SPRING 2005

7x24 Exchange

NewsLink

The leading knowledge exchange for those who design, build, use and maintain mission-critical enterprise information infrastructures, 7x24 Exchange's goal is to improve end-to-end reliability by promoting dialogue among these groups.

2004 Fall Conference, *End-to-End Reliability: Innovation,* Reaches Record Attendance

Keynote Speaker, Trisha Meili, motivates conference attendees on Tuesday morning.

The Fall 2004 Conference held at the Hyatt Regency at Gainey Ranch was a tremendous success with 378 people in attendance. Overall the conference rated 6.1 on a scale of 1-poor to 7-excellent. The educational experience was one that members raved about. Attendee comments attest to the results:

"Great fun and interaction with peers while learning!"

"Excellent sessions, well worth the trip"

"7x24 is a well focused, valuable organization with great educational benefit"

"Very informative speakers and presentations"

Highlighting the conference were keynote presentations by Cindy Berger, Senior Vice President, American Express Technologies on the topic *"High Availability at American Express"* and by Don Ferguson, Director of Products and Technologies, EMC Corporation on the topic *"Information Lifecycle Management"*. Trisha Meili, author of the best selling memoir *"I Am the Central Park Jogger: A Story of Hope and Possibility"* motivated the audience with her message of "Recovering to Wholeness" after facing insurmountable crises.

2005 Spring Conference Highlights

The Spring Conference themed "End-to-End Reliability: Today, Tomorrow & Beyond" will be held June 12-15 at the Boca Raton Resort & Club in Boca Raton, Florida. Program highlights include a Keynote Address by **John Egan**, Director of Business Continuity for EMC Corporation, entitled *"Regulation and Compliance: The New Key Drivers for End-to-End Reliability"*; a keynote by **Hubert Holmes**, EVP of Cicada Corporation , entitled *"Financial Services Grapples with Reliability of Data"* and a Keynote Address by **John Gilbert**, COO & EVP of Rudin Management Company entitled *"The New Wireless World"*.

Back by popular demand on Tuesday Evening is the "S.S 7x24 Exchange Party Cruise" on Florida's fabulous Intracoastal waterway sponsored by ABB, Active Power, AFCO Systems, APC, Caterpillar, Danaher Power Solutions, Russelectric and SIEMENS.

For Spring Conference programs and registration information please visit 7x24exchange.org or call (646) 486-3818.

Why Strict Engineering Discipline is Critical to Driving Higher Service Levels in the Data Center

by Harold Feinleib, Chairman & Founder, Managing Director of Product Development, Aperture

Never as much as today are corporate executives realizing that the nerve centers of their organizations are housed in their Data Centers*. So much so that they are now being called Critical Sites. Never before have IT Managers had to reach for an impossible standard—to provide "flawless" service through operational excellence. The reason is clear—the information systems that are used to run today's organizations are absolutely critical for people to do their day-to-day jobs, from mailrooms to boardrooms.

When asked what was the most mission critical application he had in his company, the CIO at a major pharmaceutical company responded unequivocally, "E-mail. When people can't communicate, everything stops. If we have to meet a filing deadline, it requires the coordination of information and documents from our people spread all over the world. If any part of the system, which consists of several hundred servers, is down, we can't get the job done. There is simply no other way to make it happen."

With such a demanding imperative, why are so many Data Centers run with diverse and disparate processes that can't possibly deliver this level of service. It is certainly not for a lack of trying.

Standardized management processes have been the norm in managing other critical sites for decades. Just look at the way nuclear power plants and aircraft are managed. Because of the dire consequences of failures, they must employ very strict engineering discipline. Why not in the Data Center?

While lives might not be lost if there are failures in the Data Center, aren't Data Centers critical enough to an organization's business operations that make failures very costly?

It is well known that the more complex and the more critical a system is, the more essential it is to employ sophisticated systems and strict engineering discipline to manage it.

To manage, maintain, and change a complex system, five things are needed:

1. Monitoring systems that provide real-time information about the operation of the system
2. Redundancy of critical components
3. Accurate up to date documentation of the system.
4. Well defined and standardized processes that support the maintenance and change to that system
5. Immediate access to the documentation needed to diagnose, repair, and change the system.

The Data Center is certainly a "complex system". Why aren't integrated best practices being applied to managing it and thereby achieving operational excellence? The answer lies in several factors:

1. Historically, the Data Center was viewed as a facility and not as a dynamic, integrated system, whose components must inter-relate with each other at every point in time.
2. The different data center groups (Facilities, Power, Systems Engineering, Network, etc.) view themselves as functionally separate and distinct from each other.
3. The changes in technology have been coming so fast that each group can hardly keep up with its own area, much less be able to see how they fit into a unified system to provide flawless service.
4. The information system and practices to support each participant group are often homegrown to support their specific needs, creating disconnected islands of information.

