The Death of a Spreadsheet – Streamlining Gas Turbine Operations and Maintenance Reporting

Presented by   **Beatriz Blanco**

Jerry Vin

**MITSUBISHI HITACHI POWER SYSTEMS**

Agenda

- About Mitsubishi Hitachi Power Systems America, Inc.
- Current PI System Configuration
- Need for Improving Report Efficiency
- Reporting Application
- Implementation Details
- Diminished Review Time, Editing and Conversion Efficiency
- Conclusion

About Mitsubishi Hitachi Power Systems America, Inc.

- MHPSA is an industry leader in gas turbine technology.

- The MHPSA Remote Monitoring Center (RMC) monitors 70+ gas turbines around the world using the PI System.

- Coupled with Asset Framework and Analytics, the RMC uses the PI System to drive R&D, mitigate potential issues, troubleshoot problems, and distribute reports for customers.

MHPSA PI Systems Configuration

- From P & Q Lines two main data sources configurations are used. The data from the P&Q line is first collected using these interfaces.

- This data is then transferred to the site/remote PI Server™, using either PI Interface for OPC or PI Interface for UFL.

- The data will then be transferred to Orlando Service Center collective PI Servers™ using PI to PI Interfaces located on Buffer servers.
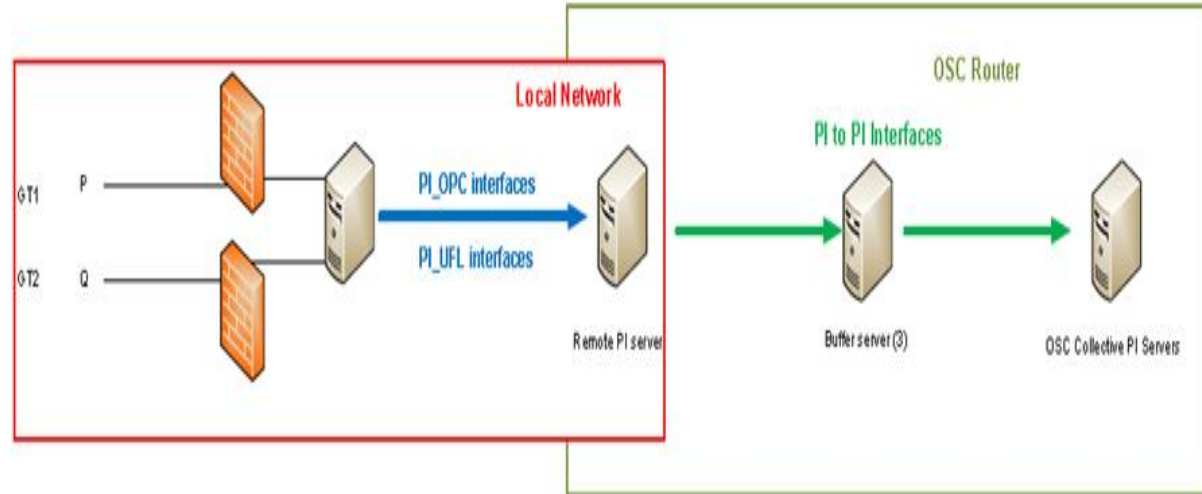
MHPSA PI Systems Configuration

- Once on the OSC PI Servers™, the data is now available to users through various applications that include PI ProcessBook®, PI DataLink®, Asset Framework etc. Data is stored on archives with no time limit.

- The configuration of the data sources are different, but in each instance the data flows from the controller to the Orlando Service Center collective PI Servers™.

- The framework of the quarterly report was based on this data collection, as well as other tools that the RMC has developed.

