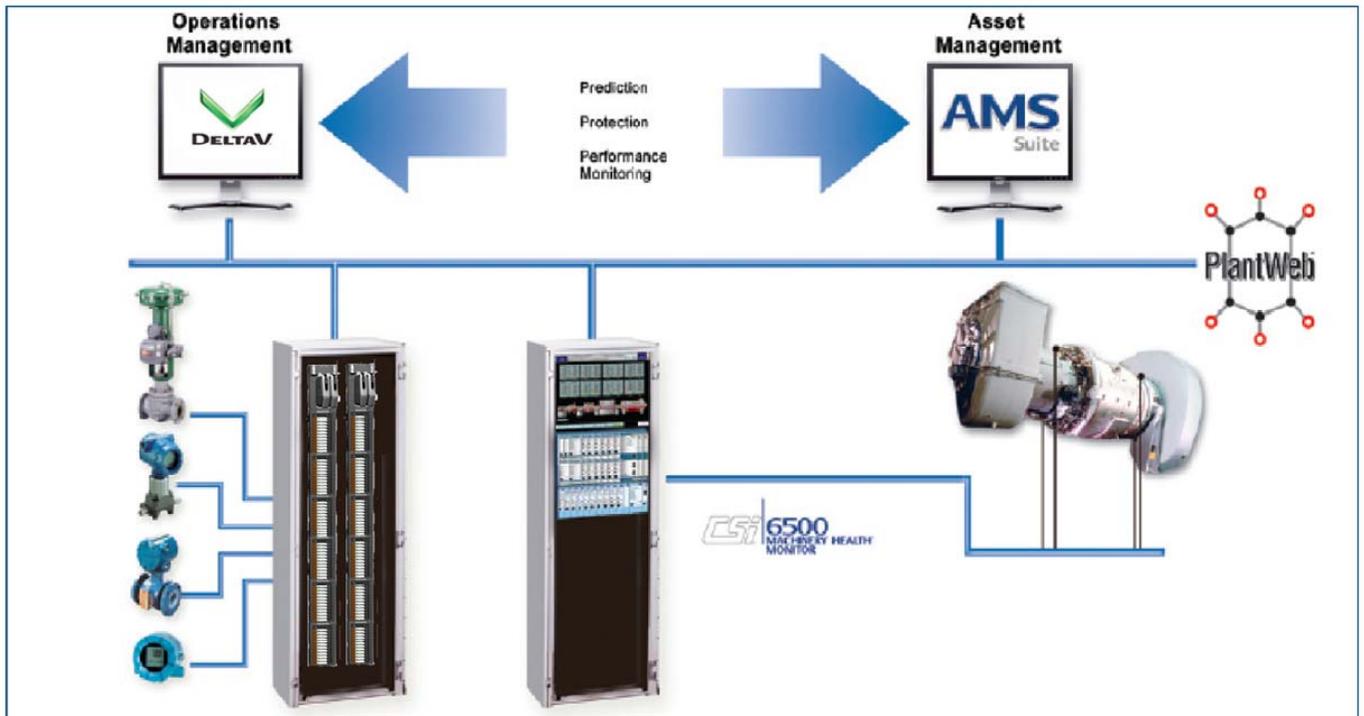


# Integrated Machinery Protection and Prediction

Real-time integration of machinery information in the DeltaV™ Process Automation System delivers actionable information to operations staff and protects the condition of critical machinery assets.



**Table of Contents**

**Introduction..... 3**

**Traditional Integration..... 3**

    Complex and Expensive..... 3

    Operator Graphics..... 4

    Is it Worth the Effort?..... 4

**Integrated Machinery Health from Emerson ..... 5**

    Three-Step Setup..... 5

    Operator Graphics..... 6

    Machinery Health Diagnostics..... 7

    No Effort! ..... 7

**Total Monitoring Solution ..... 7**

    Identify and Prioritize Production Risks ..... 8

    Relevant Information ..... 9

    Key Asset Details ..... 9

    Improve Business Results ..... 10

**Summary ..... 10**

## Introduction

Asset Management can be defined as a set of disciplines, methods, procedures and tools to optimize the business impact of costs, performance and risk exposures. Who has 'responsibility' for Asset Management? The Operations and Maintenance groups must work together to identify and implement ways to improve equipment health. Access turbomachinery asset information can provide both groups with information needed to create operating and maintenance strategies for each piece of equipment.

