



Annual Conference of the Prognostics
and Health Management Society 2009

LIVING HISTORY

A Tale of 9,840 Batteries

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Agenda

- DPMC Overview
- Operating Environment
- Batteries
- Battery Management
- Aging Study
- Issues
- Lessons Learned



DPMC Overview

- Monitoring and Management of Emergency Battery System Access Worldwide
- Patented Web Accessible Field System and Engine for Analysis of Battery Condition
- Predictive Trending and Analysis Methodologies



Operating Environment Summary

- Normal Float Voltage 540 V (2.25 V/CELL)
- Temperature Variance between 68 – 75 F
- Normal Float Service Since 2000
- No Capacity Load Testing Since 2000 Install
- Infrequent Short Discharges



The Batteries

- UPS 20-year (design life) VRLA single cell units
- UPS rated at 1,842 & 2,946 watts/Cell at 12 Minutes (2 sizes)
- Placed in Service mid-2000
- 9,840 Units in 41 each, 240 Cell Strings



User and System Facts

- Large Multinational Internet Hosting Company
- Study group at 5 USA Site Locations
Installed in 2000
 - SAN JOSE - 10 STRINGS
 - LOS ANGELES - 3 STRINGS
 - DALLAS - 4 STRINGS
 - CHICAGO - 10 STRINGS
 - WASHINGTON DC - 14 STRINGS
- Re-hydration and Catalyst Installation
Process completed late 2006 to mid 2007
(IOVR – Internal Ohmic Value Reduction)



Monitoring Parameters and Services

- Constant Monitoring Since 2000 Installation
- Managed Monitoring Services since 2000
- Monitoring Parameters Include:
 - Voltage
 - Ohmic Value
 - Temperature
 - Discharge Data
- All Parameter Data Trended, Archived and Analyzed for Predictive Analysis, including Replacement Data and Service Life

