

## **Real-Time Event Analysis using In-Memory CEP for Actionable Situational Awareness**

# Introducing Space Time Insight

**Global Presence:** Global HQ: Fremont California, USA  
Regional HQ: Hong Kong, India  
Sales Offices: Hong Kong, South Korea, throughout USA

**Award Winning Recognition:**



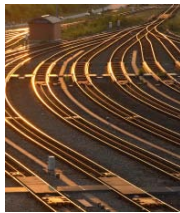
**Markets:**



Utilities



Chemicals, Oil & Gas



Railroads



Pharmaceuticals



Consumer Goods

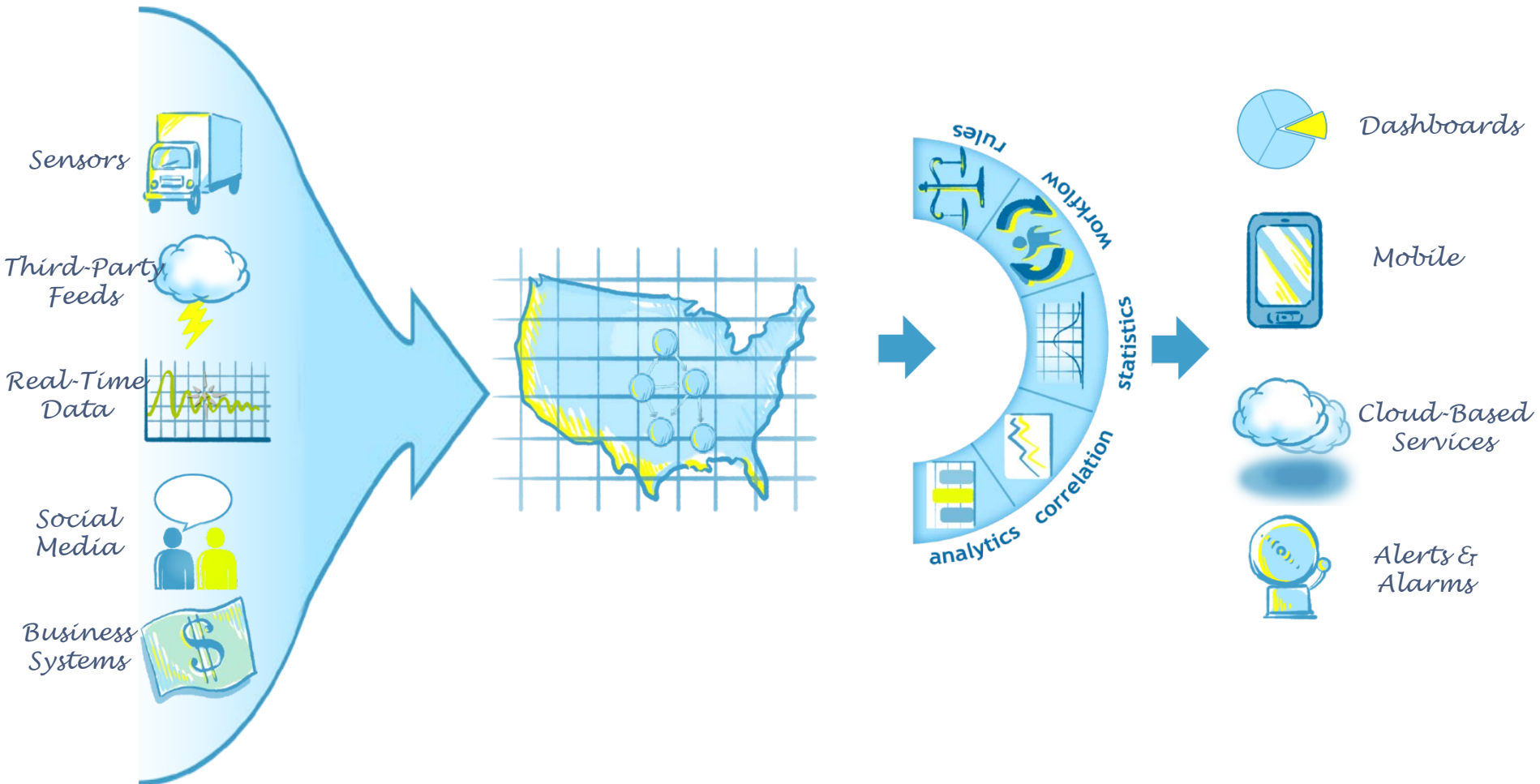
**Expertise:** Geospatial Visualization, Business Intelligence, Compliance, Systems Integration