Most IT organizations have the monitoring systems in place to track power, cooling, systems, and network operations. Many subscribe to the practice of redundancy for critical components.

In a review of 50 Fortune 1000 organizations, not one had up-to-date Data Center documentation, not one had automated the processes for installing or changing equipment in the Data Center, and none provided universal, immediate access to an integrated repository of Data Center documentation for engineers and technicians who need to make design changes or trouble shoot problems in an organization's operations. And none had a good handle on their capacities relating to space, power, and network.

Without these, an organization's business operations are at risk. They can't possibly achieve operational excellence and the results speak for themselves. They are surprised when they find that the space they thought they had to install new devices cannot be used because there is insufficient power to run them.

Let's examine why each of these components are critical to provide the levels of service demanded by today's modern enterprise.

Documentation

Most organizations have some form of documentation. It is usually a scattered collection of Vision drawings, CAD plans, whiteboards, Word documents, and spreadsheets. And, as with all documentation it is usually the last thing that is updated when changes occur, if it is updated at all. To make matters worse, when documentation does exist each of the participant groups maintains "their" own in a form they find most convenient to them, making it impossible to understand the inter-relationships between the components and get a complete picture of the system.

Data Centers and the equipment they contain change so fast that most documentation is horribly out of date. With this state of affairs no organization's documentation is "complete". The current state does not allow for all the intricacies, interdependencies, and complexities of the various systems to be documented in a uniform way.

Without up-to-date documentation engineers are planning their changes based on erroneous data. So there is no wonder that mistakes will be made. If they don't trust the data, then they must verify each and every change they plan by checking the physical equipment and this too leads to errors. Who hasn't heard about a critical system going down because some piece of equipment was disconnected and nobody knew that the critical system was dependent upon it?

With this mindset, what is a gun-shy engineer to do? Do everything possible to prevent an error, which often means leave the old stuff exactly where it is, and order redundant new equipment. This might prevent problems, but it costs a lot of extra money and wastes expensive data center space.

How fast can an engineer trouble-shoot a problem? How fast can they determine what needs to be done to correct it? The answer lies in two things — how experienced and competent that engineer is and how accurate the picture of the entire system is in his or her head? An outstanding engineer with an accurate picture of the system can trouble-shoot the problem very fast. An outstanding engineer with an inaccurate picture of the situation will waste time going down the wrong path. Being outstanding, they will sense most of the time that they haven't solved the problem so they will keep working until they truly understand it. But some of the time they will come to the wrong conclusion about what is causing the problem. This will lead to serious problems.

A competent, but not outstanding engineer who is not so familiar with the system and who is working from inaccurate documentation is like working in the dark. That engineer will not know when they don't know what is wrong. They will likely act on poor information, and the results can be drastic. It has happened in every organization, not just once, but many times.

Process

The second component that must be addressed is the underlying process by which the organization handles problems and changes.

Many organizations have a good problem tracking system and a poor change management system. This is because change management crosses departments so it must be coordinated and used by all participants for it to work effectively. Most organizations simply have not yet evolved to this level of sophistication in their data center operations.

Let's examine installing a device. It takes the coordination of several groups—Systems Engineering, Data Center Facilities, Network Engineering, and Vendors to install a piece of equipment. Without a cross-department process for managing the installation and maintenance of equipment, installation errors and inefficiencies will inevitably result. These will be caused because the installation specification will not be fully detailed so there will be no room for judgment by the technician installing the device.

**The term data center is used in this document to refer to the physical facilities that house an aggregation of operating platforms (large data centers, small data centers, server farms, server rooms, etc.)*

Only a trained engineer, using accurate documentation can plan and specify the way a device should be installed to meet all the complex requirements to insure required levels of reliability. Do all the devices that fulfill the customer's requirements need to be plugged into two independent power sources or is it better that they be plugged into the same power source so if power is interrupted all the devices fail together. Only the engineer knows these requirements.

Inefficiencies result when the information being captured up front is incomplete, requiring unnecessary interactions to get the complete specification.

How will each group's portion of the job be tracked and how will its status be communicated? If there is no standardized process for capturing all the relevant information needed to perform and coordinate all the tasks necessary to install a device, every group will need to communicate excessively to find out when the others they depend upon will be complete. Often engineers show up expecting everything to be in place so they can do their job, only to find that the needed work is still incomplete. This wastes time, cost money, and affects morale. Only organizations with high morale can provide high quality customer service.