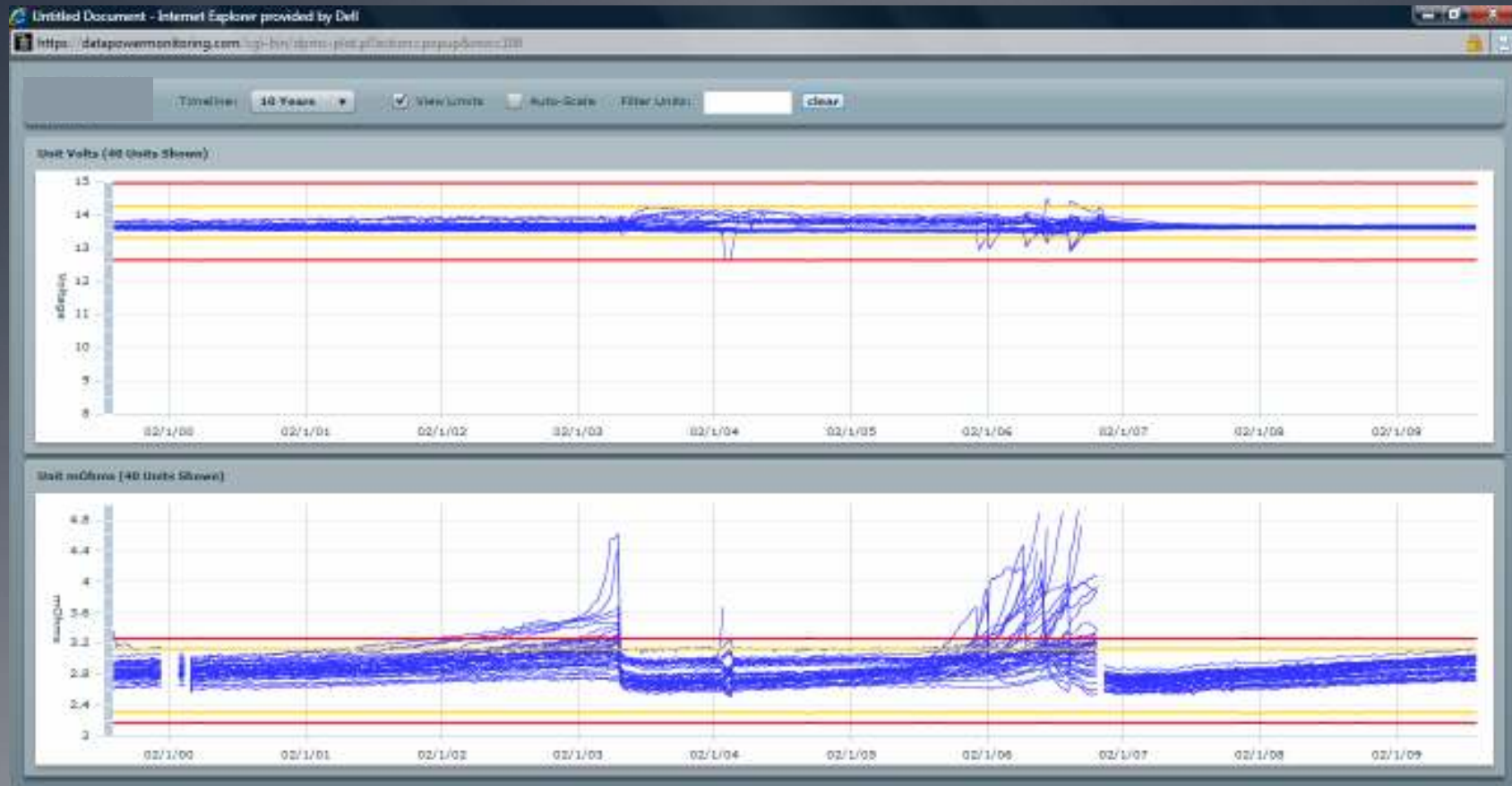


Study Group Replacement Data

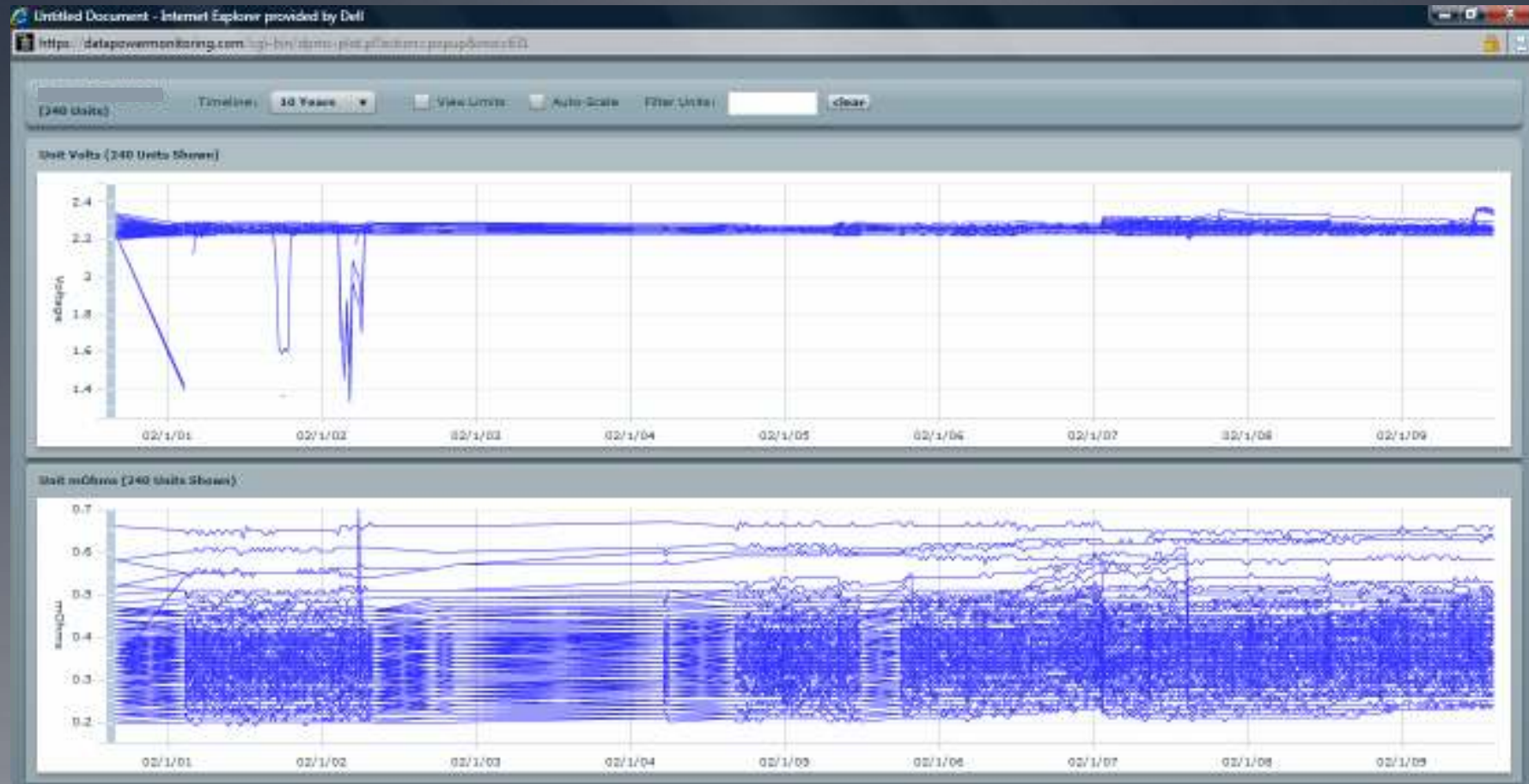
- Population 9,840 units in 41, 240 Cell Strings
- Years of Float Service – 10
- Present Battery Replacement Count - 208 units
- Typical Analysis and Replacement