MHPSA PI Systems RMC Developed Tools

- The RMC has created Tools utilizing PI DataLink® and Asset Framework that include the following:

  - » Start Up/Shutdown Comparisons
  - » Start Up/Shutdown Parameters Data Pulls
  - » 3 Day vs 10 Day Comparisons
  - » Swirl Analysis Tool
  - » Daily Chart Builder
  - » Quarterly Reports
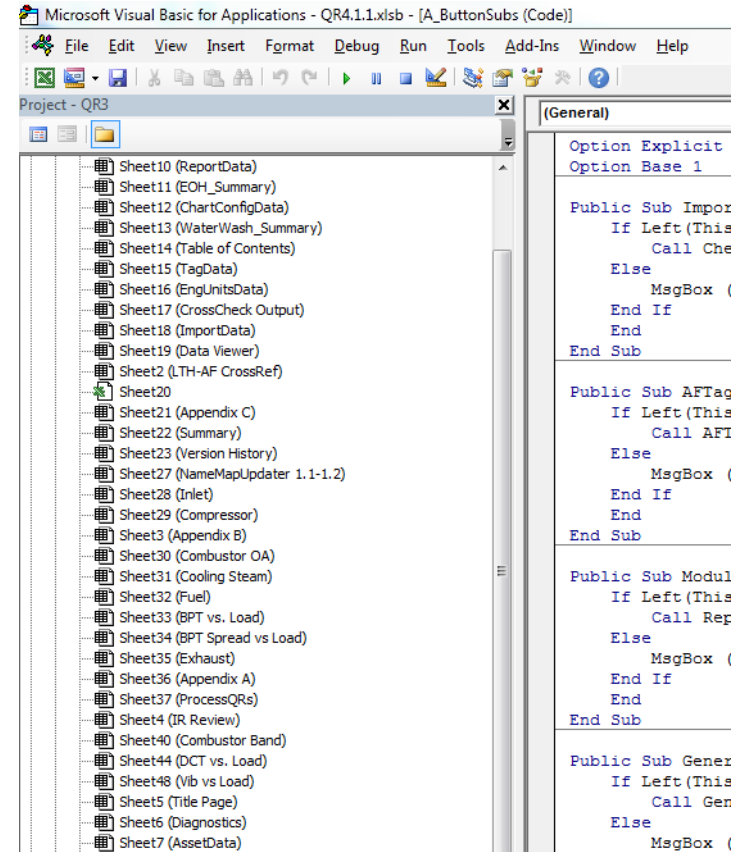
Quarterly Reports for Customers

- The Quarterly Reports provide segmented comparison data of the gas turbine's major systems, along with a summary of issues being tracked for an individual site.

- The reports provide the ability to keep the customer up to date on all long term and short term trends and issues.

- The original reporting tool was created using VBA and Macros in Excel.

Quarterly Reports for Customers

- These macros often failed, were difficult to troubleshoot, and the reports were difficult to modify.

- New unit additions to the existing Excel spreadsheets were time-consuming, and inputs necessary for the macros to run were easily missed, causing failure.

- With every revision, several inputs needed to be adjusted and likely failures occurred.

Quarterly Reports for Customers

- Two attempts were made to re-vamp the reporting tool.

- Both products utilized our current Asset Framework structure.

- Each plant is divided into major systems, and templates are created based on frame size, units of measure, and special systems.

Earlier Attempt at New Quarterly Reporting Tool

- First new tool used Microsoft SQL Server Reporting Services (SSRS)
- Data imported from upon report generation
  - From Asset Framework (AF) using PI OLEDB Enterprise
  - From Sharepoint using built in querying tools
- Subscriptions scheduled to save reports as PDF documents
- Problems
  - Charts generated as images and could not be easily edited or annotated
  - Any document changes required annotating the PDF and then "printing" to a new PDF to flatten the document
  - Manual exporting of many reports independent of subscription
  - Limited to features and calculations that SSRS provides
  - Bugs in SSRS that could not be fixed

New Quarterly Report Tool Requirements

- Customer requirements
  - Chart annotation and editing before exporting
  - Workflow management
  - Bulk exporting of reports
  - More intuitive user interface with quicker response
- Developer requirements
  - Ability to add new features without SSRS limitations

Solution

- Metadata stored in SQL Server configuration table
- Import raw data to an intermediate database
    – Stores calculation results
    – Stores annotations and chart edits
    – Stores workflow information
- Build a web application to interact with the intermediate database
    – Easy to customize visually
    – Access to many JavaScript libraries
    – Can create custom controls and dialog boxes for any custom feature requests