## Traditional Integration

### Complex and Expensive

In traditional control systems, access to machinery health diagnostics is complex and expensive, requiring Modbus expertise, system expertise, and specific machinery knowledge. Typical configuration steps include, but are not limited to:

- Naming the module (enter-it-once concept does not apply)
- Specify data direction
- Data type selection (signed, unsigned, 16 bit, 32 bit)
- Browse for tag type
- Determine data type (1 = output registers, 2 = input registers)
- Data start address (Don't forget the offset at starting address. Different for 16 bit vs. 32 bit)
- Control system configuration (function blocks, control modules)
- Faceplate design (scale factors, engineering units, scale range, alarm limits, metric conversions, linking data values)
- Operator graphics design and linking to data values
- Alert configuration
- See manual for the rest...

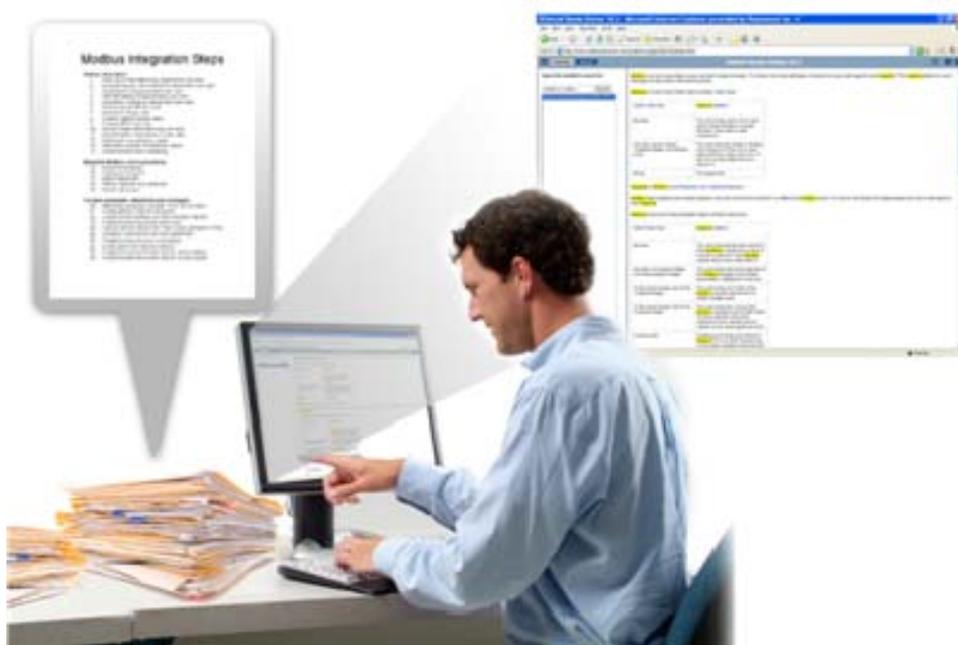


Figure 1 – Machinery Health Integration has Traditionally been very Complex

There are more than 30 steps for each of four or more parameters like: vibration value(s), alarm limits, sensor health, relay state, times two channels across 12 monitors. Machinery protection systems can require 2,400 steps for 24 vibration channels to complete the integration process. These are not simple steps that are easily completed by someone unfamiliar with the process. The integration takes someone with detailed knowledge of the machine, or there is a learning curve to determine how vibration and process automation systems are implemented.

### Operator Graphics

Traditionally, once data pipes were established via Modbus or another bus protocol, extensive services were required to actually make the data useful for the operator. Control strategies, alarm limits, etc. must be configured using the mapped data. Then operator graphics and faceplates must be configured to display the control strategies, machinery parameters and alarms.

### Is it Worth the Effort?

Complete integration typically takes up to five days. Once the configuration is completed, network issues, testing time and nuisance alarms are likely to be increased because of the complexity and tediousness involved in the setup. All too often, plant operators, maintenance personnel and plant management are left without key machinery health diagnostics, because many facilities do not think the benefits of accessing the health information outweigh the cost and pain of going through the setup and configuration process.

However, turbomachinery assets are expensive and have costly repercussions – potentially to both personnel safety and budgets – if they fail. Human safety is at risk if machines fly apart. Machines can take weeks or months to repair, resulting in blown maintenance budgets and production schedules. Additionally, without feedback from machinery, operators do not understand the effect that plant operations have on machinery health. Nearly half of equipment breakdowns are related to poor operating practices.

Access to equipment health data can prevent catastrophic failure, reduce maintenance costs and maximize production. However, it is frequently difficult to see past the mountainous effort that is usually required to provide the equipment health data to operators and other personnel.

