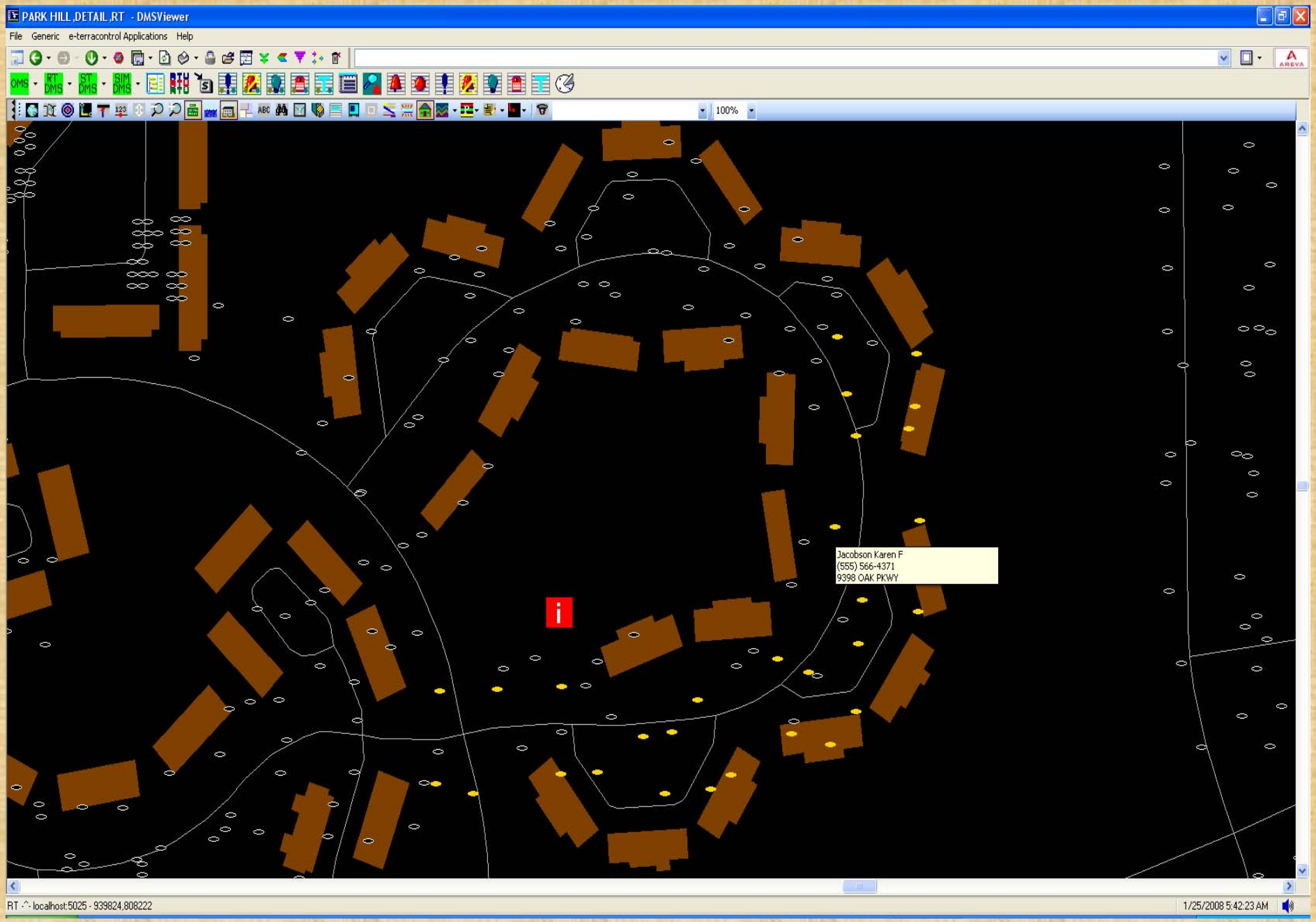
- **AMI Project completion in 2010**
- **Full Two-Way Network (By Definition)**
  - ✓ **Read Any Meter anytime**
- **All reading Types**
  - ✓ **KWh Readings; TOU Readings; Demand Readings (including Resets); Load Profile**
- **Voltage Information**
- **Active Power Outage, Power Restoration, and Tamper Detection**
- **Support Multiple Meter Vendors**

Distribution Network Management of the Future

- **Further demand for distribution network situational awareness and improved performance indices**
  - **Visualization of automation!**
  - **More severe penalties for reliability transgressions**
  - **More physical network reconfiguration capability**
  - **Dynamic model always showing current state of network**
- **Progression towards AMI becoming the primary tool for observation and a key component of supervisory control of the distribution network including the consumer premises -> real-time state observation and demand response enabler**
- **Complementary interaction with, and supervisory control of, field deployed automation (automated feeder/substation reconfiguration schemes like IntelliTeam)**
  - **closed loop reconfiguration – this is a key part of the "self-healing" bit in Smart Grid**
  - **implies providing broader, and dynamic, network connectivity knowledge to fast field deployed automation schemes**

Distribution Network Management of the Future (cont.)