**Member:** Demand Response and Smart Grid Coalition (DRSG)

**Strong Partnerships:**



# High Speed ! High Volume ! Analytics @ the Speed of Data Acquisition

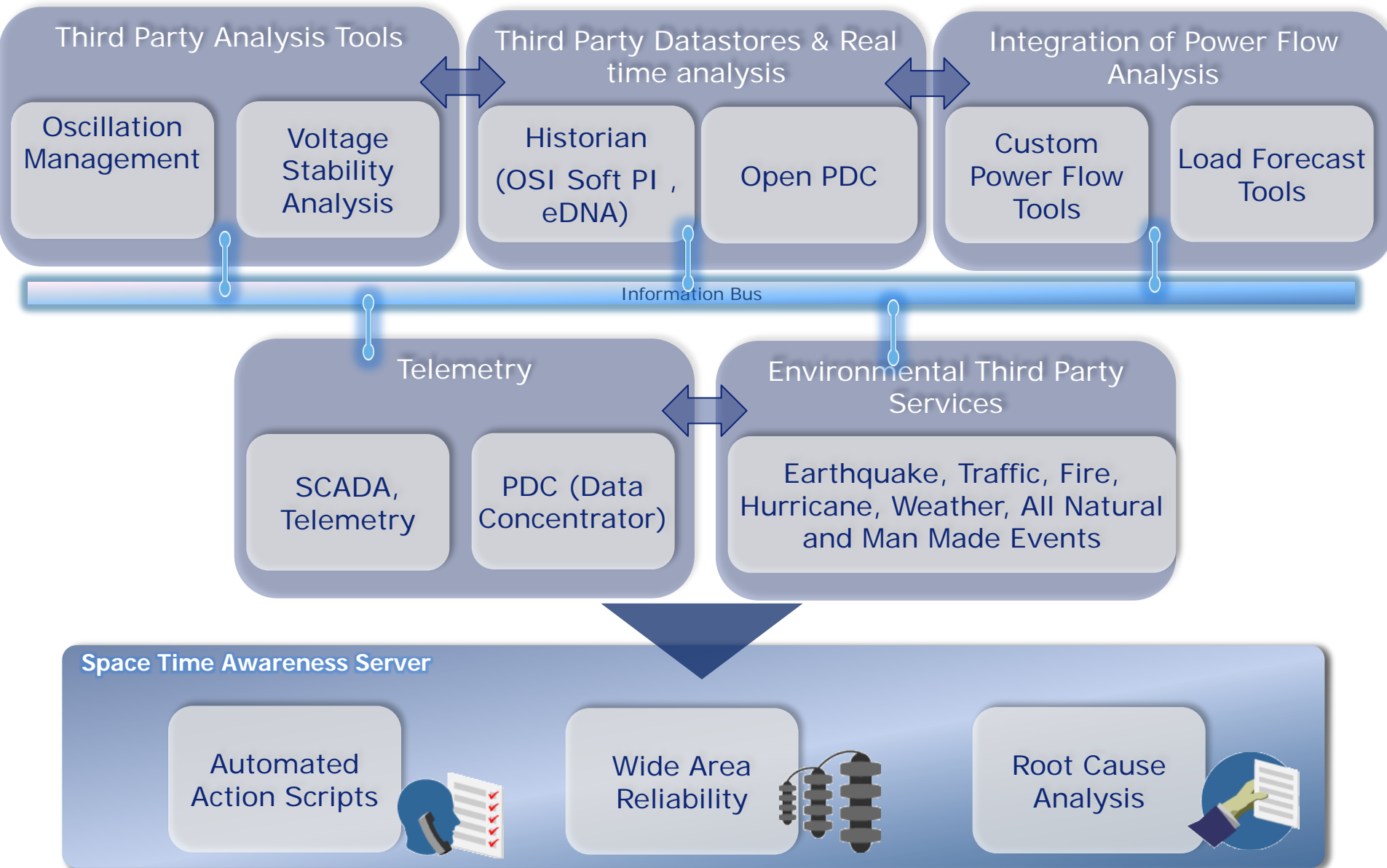


- Wide Area Visualization of Synchrophasor and non Synchrophasor data
  - Graphical Visualization of Transmission, Substations and Generation Assets
  - Weather, Earthquakes, Wild Fires and other Natural Events
  - Sub-Second Refresh of PMU data and Charts
    - Voltage, Frequency, MW/MVAR flows, Power Quality across PMUs
    - Phase Angle, oscillations, oscillatory modes, voltage stability, angular stability
    - System operating limits, and etc
  - Real-Time visualization of non Synchrophasor data
    - SCADA, state estimation, contingency analysis, reactive reserves(dynamic & static)
    - Generation load imbalance