Requestors need to know the status of their request at any time. Project managers need to know that each group is on schedule to do their piece of the job. If there is no unified system to support this communication, then unnecessary phone calls will be made and e-mails will be sent and when a problem is discovered, escalations will be required to resolve the issue. Is this anyway to run a critical part of the business?

And when errors are made, can the process be examined where the slip-up occurred so the process can be corrected to prevent that error in the future?

Immediate Access to Information

As we have seen, accurate up-to-date information is critical for fast trouble-shooting and proper engineering of changes to the Data Center and the equipment it contains. Too many times this information is scattered in files without any ability to search for the information preventing access to all the needed information.

If access to a specific device is needed to see how it is configured, an engineer needs to know what drawing that device is contained in, where that drawing is, and then also be able to find the textual documents that contain the associated information. Without a carefully constructed system that ties all this information together and provides fast and easy access to it is akin to putting concrete boots on your staff's feet and asking them to run a marathon. We all know how hard it is to find good people, and how much we have to invest in their training and education. So why would we put obstacles in their way that slow them down? Instead, we should be leveraging their productivity by giving them the appropriate tools to do their jobs effectively.

What if there was one integrated Data Center web site where an engineer could click on a tab, which brings up a simple search form where they could enter the device name or IP address and all the information about the device was immediately displayed, including the drawing that showed the location and detailed configuration information for that device? It is this kind of easy and immediate access that an engineer needs to do their job so they can deliver to the service levels demanded by the organization.

Integrated Repository for Management Decisions

Management needs to plan for the future, to make decisions on how to support the anticipated needs of the organization. They need to do annual budgeting, to manage maintenance contracts and their cost, to be able to negotiate with hardware and software vendors, to provide information to finance and possibly regulatory agencies, and to reduce risk by planning for contingencies. If there is no enterprise wide repository that accurately reflects the data center infrastructure, then it is very difficult to manage these essential tasks and make important business decisions with any level of confidence.

In order to have an integrated repository that is accurate and up-to-date requires a process that captures the required information in a standardized format and stores it in a central repository. The place to capture this information is in the process that supports the installation of new equipment and the change and movement of existing equipment. As the equipment in the data center changes the system captures all the necessary information and stores it in the central repository at the right time, keeping the central repository up to date. To work optimally this process needs to be used by all the groups in the data center organization.

With this process working in the organization, management will be able to make the business decisions needed to support the enterprise because they will have an up-to-date enterprise database that they can access easily. The engineers and technicians will follow a process that will support and coordinate the day-to-day work they do to install and change equipment in the data center. They will have quick access to the documentation they need to maintain and plan changes to the equipment.

What would a state-of-the-art system that provides these capabilities look like?

Imagine a single Data Center Portal that is used by three types of users:

Planners, engineers, and technicians in the data center Facilities, Network, Power, and Systems Engineering groups use portal applications so that they can plan, coordinate, and perform their jobs most effectively. The portal applications provide a standardized method for capturing data and communicating about the projects needed by their customers.

They also use the portal to quickly find information (both drawings and data) that helps them perform their jobs. They can easily move within this body of information from one device to another and see the complete configuration associated with the device and its power and network inter-connections. The portal applications automatically keep data center information and documentation accurate and up-to-date as devices are installed and changed.

The data center operations managers use the portal to schedule and oversee the work delivered by the engineers and technicians.

The data center executive management uses the portal to access information to make business planning decisions concerning the data center.

The portal has the following components:

1. **The Data Center Repository** is where all the drawings and database information about the Data Center are stored. It contains information about devices, space, power, and network connectivity. Each object in the drawing contains specific information about the real-world object it represents. The Data Center Repository provides a centralized store for all information about the data center and its contents.
2. **Self Service applications** to request and specify the installation of new devices, make changes to existing devices, and move or dispose of devices. These applications support the specific work processes (sub-tasks) needed to fully specify and install the equipment. They provide a standardized method for capturing the required information and a standard method of communication between all departments and personnel that are involved in the work process. When equipment is installed, the Data Center Repository is automatically updated so it stays current at all times.
3. **Locators** that allow Data Center personnel to search for information about devices and other aspects of their Data Center in order to plan new installations or repair existing equipment faster.
4. **Visualizers** that allow Data Center personnel to bring up current documentation (drawings) for any part of the Data Center so they can plan changes and trouble shoot problems faster.
5. **Reports** that help manage the work that the entire organization does, including charts and graphs to show trends.
6. Easy access to **Business Planning Information** from the Data Center Repository, the work request database, and other legacy databases in order to make business-planning decisions concerning the Data Center and its assets.
7. An **Interface Manager** to other data center systems so information can be shared across systems.