- **Further requirements for automated loss minimization, reliability, and demand management means increased control at the distribution level**
- **Utility interface to Distributed Generation (monitor and control)**
- **Precise fault location determination to speed dispatch/repair**
- **Predictive and pro-active reconfiguration plans**
- **Analytical predictions of network tampering/power theft**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Jacobson Karen F
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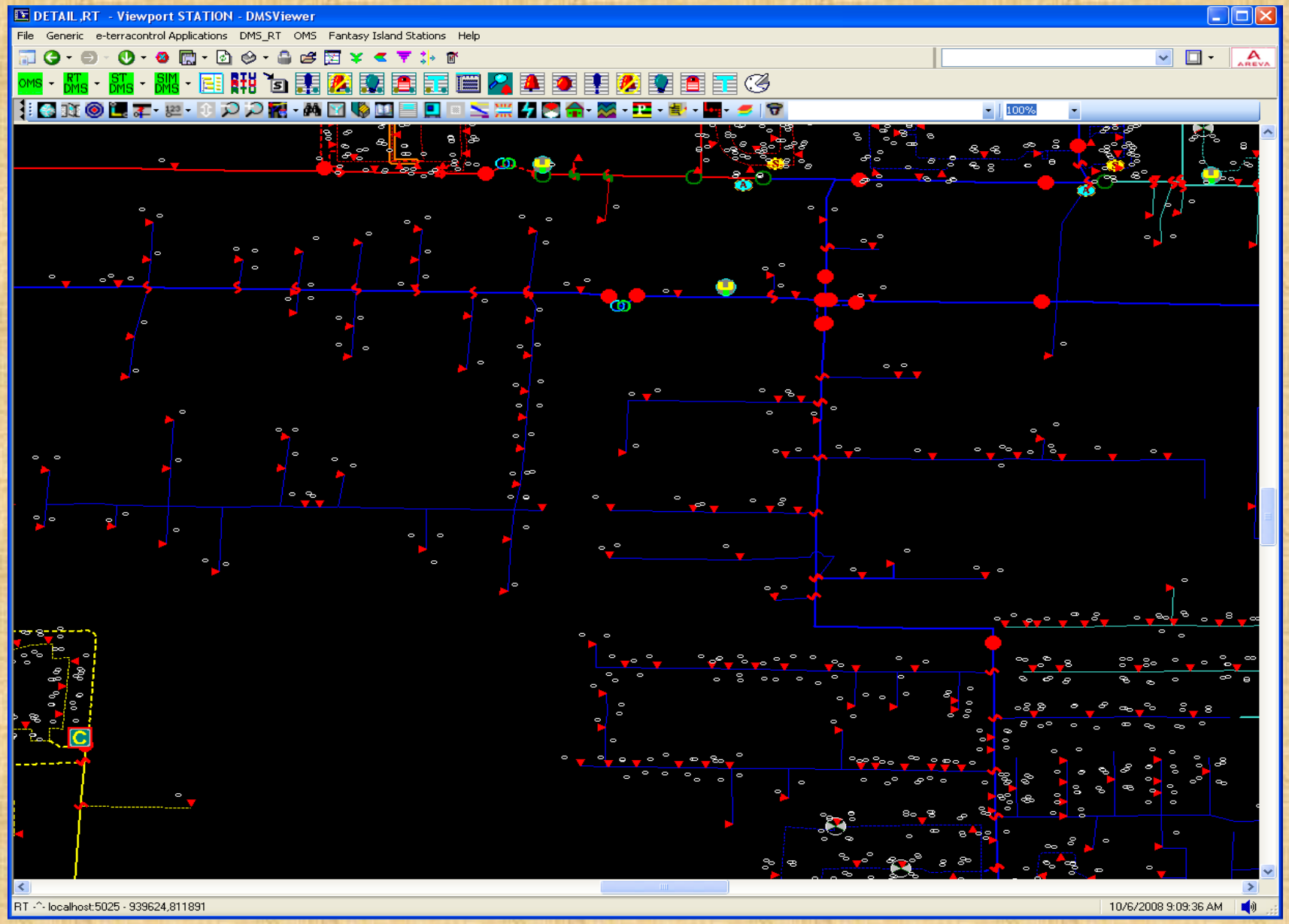
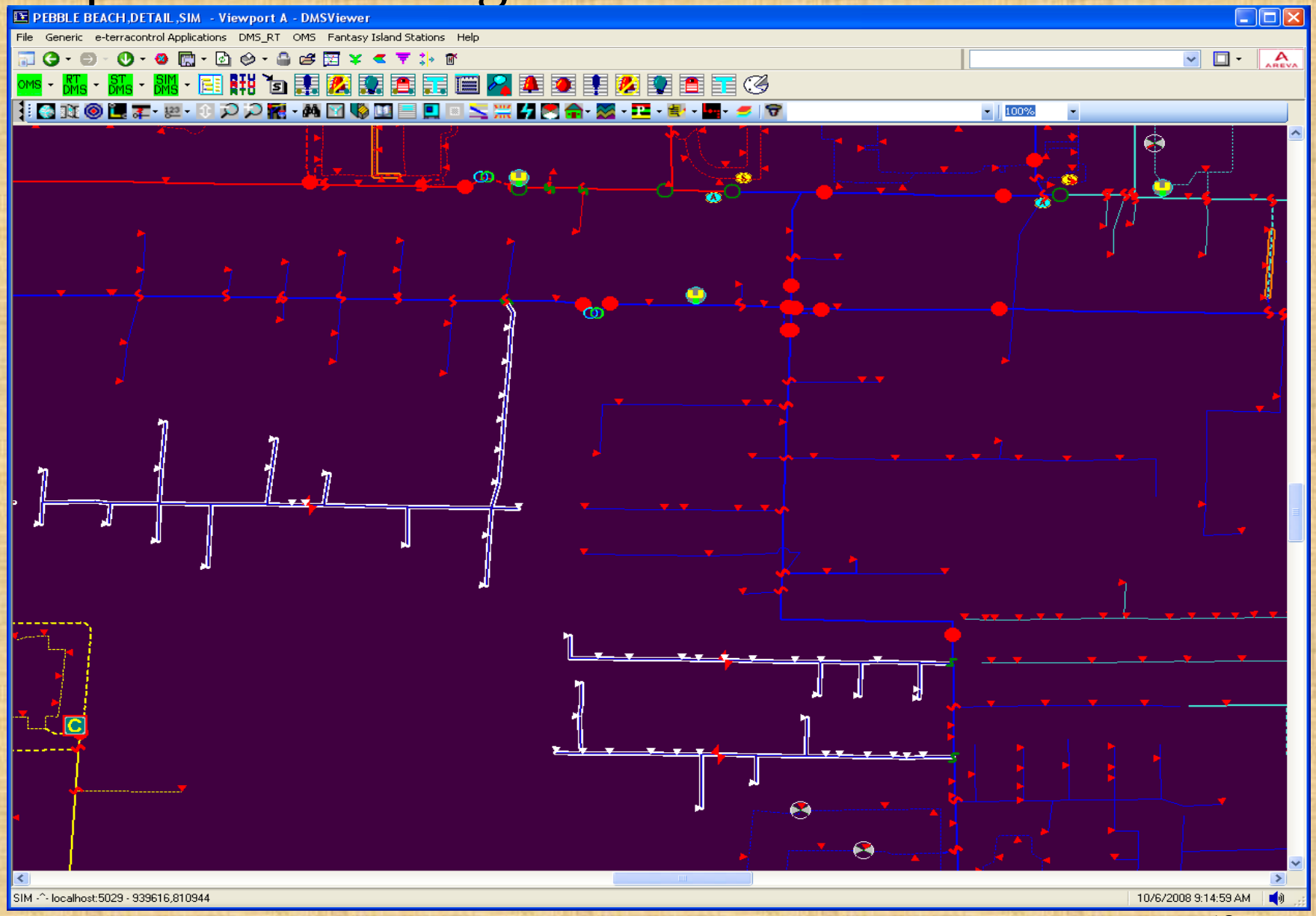
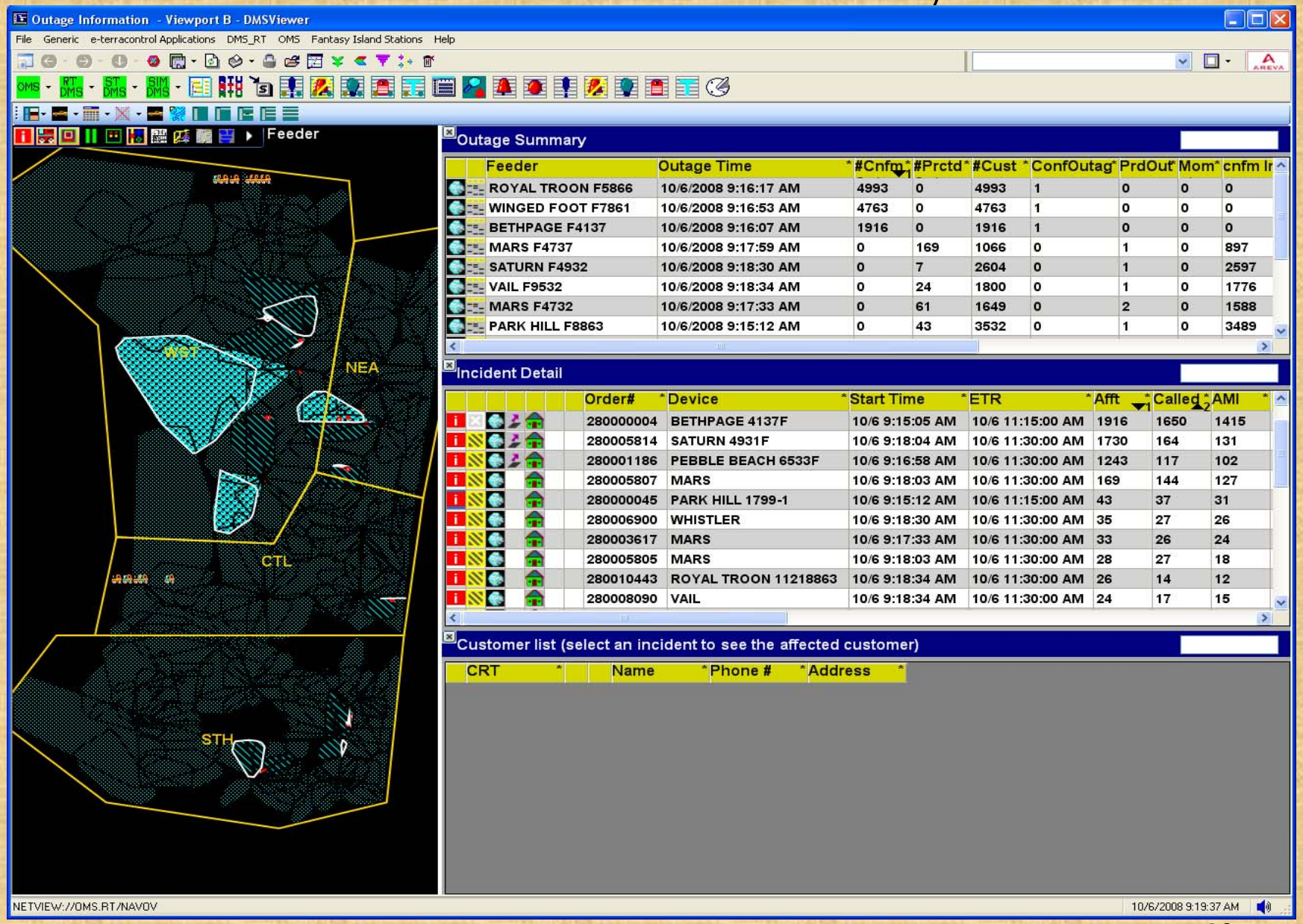