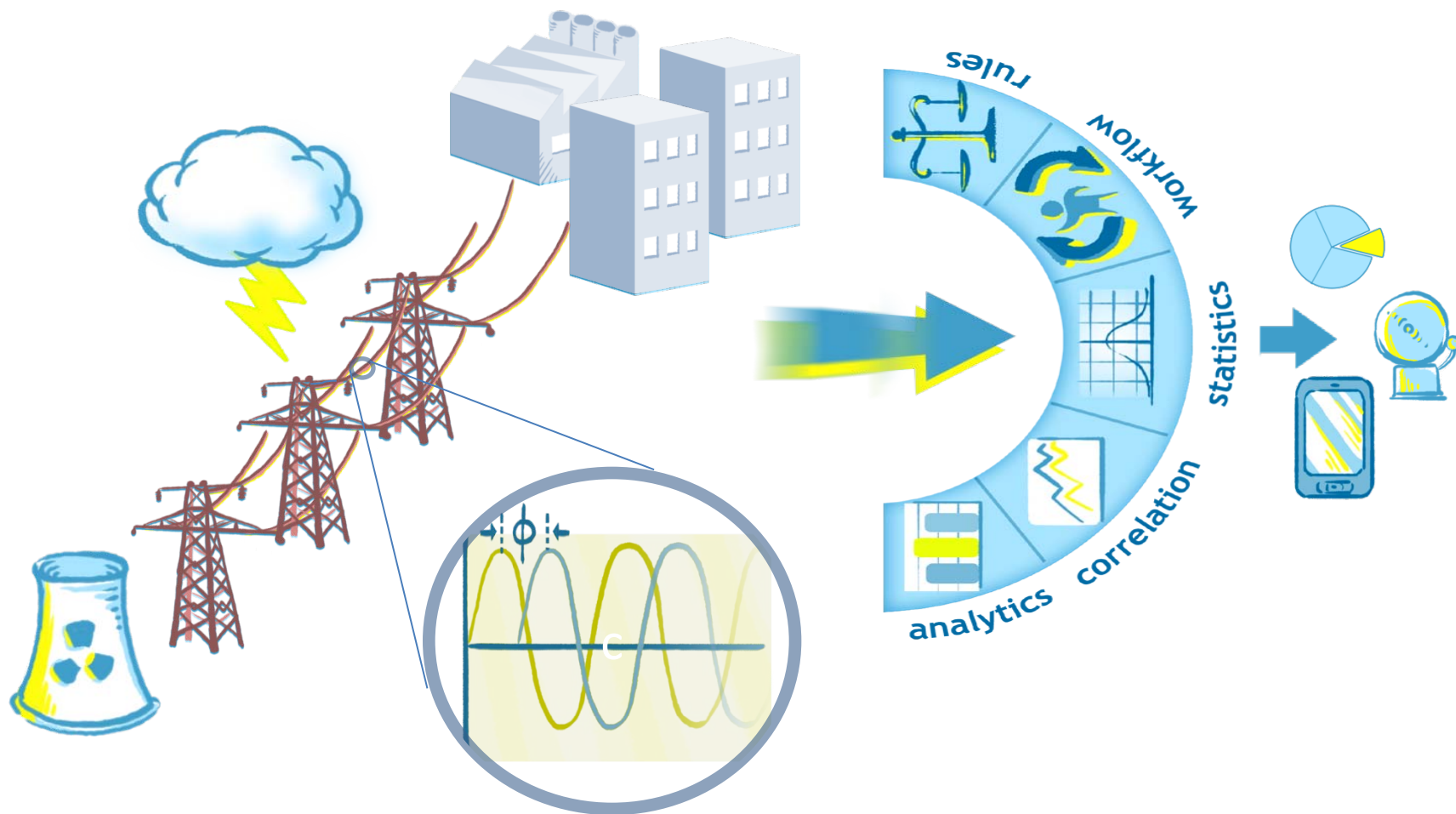


- Real-Time Event Detection, Alerts, Alarms
  - Frequency Transient behavior Alert/alarm based on set thresholds
  - Voltage monitoring alert/alarm based on set thresholds
  - Reactive Reserve alert/alarm based on set thresholds or user input
  - Voltage stability, Phase Angle, damped oscillations, rate of change alerts/alarms
- Synchrophasor Communication Trouble-shooting
  - Real time alerts on bandwidth issues, SLA compromises
  - Unresponsive PMU alerts- 10 min, 30 min alerts or configurable by device

# STAS Wide Area Situational Awareness Information Flow



# Real-Time Event Detection and Analysis@ the Speed of Data Acquisition



# Visualization of Wide Area Assets

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Welcome Demo User

Smart Cockpit

AMI

EAM

ESM

WAMS

Crisis Management

Market Management

Situation Room

ISO

Change Password

Logout

## Transmission Lines

AutoRefresh

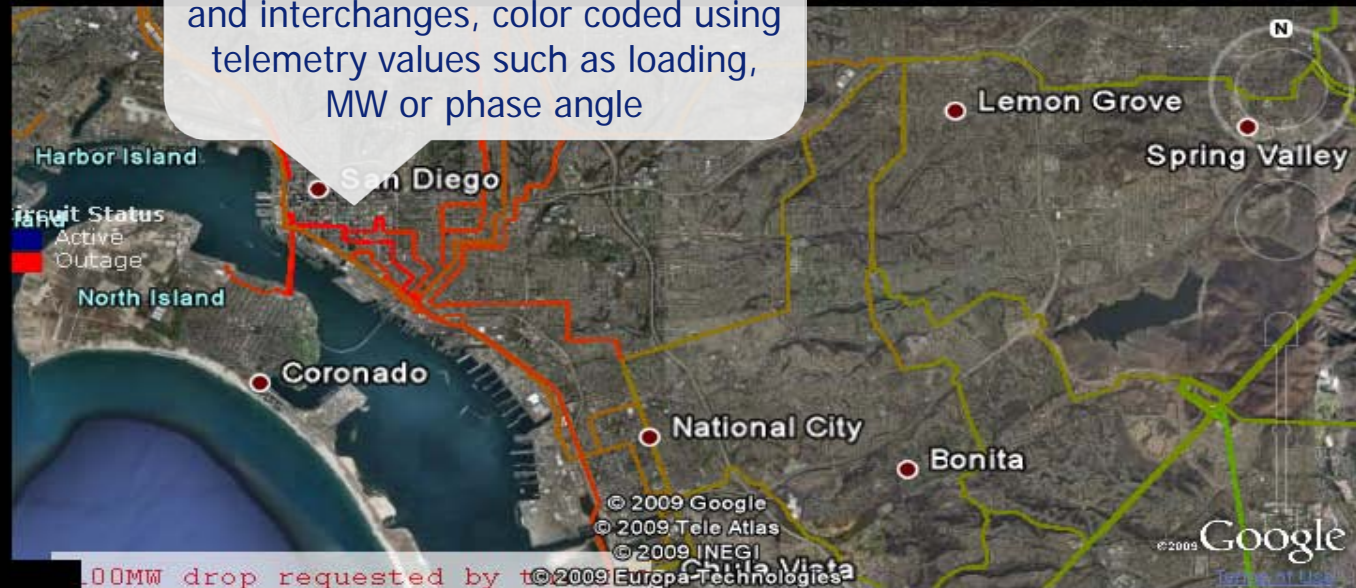
Refresh

Apply Regions

Time

Expand

Visualization of Transmission lines and interchanges, color coded using telemetry values such as loading, MW or phase angle