Summary

Today's organizations are very dependent on the reliable operation of their data centers. In order to achieve the highest reliability levels, engineering discipline must be employed. A system that handles all the changes made to the data center, keeps the documentation of the data center up to date, and provides fast and easy access to the documentation is required to achieve these levels of reliability and to provide the service that customers in the organization demand. As an additional benefit, this system will provide a comprehensive information base from which strategic business decisions can be made concerning the data center.

Battery Asset Management: VRLA Aging Characteristic

by Bart Cotton, Founder and CEO, Data Power Monitoring Corporation

A lot of time and money is spent on the electrical and mechanical design of mission critical facilities. These facilities have very large and complex infrastructures. Redundancies designed and built into the facility infrastructure are important to maintain end-to-end reliability.

When we talk about end-to-end, this starts from the power company service entrance and ends with the computers and telecommunications systems located on the computer room floor. In between, we have all of the emergency power systems that include the service entrance/distribution switchgear, UPS complexes, generator sets, static switches, secondary power distribution, and power management modules. These systems are all there to serve the facilities' customers. These critical facilities can encompass hundreds of thousands of square feet of processing and communications space. In order to keep this all humming, levels of redundancy are designed into the system to ensure that the communications and data processing are failsafe. A lot of time and money is spent making sure that power is available at least 99.999 percent of the time to the equipment that needs it. In special and super critical situations, designs are contrived that will ensure availability to 99.9x percent. Some centers are designed as high as 99.9999999 percent or 9 – 9's. These designs result in many millions of dollars invested into this infrastructure.

Consider the following:

A centre that is built to 99.999 percent (5 – 9's) availability, means that power will be available all year except for about five minutes a year to mission critical equipment. In the case of 7 – 9's, power will be lost for about three seconds, and with 9 – 9's, we will lose about 30 milliseconds per year. All current computer and telecommunications equipment can withstand a loss of power up to 20 milliseconds before it goes down.

The chart at right addresses the 9's:

What this really means, is that at 3 – 9's of reliability designed into the facility, there would be 526 minutes of down time during one year. In the case of 9 – 9's, there would be 30 milliseconds of down time in one year. Below is the Information Technology Industry Council (ITIC) curve on computer power tolerance limits. Note that the total loss of power tolerance is 20 milliseconds.

The Battery Asset

In the process of managing end to end reliability in critical facilities, there is a very large battery asset that is often overlooked in these reliability designs. This battery asset is independent of the reliability calculations, which become meaningless if the battery asset integrity is compromised in any way.

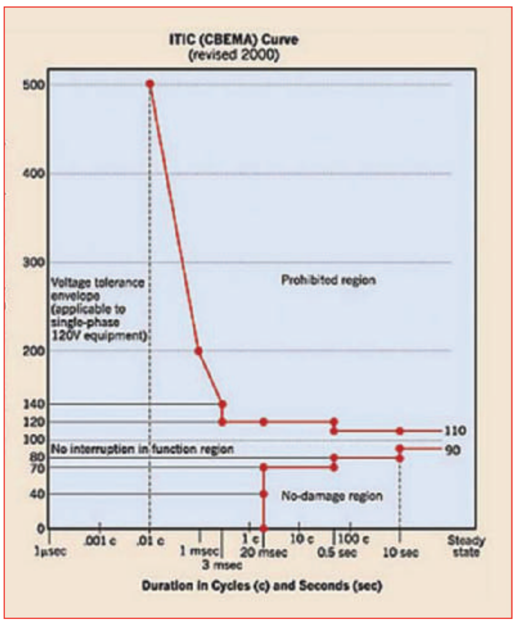
The generators can start and be on line in as little as seven seconds, but 15 to 20 seconds is more typical. In addition, we not only have to get them started, and up to speed, but we have to transfer the load (i.e. the facility) reliably to generator power. Depending on the condition of the generators, and their control switchgear, it can take a few more seconds. And transferring to generator power from utility power, or during the transfer back to utility power after the outage is over, can represent a double whammy for each power interruption.

It should always be remembered that the complete integrity of the x – 9's centre is 100 percent dependent on the battery asset. All the energy required to keep things up and running during a power emergency starts with the battery. Even generators and switchgear use batteries to start, in addition to the hundreds and thousands of battery cells used by the UPS systems.

Battery Asset Lifetimes

This critical battery asset life is finite in nature, and must be managed economically and reliably. It can be worth millions of dollars that will be spent over time. Today, this asset can be VRLA batteries that typically last about five to ten years – depending on model and construction – before replacement, or vented lead acid, which typically lasts about 20 years. The dominant battery out there today in these critical applications is a five-year life VRLA. The reason for this is an economic one, because the short life VRLA is less expensive, usually requires less maintenance and doesn't present the environmental issues that the longer life VLA (or flooded type) battery does.