Technology Used

- Import of Raw Data to Intermediate Database
  - C# application built to import data and crunch numbers
    - PI data imported using PI OLEDB Enterprise
    - Sharepoint and SQL Server imported using .NET libraries
  - Intermediate data storage in MongoDB
- Data and report frontend in a web app viewed in a web browser
  - Deployed to an IIS web server
  - Web application built in Angular 2 using Material Design styles
  - Custom charts built in D3.js

- Report output to PDF using wkhtmltopdf

Quarterly Reports Lookup

Quarterly Reports Generation

Quarterly Reports Workflow and Report Status

Quarterly Reports Chart Editing

Quarterly Reports Data Annotations
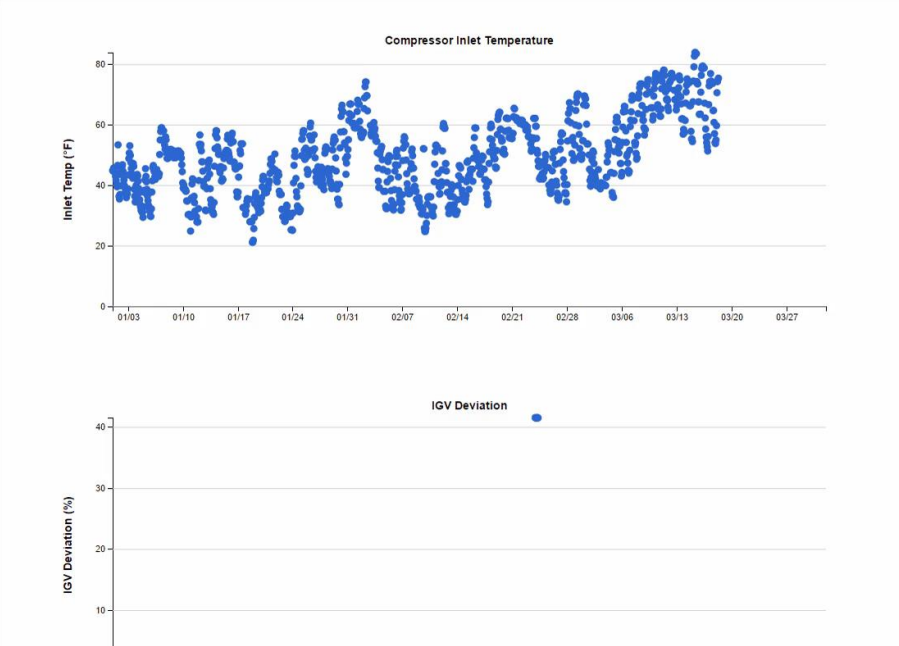
Quarterly Reports PDF Export

Using PI Data, Asset Framework, and PI OLEDB Enterprise to Streamline GT Reporting

COMPANY and GOAL

MHPSA monitors 70+ gas turbines and wanted to reduce the time it took to create, modify, and annotate reports, and minimize troubleshooting time.

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CHALLENGE

Finding the most efficient user friendly interactive reporting tool that utilized both the PI System and Sharepoint

SOLUTION

MHPSA collaborated with DST Controls to create a self contained application that incorporated all the data sources required.

- Engineers can quickly annotate current and resolved issues, and identify and resolve potential problems.

RESULTS

Engineering review time decreased by 25% . Report creation and printing time decreased by 50%.

- Effectively streamlined the process to reduce the overall number of hours spent on total package for reporting to allow quicker reactions to potential issues.
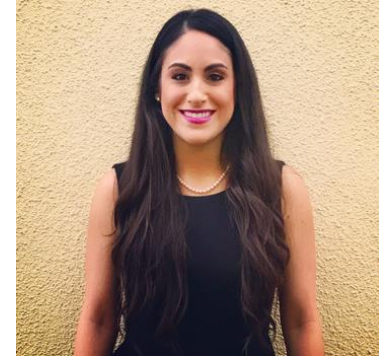
Contact Information

Beatriz Blanco

Beatriz.Blanco@MHPowerSystems.com

RMC Engineering Manager

Mitsubishi Hitachi Power Systems America, Inc.

Jerry Vin

JVin@DSTControls.com

Project Engineer

DST Controls, Inc.

Questions

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado

Custom applications using PI tools to create reporting, streamlines the entire process.