100MW drop requested by to 2009 Europa Technologies



# Dynamic Wide Area Oscillation Visualization

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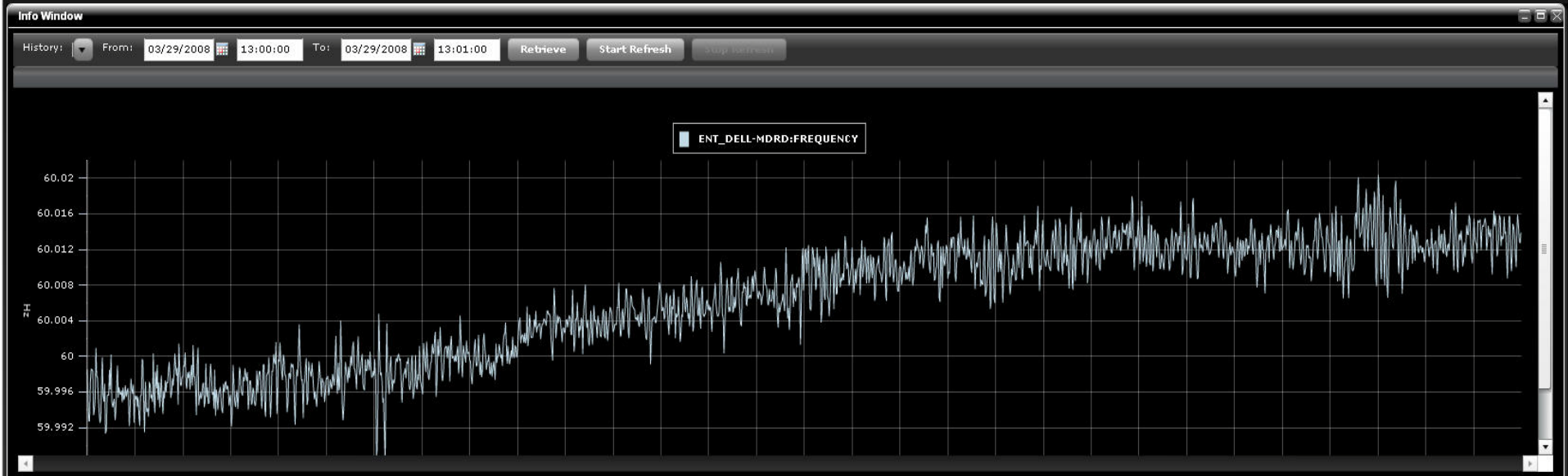
Welcome Demo User

Perfect Dispatch Cockpit Smart Cockpit AMI Renewable Field Workforce **WAMS** Crisis Management Market Management ISO Situation Room SupplyChain Logout

- ☐ Dashboards
- ☒ Boundary
- ☐ Substations
- ☐ Transmission Lines
- ☐ Hurricane
- ☐ PMUs
- ☐ Phase Angle Difference
- ☐ Phasor Clock
- ☒ Frequency
- ☐ Report
- ☐ Reserves
- ☐ Generation Stations
- ☐ Load Pocket
- ☐ PQ Profile
- ☐ Islanding
- ☐ Power Flow Timeline



- Dashboards
- Favorites
- Rubber Banding



# Phase Angle Visualization

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Smart Cockpit

AMI

Renewable

Field Workforce

WAMS

Crisis Management

Market Management

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Situation Room

SupplyChain

Logout

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- ☐ PQ Profile
- ☐ Islanding
- ☐ Power Flow Tipline
- ☐ Power Flow Arrows
- ☒ Lightning

## Angular difference calculation

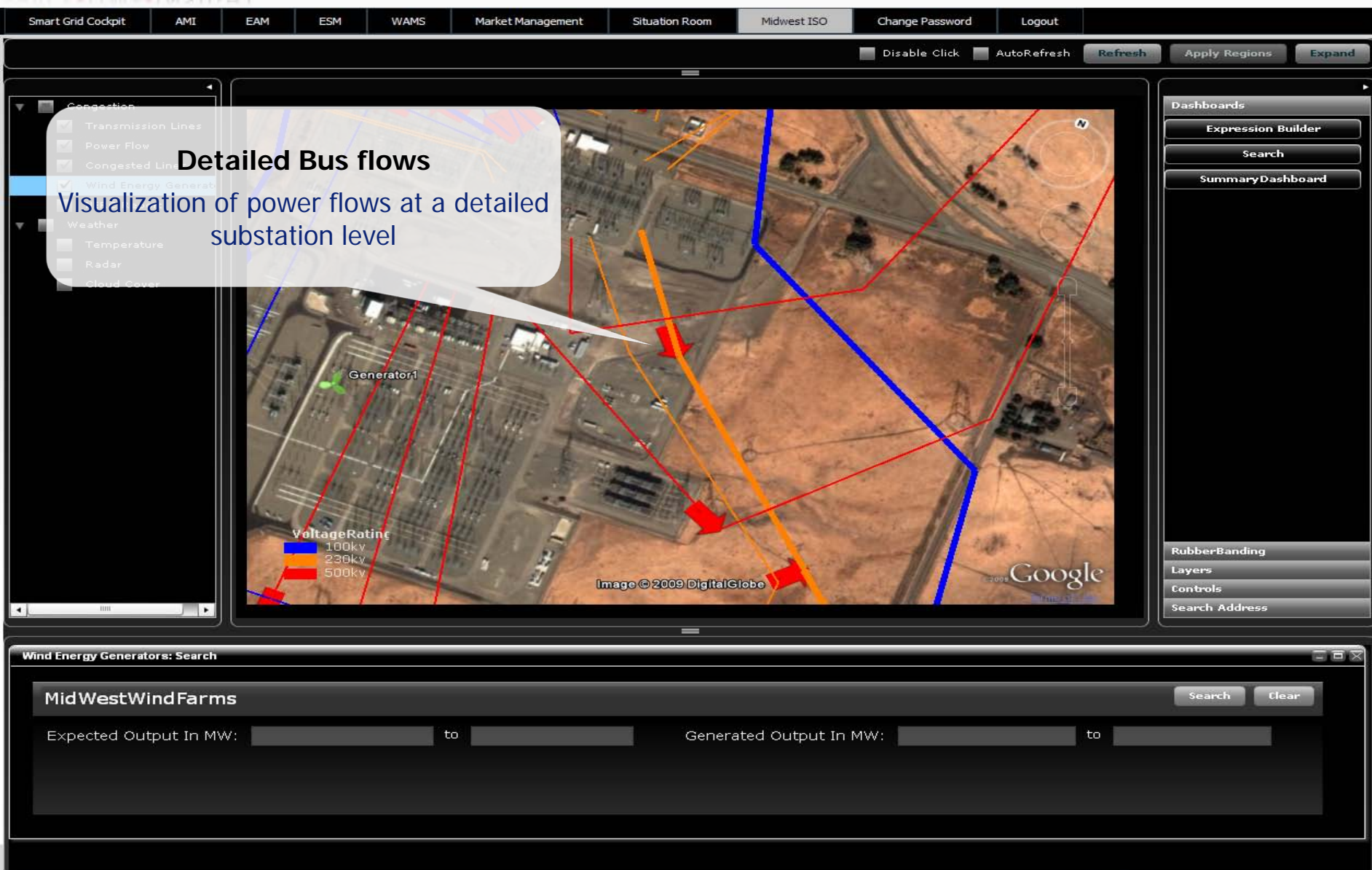
Top 5 phase, voltage angular deviation compared to a reference angle