We are going to concentrate on this short life VRLA, as it is used in the majority of Mission



Critical facilities in this discussion. Data Power Monitoring Corporation has collected large amounts of battery data over the past decade. In our database, we have compiled over 20 million points of data based on performance of hundreds of thousands of VRLA batteries and it is constantly growing. We collect this data based on several battery monitoring equipment measurement parameters. This data is constantly analysed for failure mechanisms and trends.

A Real Life Example

As an example of a typical large UPS user, we apply principles learned from many years of observation and our large database of VRLA battery performance parameters. This typical large user was growing, and installing UPS systems in many large mission critical centers over a period of several years. After several years, the user ended up with a large battery asset that had to be closely managed. This was both for prediction of individual battery failures in order to maintain battery asset reliability and to predict end of life for the battery asset. UPS systems and their associated battery systems were diverse locations that had the typical problems associated with new construction and retrofit situations.

To illustrate the magnitude of this battery asset, if a VRLA battery unit was worth around $250, then the end user's asset was worth several million dollars. Working together, we collectively kept their systems reliable and smoothed out their asset replacement budgets. Rather than spending millions of dollars all at once, when the battery asset was at end of life, we helped to spread out these costs, and replace end of life battery systems.

The New IEEE Battery Monitoring Standard – Trying To Hit A Moving Target

After 10 years, the Institute of Electrical and Electronics Engineers (IEEE) is at the final stages of developing a new battery monitoring standard. While it is close to completion and involves the above measurement parameters that indicate battery failure and aging characteristics - not all are included here – there are presently 17 measurement parameters. As the technology changes, we find new indicators of battery state of health, and aging mechanisms. Some of these include the following:

Common mode noise – Battery terminals (positive and negative) to earth ground. To date, we see little effect on aging, but this can affect monitoring accuracy, and is a safety issue.

Differential noise – This is caused by rectifier ripple, inverter feedback and other power electronics effects. It contains a very wide harmonic spectrum, and affects the battery aging process dependent on the noise level. We are in constant study of this factor. Its significance is not yet well understood.

Dynamic Noise – This is caused by small UPS input disturbances as small as 1 to 2 percent at the millisecond level. This phenomenon occurs frequently and will cause up to six to eight second light battery discharges. These are not picked up by PQ measuring instruments due to the level of disturbances being within computer tolerance (reference CBEMA, now ITIC curve as shown above). There have been many studies over the years in the integrity of the national power supply that show these disturbances occurring at varying frequencies. They can cause rectifier electronics to become unbalanced in three phase application which in turn, can cause shallow discharges to occur for 6 to 10 seconds in the battery system while the rectifier is correcting its internal imbalance.

Technical Text – Data Power Monitoring Specific Aging Factors:

Voltage

The amount of charging current provided to a group of batteries is determined by the ability of each individual battery to maintain a specified voltage level. Some batteries require more or less floating current that is an indication of its state of health.

As string charging current is dependent on the string voltage to be maintained, batteries present more or less resistance to this constant charging current. This change of resistance can affect individual battery voltage levels. High resistance batteries that need more charging current to maintain voltage levels, begin to exhibit dropping voltage trends over time.

Batteries that require less charging current would begin to exhibit rising voltage over time. This sometimes can be the battery drying out, such as loss of electrolyte that is finite in a VRLA. Both rising and dropping trends can be cause by a myriad of other things involved in its construction and chemistry. In addition, these changing trends can reverse themselves, depending on what is going on inside the battery. The key to remember is that charging current is based on a group of batteries, not individual battery requirements.

Unit Ohmic History And Change Rates

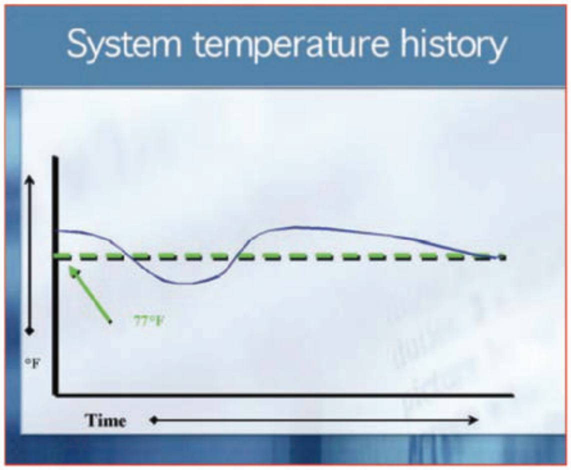
As batteries age, internal ohmic values will rise over time. By frequent monitoring and trending of these values, aging can be seen as it occurs. This is for both individual batteries, and string average values. All batteries tend to age at different rates, depending on their environment, cycling, plus their physical, and chemical integrity.