Pre-fault View of Overhead Circuits



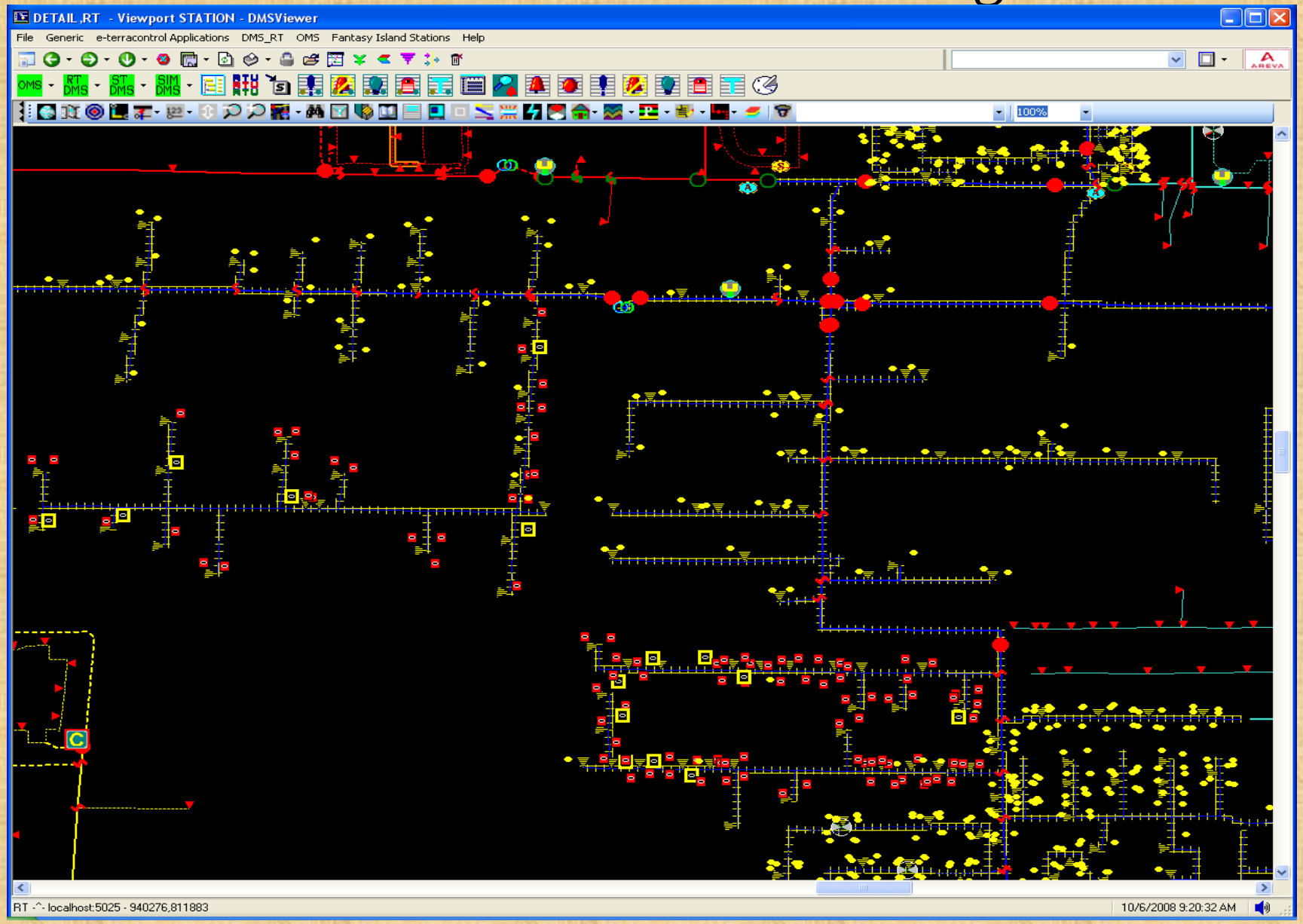
Dispatcher Training Simulator with 3 lateral faults



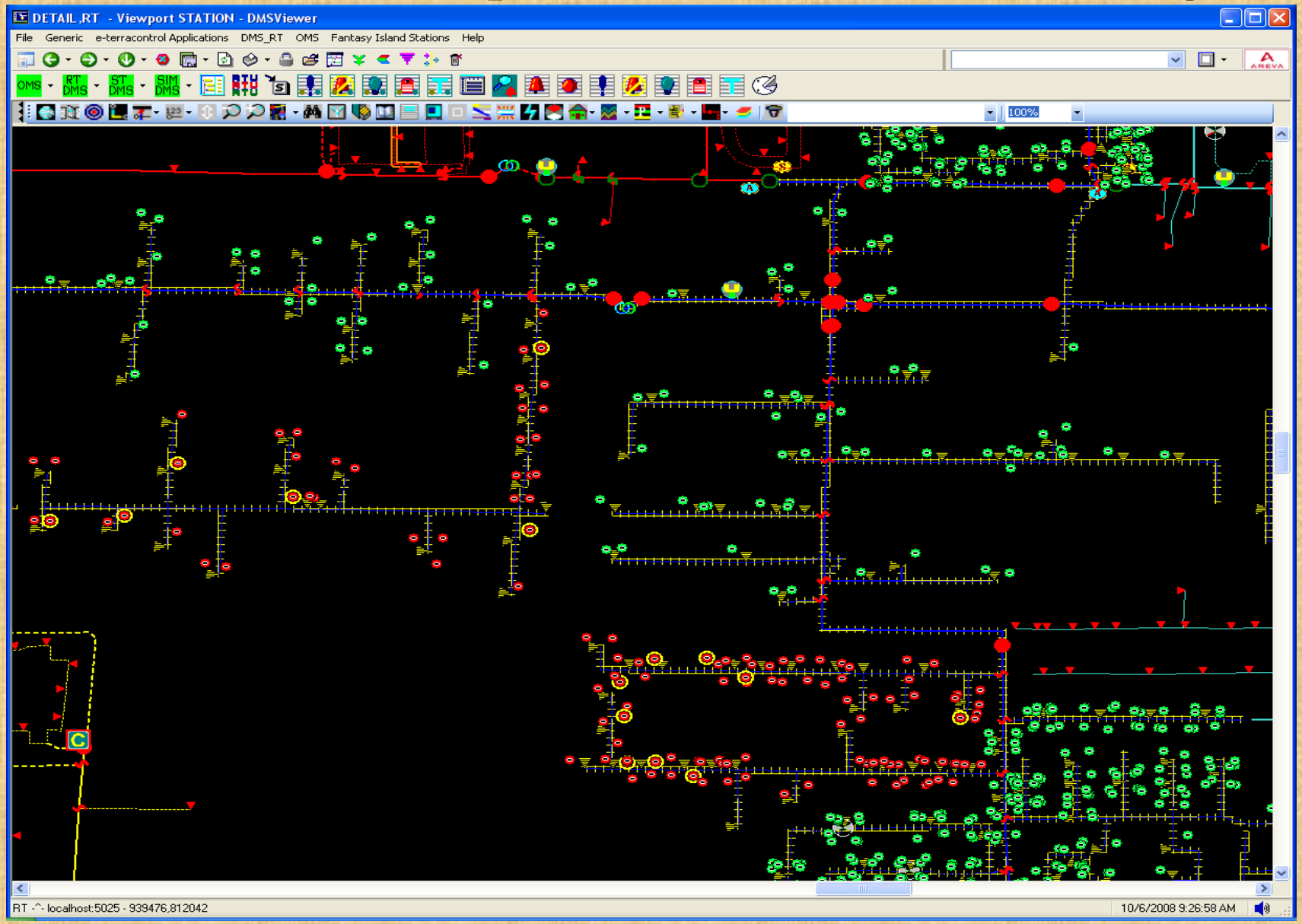