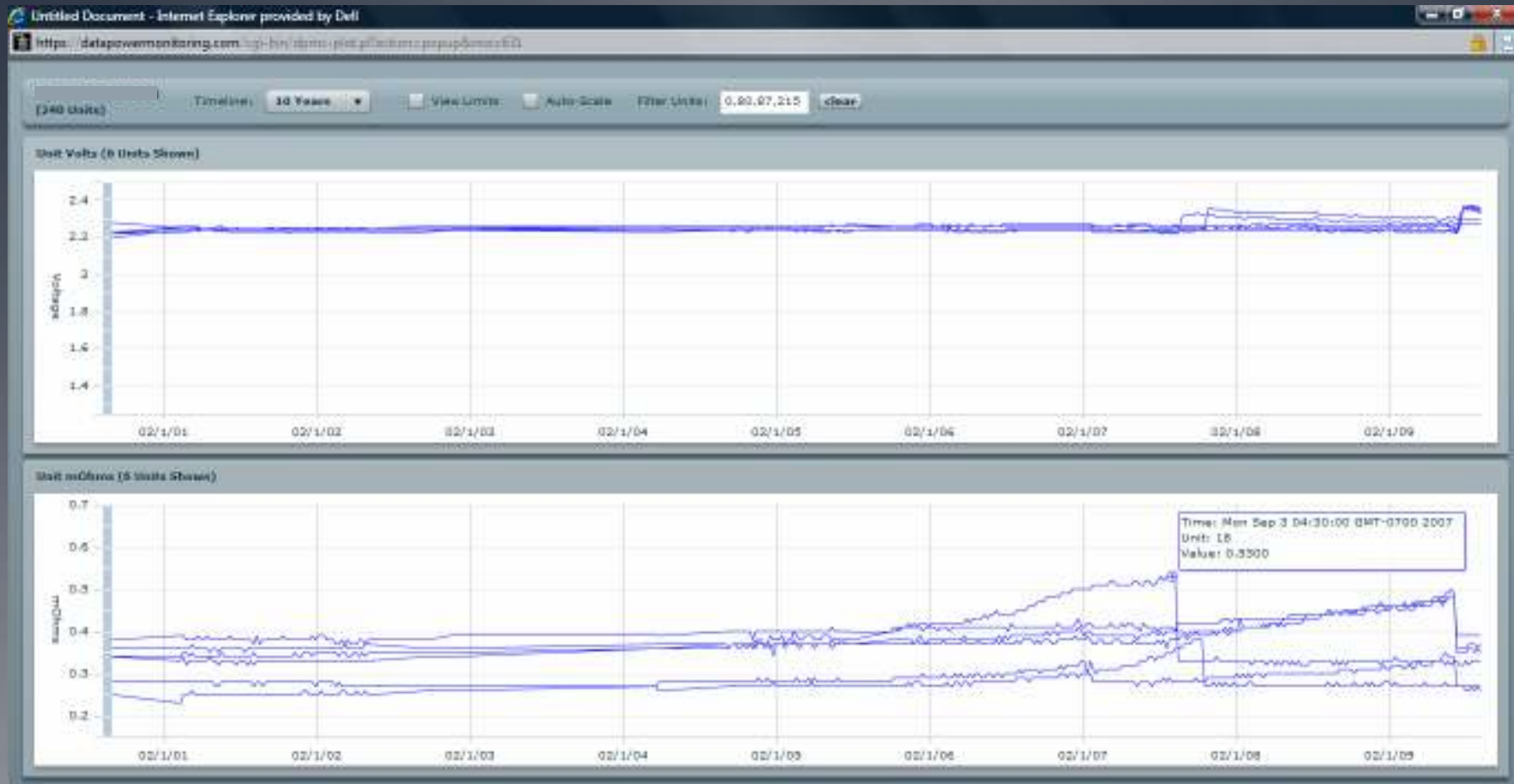
3 Battery Lives Including Acceleration Fingerprints