As electrolyte volume decreases due to normal venting, electrolyte typically cannot be replaced in VRLA's, this affects both voltage and ohmic values. These changes allow for some mathematical projections as to when battery end of life will occur. It is well known that when batteries have increased ohmic values at about 25 percent of their initial or specified values, their performance capacity has decreased to about 80 percent.

In IEEE recommended practices, the 80 percent capacity value represents a "non-performing", or a battery that is at end of life. This can vary somewhat with large scale VRLA's and vented batteries. Normally, this performance capacity is determined by means of documented discharge testing. When this testing is not performed on a regular basis, the ohmic value capacity determination is the next best thing. A particular standard that discusses and specifies the 80 percent capacity, and the 25 percent ohmic change is IEEE 1188, the VRLA maintenance standard. The 80 percent capacity is also used in load testing performance specifications, and calculations, to determine a non-performing battery. At right is a graph showing ohmic values versus battery life:

System Temperature History: 77 Degrees F

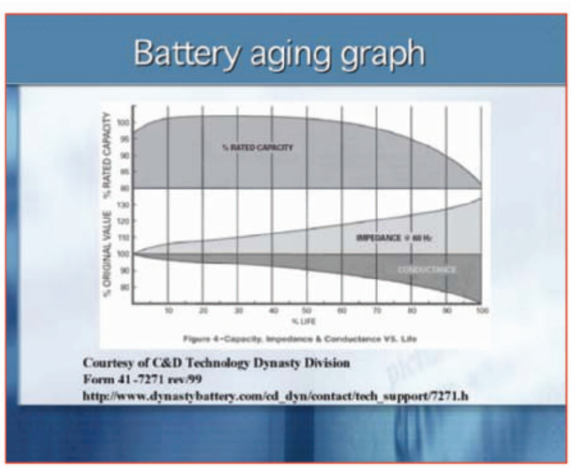
All batteries perform at their best at this temperature and typically may run a couple of degrees less. As temperatures rise over 77F, battery life can decrease. With every 15 degrees F above 77 degrees F, battery life can be halved. This generally has to do with battery heating, accelerated deterioration, and excessive venting. Batteries can run under 77 degrees F and perhaps last longer, but capacity is reduced at the lower temperatures. Temperature control is a major factor in battery life.



The timeframe represented above would be about two years in a new construction UPS application. The temperature is for a group of batteries within an enclosed battery cabinet. At the beginning of the installation, temperatures were high because of incompletely commissioned air conditioning systems. When the A/C systems were all commissioned, temperatures became cold in the UPS/Battery cabinet room area, as the A/C settings were for UPS systems with a higher percentage of load than was present at the time. As customer load increased, and the UPS systems generated more heat in the room, A/C controls were not properly set to respond to the rising heat levels. As a result, there was a significant period of time when batteries were running warmer than normal, thus affecting their life.

Unit Replacement Percentage Within Battery System

As defective or failing batteries are replaced within a string, a battery unit interaction begins. This interaction is exacerbated as additional batteries are replaced. We like to call it the "King of the Hill" effect. This interaction negatively affects string aging. There is no standard or recommended practice for this important percentage. With batteries, new ones require less charging current than the older ones, but the charger doesn't know that, and will tend to overcharge the new ones, weakening them in the process. This activity is constantly going on within the string. We use a factor of 25 percent replacement over battery string life since new, as long as it is constantly monitored.) Many UPS service organizations use 10 percent to 25 percent before string replacement. This factor is not based on age of the string, or the individual batteries within the string. We tend to use the higher percentage range because we are looking at many other factors affecting system life.



Parallel String Interaction

When end of life characteristics are developing in individual battery strings within a multi-string system, all strings must be replaced. In case after case, we have found that replacements of individual strings will decrease battery life for the complete system due to interaction between the old and the new strings. Older strings with aging batteries will use larger charging current than the new strings due to differences between average string ohmic values. The charger cannot discriminate between strings. As the charger generates enough current to keep the older strings charged to proper string voltage levels, the new string does not need this additional current and will tend to overcharge. This process creates heat and some resultant venting, thus decreasing the life of the new string. As this process continues, the older strings will age at their normal rates, and the new string will catch up in the aging process.

Individual Battery Interaction – "King Of The Hill" Effect

As batteries are replaced within a string, we end up with batteries with different ohmic values due to age, environment and many other factors. Again, older batteries require more charging current to maintain voltage levels. This in turn causes newer replacement batteries to overcharge, until they tend to raise their ohmic values to somewhat equal to the older batteries.

This process becomes more severe as more individual batteries are replaced within the string.