OMS Incident Summary



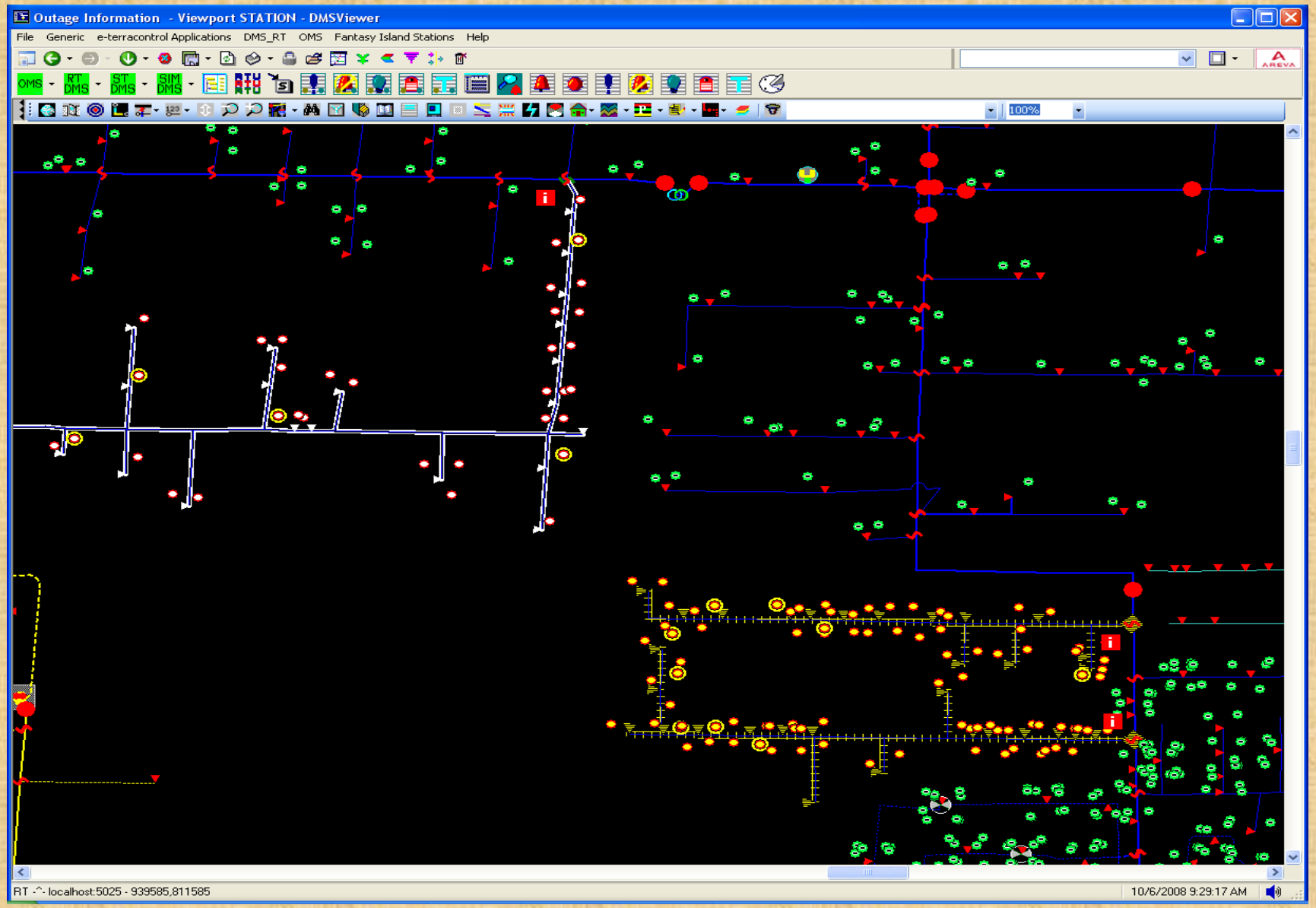
Predicted Feeder Level Outage



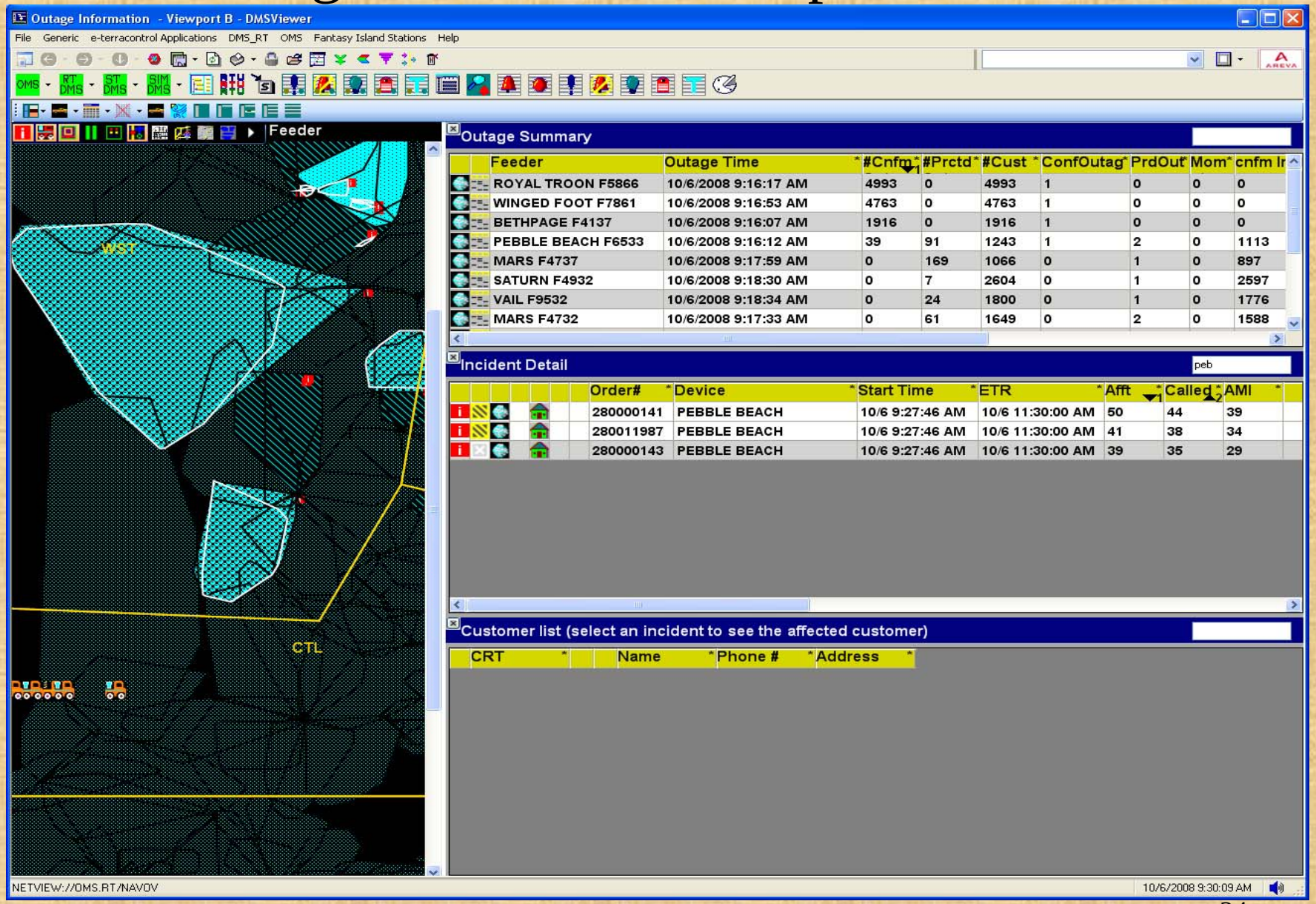
Smart Meter Responses to Feeder-wide Ping



Confirm Fused Lateral Outage



Feeder Outage Refined to Multiple Lateral Incidents



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