# Detailed Visualization

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# Wide Area Visualization of Weather Events

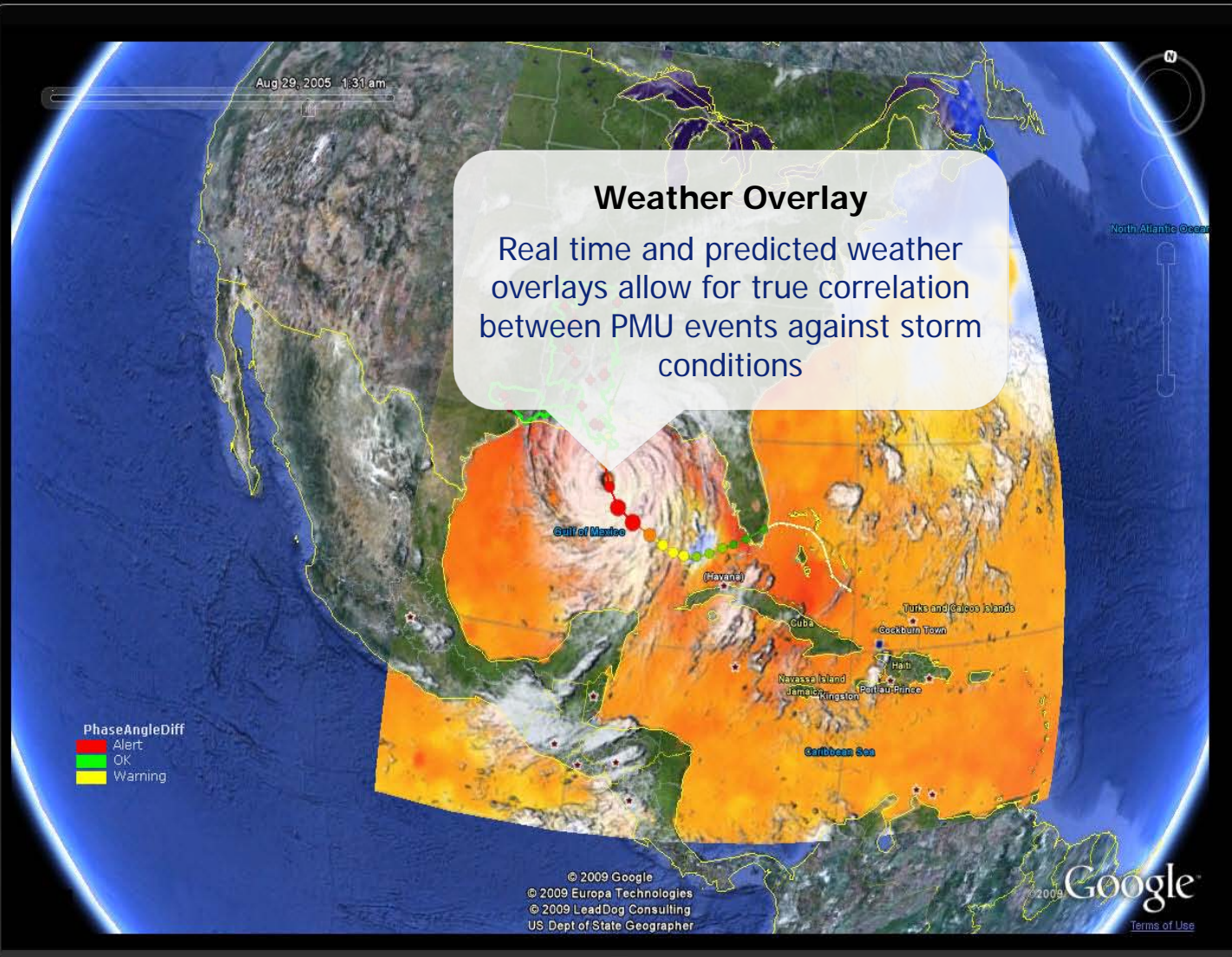
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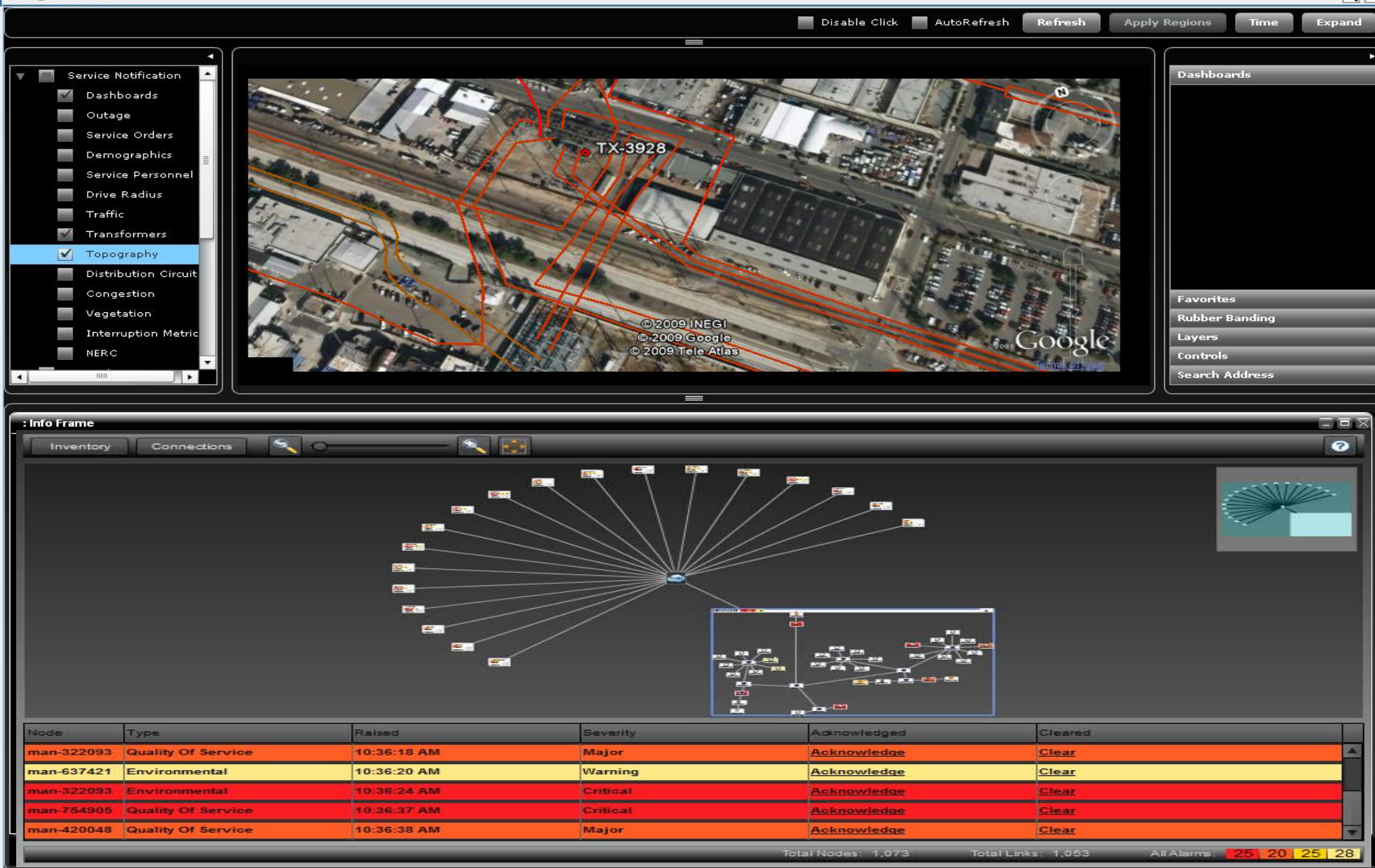
Dashboards