Unit Vs. String Vs. System

All three affect each other, and must be taken into account when studying aging systems. Some VRLA's can last longer, depending on the types. We cannot age batteries with any real certainty without lifetime monitoring.

Conclusion

Battery aging processes affect battery asset management. In the aging process, all factors shown above have a role to play. Customer load levels, individual system criticality, UPS system redundancies, and planning, are additional factors that must be calculated into the mix.

Planning must occur to result in just-in-time battery replacement that can be more easily budgeted for. A running budget planning process,

continued on page 7

Attendee List
2004 Fall Conference
End-to-End Reliability: Innovation

3M
ABB Inc.
Active Power
Aetna Inc.
AFCO Systems
Affiliated Engineers, Inc.
AKF Engineers
America Online
American Express
American Power Conversion
Andrew Browning Group, LLC
Archon Group / GENISUS
Atlantic Detroit Diesel - MTU
Austin Generator Service
Automated Logic - Critical Systems
The Bick Group
Black & Veatch
Blue Canopy Group, LLC
Burr Computer Environments
Business Information Services
C&D Technologies
Callison Architecture
Captain D's LLC
Carter & Burgess
Caterpillar
CBeyond Communications
CCG Facilities Integration
Cendant Corp
Charles Schwab
CheckFree Corporation
ChoicePoint
Cisco Systems
Citadel Investments LLC
City of Seattle
Cobasys
Colliers Turley Martin Tucker
Computer Room Svcs. Corp.
ComputerSite Engineering
ComRent International LLC
Constant Technologies
Constructors & Associates, Inc.
Corgan Associates Inc.
Critical Facility Associates
Cupertino Electric, Inc.
Cushman & Wakefield
Danaher Power Solutions
Data Aire Inc.
Data Power Monitoring Corp.
Data Support Associates/Encore
DeGroot Mission Critical
Department of Defense
DFW Consulting Group
DLB Assoc. Consulting Engineers PC
dRay Tech, Inc.
Dunham Associates
E5 Group, Inc.
East Penn Manufacturing Co.
Eaton Powerware
EDS
Edwards & Zuck
EMC Corporation
EMCOR Facilities Services
EMCOR Technologies, Inc.
Emerson Network Power
Energy User News
EnerSys Inc.
Engineered Computer Rooms
Environmental Systems Design
EYP Mission Critical Facilities
Facilities Engineering Assoc.
Federal Reserve Bank of Dallas
Federal Reserve Bank of NY
Fidelity Investments
First Data Corp/Western Union
Ford Motor Company
Fox IT, LLC
Freddie Mac
GE
Gensler
GHT Limited
Gilbane Building Company
Glumac International
Goldman Sachs & Co.
Grubb & Ellis
H&R Property Management Ltd.
H.F. Lenz Co.
Highland Associates
Hitec Power Protection, Inc.
HMA Consulting, Inc.
Holder Construction Company
Hood-Patterson & Dewar, Inc.
Horizon Project Advisors, LLC
IBM Corporation
IBM Tawain Corp
IEEE
INFLOW
Inglett & Stubbs
Innovative Research
Inracks, LLC
Intel Corporation
ISO
James Johnston & Associates
Jaros Baum & Bolles
JDC Power Systems, Inc.
JE Dunn Construction Company
Johnson Controls, Inc.
JP Morgan Chase
JT Packard
Kaiser Permanente
Kling
L3 Communications
Lawrence Berkeley Nat'l Lab
LayerZero Power Systems, Inc.
Lee Technologies Group
Level 3 Communications
Longden Company, Inc.
Manomet Solutions
Marathon Electric
Mark G. Anderson Consulting
Master Card International
Mazzetti & Associates
MCE
MFS Investment Management
MGE UPS Systems
Michaud Cooley Erickson
MIT
NASDAQ
NER Data Products
Northam Realty Advisers
Northstar Battery Company
Obvius
Orr Protection Systems, Inc.
Pacific Gas & Electric
Padia Consulting
Parsons
Pentadyne Power Corporation
PermAlert ESP Inc.
Pershing
Philadelphia Stock Exchange
Piller, Inc.
Power Distribution, Inc.
Power Management Concepts
Power Measurement USA
Prince William County Econ Dev
Project Solutions Group
Quest Diagnostics
Qwest
Reliable Resources
Resilient Solutions
Rittal Corporation
RLE Technologies
Rosendin Electric, Inc.
RTKL Associates, Inc.
Russelectric
S&C Electric Co.
Safeway Inc.
Saft Power Systems
Sandia National Labs
Sanmina - SCI
SatCon Power Systems
SBC
Server Technology, Inc.
Shaw Communications
Siemens
Siemon
SPL Integrated Solutions
Square D/Schneider Electric
St. Johns Consulting Group
State of California HHSDC
State Street Corporation
Strategic Facilities, Inc.
Structure Tone, Inc.
Stulz Air Technology Systems
Sundt Construction
Supportek
Swanson Rink
Syska Hennessy Group
Technical Innovation (TI)
Telpro, Inc.
TiePoint Engineering, PC
Tishman Technologies Corp.
Trammell Crow Company
Triton Technology Systems, Inc.
Turner Construction
United Parcel Service
United Technologies Power
Universal Electric Corporation
University of Alaska
The Uptime Institute, Inc.
Vanguard Group
Visa USA
Wachovia Corporation
Walker Engineering, Inc.
Washington Mutual
WB Engineering and Consulting
The Whiting-Turner Contracting Co.
Wright Line LLC
Zachry Construction Corporation