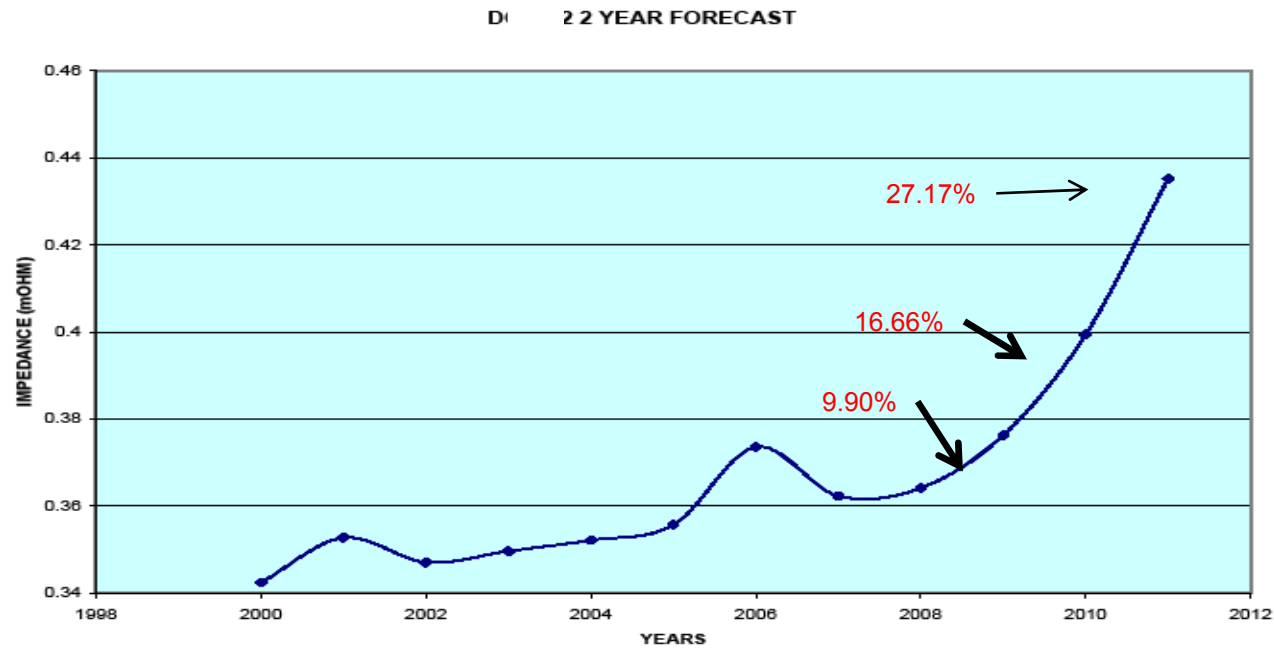
Typical String History



Individual Unit Acceleration



Ohmic Acceleration History and Prediction



Ongoing Value

- **Customer Business Value**
 - 100% Reliability Protection against Battery-related Power Failure
 - Cost-effective supplements to Manual Maintenance Programs
 - Battery Asset Management
- **Massive Archived Database Allowing Proactive Analysis**
 - Pre-emptive Corrective Maintenance
 - Predictive Analysis and Aging Forecasts



Attitude Evolution Toward Battery Health Management Services

- Not a Necessity: Manual Maintenance Organization “knows best”
- Low Risk of Failure Without Health Services
- Disaster Struck Between Manual Maintenance Services
- Health Management Services Cost Minimal Compared to Cost of Disaster Downtime and Repair
- Thinking is evolving – more of a Necessary Service
- Enhanced by Aging Data and Asset Management



Add-ons and Integration

- Maintenance Services & Testing
- Battery Product with Integrated Health Management
- EPA-Certified Recycling
- Industry Diversification
 - Data Centers
 - Telecom
 - Utilities
 - Automotive
 - Other “Green” Applications



Lessons Learned

- Batteries are Consumables
- Codes & Standards
- Complexity of End-of-Life Forecasting
- Global Dearth of Knowledge



THANK YOU