Favorites  
Rubber Banding



# Visualization of the Communication Infrastructure

Outage Restoration



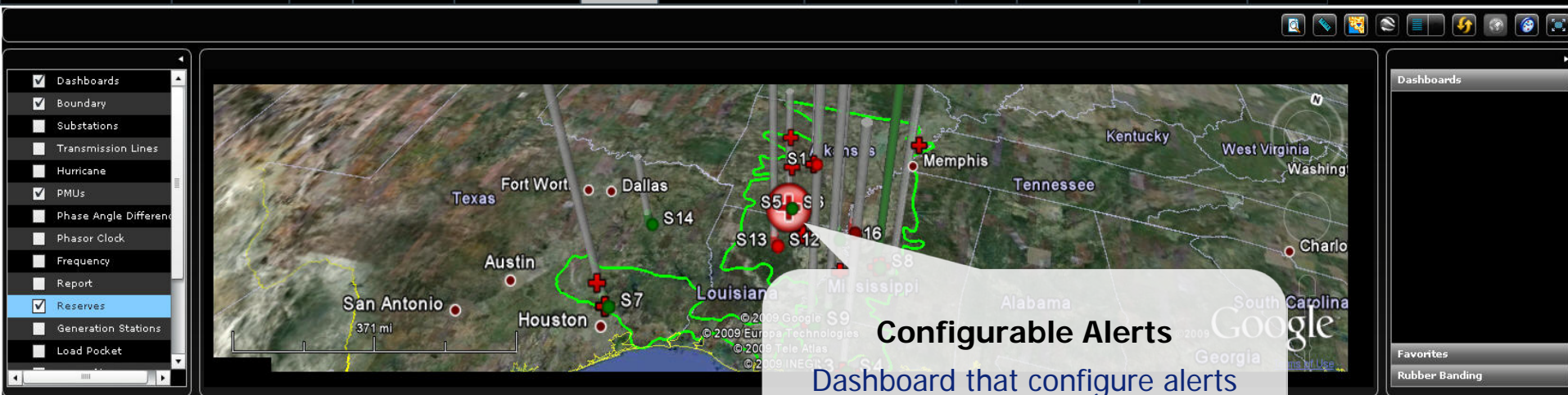
Done

# Alerts and Remedial Procedures

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**Dashboards: RAS**

Alert ID: 246 Severity:   Help ?

**Details** | Events | Logs | Comments | Attachments

**Summary:** Frequency Spike Detected  
**Personnel:** CSR1024  
**Date/Time:** 09/28/2009 14:29  
**Location:** Fremont

**Remediation Scripts**

#	Task	Priority	Status
1	Undamped Oscillations	High	Open
2	Harmonics	High	Open
3	Launch NERC Report	High	Open
5	Alert the Operator	High	Open

**Task ID # 1**

**Task Type:** Manual      **Task:** Undamped Oscillations  
**Assigned To:** Tom Hopkins      **Priority:** High  
**Start:** 28 Sep 14:30      **Status:** Open      **Update Status** ▼  
**Precedence:** 1      **Due by:** 28 Sep 14:35  
**Comments:**  **Undamped Oscillations**





115 kV line overload >95 % in RTCA :Check Lango

al Generation Output -  
Montana Wind



Wyoming

North Dakota

Minnesota

South Dakota

Nebraska

Iowa

Wisconsin

Michigan

Milwaukee

Chicago

Indiana

Transmission Lines

- 161kV
- 115kV, 118kV and 138kV
- DC
- 345kV
- Outage
- 230kV
- 115kV

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Image USDA Farm Service Agency