Corporate Leadership Program Sponsors

FALL CONFERENCE 2004

End to End Reliability: Innovation

Silver Members

APC Legendary Reliability™

HITEC Power Protection — POWER TO RELY ON PEOPLE TO RELY ON

SIEMENS

Key Members

ABB

Active Power®

AFCO SYSTEMS — Modular Enclosures & DataComm Products

CATERPILLAR®

DANAHER POWER SOLUTIONS

EATON

EMERSON Network Power

PDI — creating the perfect wave

Russelectric — Power Control People You Can Rely On

SQUARE D

SYSKA HENNESSY GROUP

Battery Asset Management: VRLA Aging Characteristic

continued from page 5

including system changes, additions, deletions, new installations, and load growth are essential. Budgets must be revised minimally on a regular basis – quarterly, semi-annually, or annually, to correct for condition changes, including maintenance issues. Mandatory monitoring is necessary to make budget decisions in addition to predicting failure and ensuring the integrity of the battery systems. All battery systems should be monitored on a frequent basis, a minimum of once a week or more often, depending on the monitoring vehicle. All factors, including individual batteries, strings, and systems must be archived, interpreted and watched, for both short and long term data trends and events that can affect this data. This includes outage or cycling information. Lifetime monitoring is essential. Timely and effective battery system management affects profits and reliability. As we have stated before: "Like any other monitoring system, the investment is worthless unless qualified individuals observe and interpret the information."

A battery aging technical introduction

Aging factors include some of the following indicators:

- *Unit voltage history, rise and fall – individual batteries are constantly charged to maintain a constant voltage. Regardless of what they are supposed to do, they change over time. If we see voltages changing on individual units, this is an indicator of something happening within the battery.*
- *Unit typical ohmic value – each battery model has an initial ohmic value. This could be in terms of DC resistance, impedance, or conductance, and is expressed in terms of ohms, or milliohms.*
- *Unit ohmic history and rise rates – as batteries age, internal ohmic values will rise over time. By frequent monitoring of these values, aging can be seen as it occurs.*
- *System temperature history – battery manufacturer specifications for optimum battery temperature is 25C or 77F. The temperature over time affects aging rates.*
- *Unit replacement percentage within battery system –this affects string aging. There is no established standard for this important percentage. It can range from about 10 to 25 percent. This percentage varies within this typical range depending on the maintenance organization, battery manufacturers, and how comfortable the parties involved are.*
- *Parallel String Interaction – when end of life characteristics are developing in individual battery strings within a multi-string system, all strings must be replaced. The battery charger cannot discriminate between strings, and these strings will interact with each other.*
- *Individual Battery Interaction ("King of the Hill" Effect) –units affect string health and aging characteristics.*
- *Battery discharges and data – we know that battery discharges, light and heavy, have a profound effect on battery life. It is reflected further by changes in the above parameters*

S A V E T H E D A T E S !

2005 Spring Conference

June 12-15, 2005

Boca Raton Resort & Club
Boca Raton, FL

End-to-End Reliability: Today, Tomorrow & Beyond

2005 Fall Conference

November 13-16, 2005

La Costa Resort
Carlsbad, CA (San Diego County)

End-to-End Reliability:
Infrastructure: Hardware, Software & Support

Call for Presentations

7x24 Exchange is seeking Fall Conference presentations proposals. For additional information please contact Tara Oehlmann via telephone at 646-486-3818 x104 or via e-mail at tara@dolcimanagement.com

Call for Articles

7x24 Exchange is seeking Fall Newsletter articles. For additional information please contact Tara Oehlmann via telephone at 646-486-3818 x104 or via e-mail at tara@dolcimanagement.com

Visit www.7x24exchange.org for Spring Conference program details and to register.

7x24 Exchange

322 8th Avenue, Suite 1400
New York, NY 10001

PRE SORTED
FIRST CLASS
U.S. POSTAGE
PAID
WILKES-BARRE, PA
PERMIT NO. 188