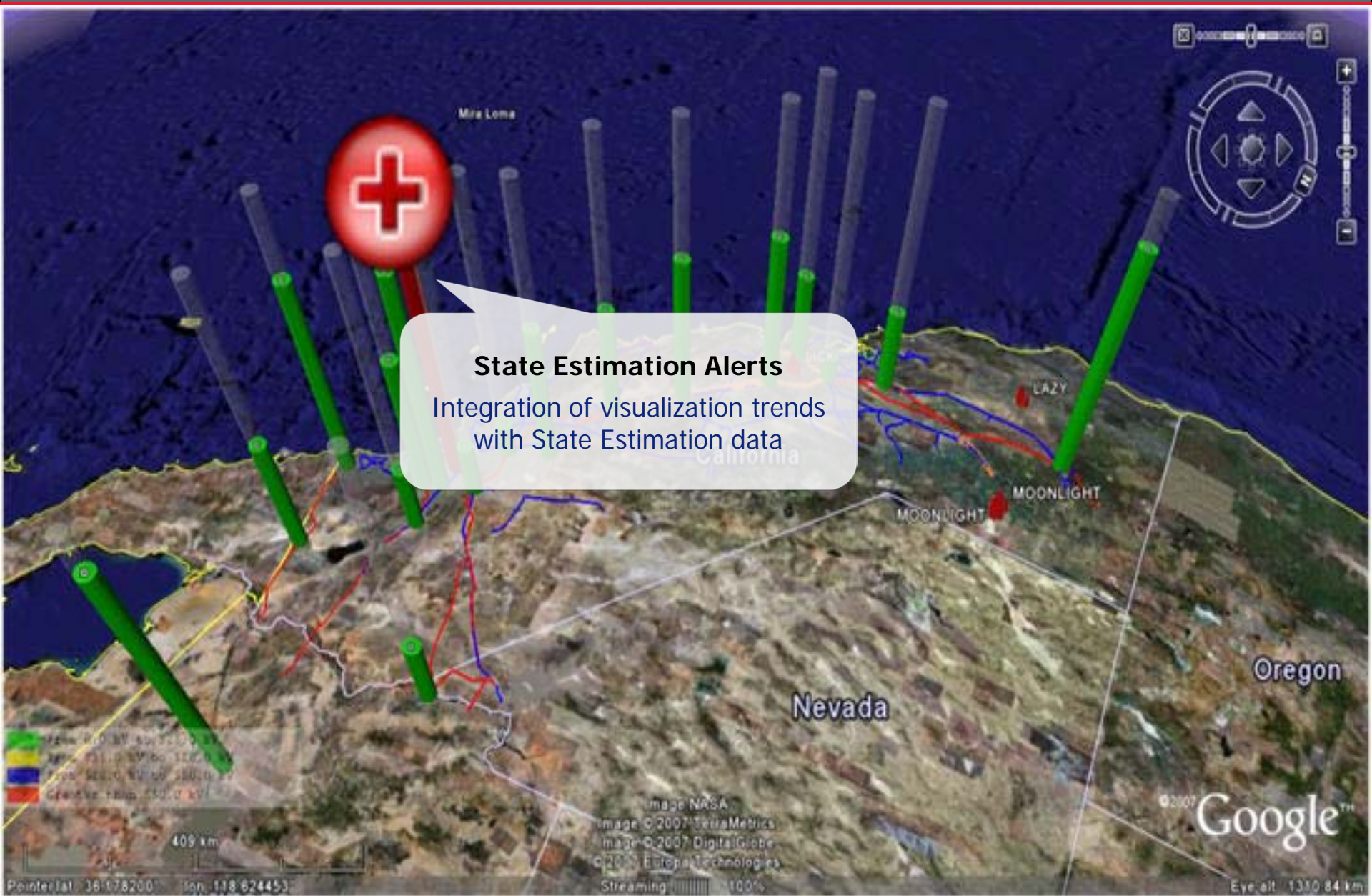
Data has been randomized to protect customer confidential data

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# State Estimation based Alerts



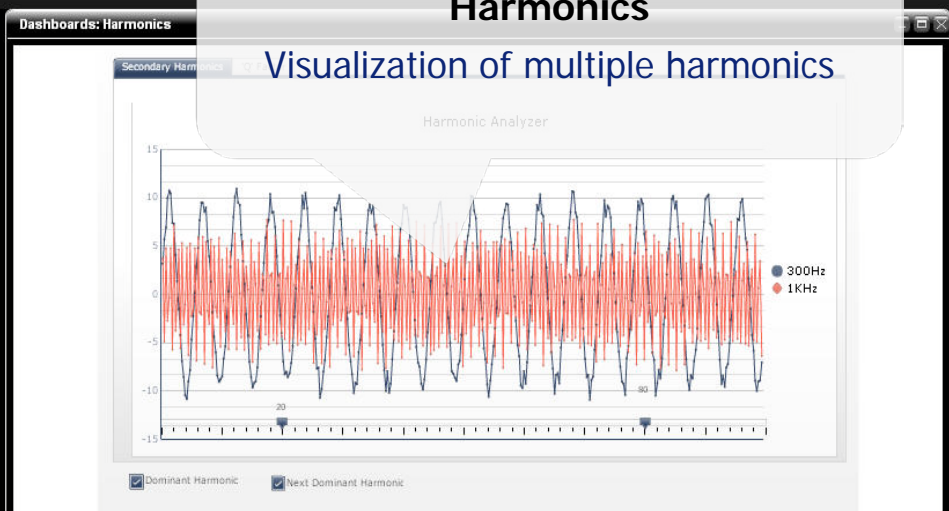
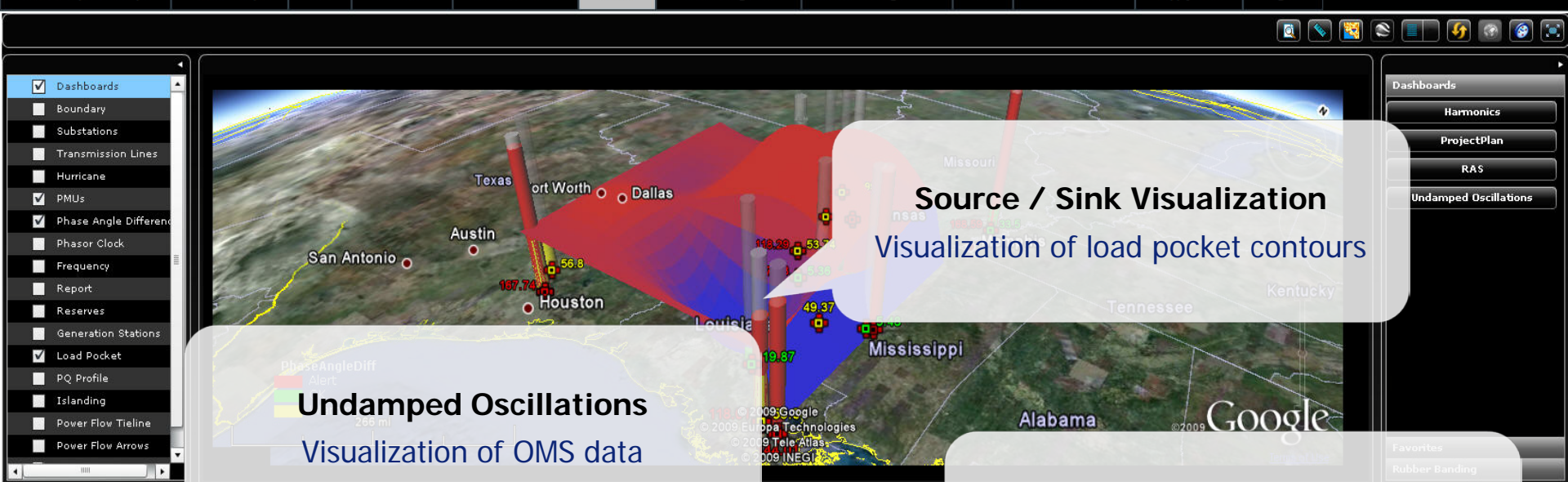


# System Stability Analysis

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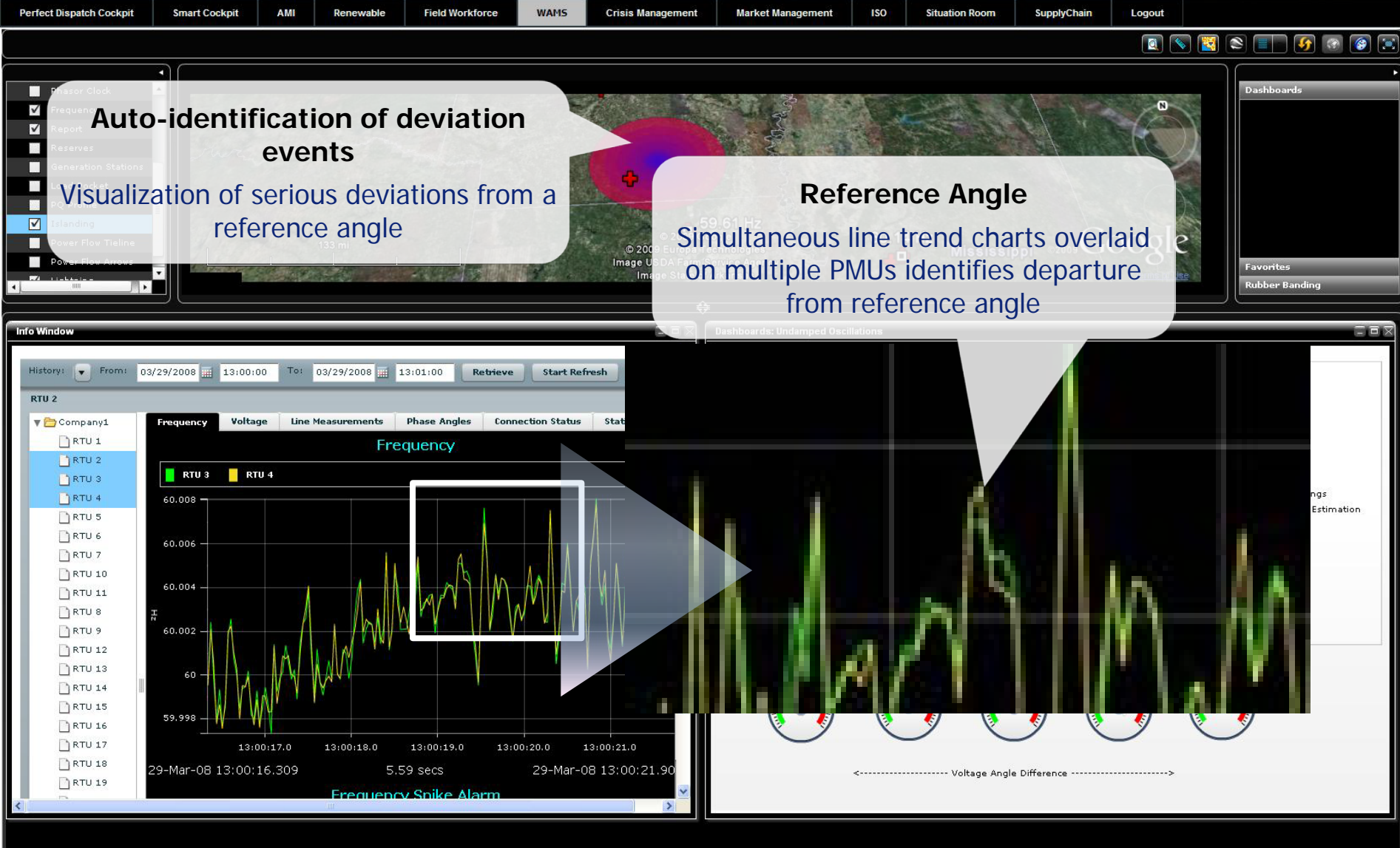
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# Phase Angle Deviation Alerts

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- Enables True Situational Awareness based on Synchrophasor, non Synchrophasor data, communication network data and weather data in a single consolidated view
- Enables coordinated and synchronized alarm/alert handling
- SOA enabled platform for seamless integration of PMU based boutique applications.

# Thank You.

## For more Information

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