## Integrated Machinery Health from Emerson

Emerson Process Management has recently taken a 'Human Centered Design' approach to deciding what technology enhancements to make. A Human Centered Design approach focuses on how people complete everyday tasks for their job, rather than enhancing technology just for innovation's sake. Emerson's Human Centered Design approach eliminates unnecessary work, reduces complexity of technology, and embeds knowledge into the technology.

The tedious tasks for adding turbomachinery information to a process automation system have been eliminated with Integrated Machinery Protection and Prediction from Emerson. Hundreds of man-hours are saved with an easier way to have complete, error-free integration of machinery health information. With DeltaV v10.3 (or higher), AMS® Machinery Manager 5.3 (or higher), and the CSI 6500 Machinery Health® Monitor A6824R communications module, users will:

- Eliminate complex and expensive integration
- Have out-of-the box machinery health diagnostics for operators
- Build operator graphics quickly with pre-configured graphical elements (dynamos)
- Have complete machinery monitoring for protection, prediction, and performance monitoring

### Three-Step Setup

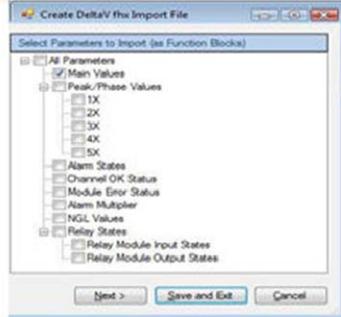
Turbomachinery is easily connected to the DeltaV process automation system in three simple steps that can take less than ten minutes. From AMS Machinery Manager and the CSI 6500 Machinery Health Monitor, asset parameters are scanned, selected, and imported into the DeltaV system:

- **Step 1 – Scan CSI 6500 hardware:** The scan process reads each card inserted the CSI 6500, as well as the configuration information. You don't need to hunt down user manuals to see what parameters are available. There's no re-entering information that was already entered into the CSI 6500. AMS Machinery Manager scans the CSI 6500 via Ethernet and discovers the monitor and all of its properties. The scan returns much of the information that was entered when the CSI 6500 was first configured. Information includes monitoring module type, module name, sensor name, bearing name, machine name, engineering units, sensor sensitivity, alarm limits, module health status, and relay states. This scan typically takes about 20 seconds per CSI 6500 system.
- **Step 2 – Select parameters and alarms:** Once the values are scanned, you can select values to set up parameters and alarms that are relevant to your facility. Choose from overall vibration data, peak and phase data, relay states, and indicate which monitoring modules and sensors should be imported. During this selection process, you can choose either the DeltaV VIM using Ethernet or the DeltaV serial interface communication method. Both communication methods can be made redundant if desired. You only need three pieces of information to complete this step: the controller name, the area name in the DeltaV Explorer, and the name of the first virtual serial port (typically c57). After the desired machinery health parameters are selected, you can accept the defaults or you can customize further. Step 2 typically takes about 5-10 minutes, depending on the level of customization.
- **Step 3 – Import to DeltaV:** After the values are determined, they are easily imported with the configuration (.fhx) file into your DeltaV System. Control modules and function blocks are automatically built during the import. Vibration function blocks are now part of the process automation control strategy. Function blocks make use of scale factors, engineering units, alarm limits, full scale range, and parameters that were selected in Step 2. Faceplates are automatically linked the new control modules and machinery health monitoring is activated. To complete the import process, download the controller. This step takes about 30 seconds to complete and at this point, the integration process is finished.

1) Scan CSI 6500 hardware



2) Select parameters & alarms



3) Import to DeltaV

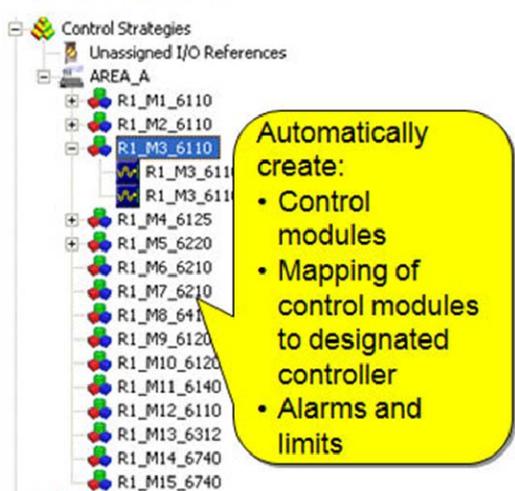


Figure 2 – Three Steps in Ten Minutes. Easy.

Operator Graphics

In addition to datasets and control modules being automatically configured in DeltaV during the import process, a machinery health faceplate template and machinery health dynamos are created for operator graphics. Operator graphics can be customized by using these basic dynamos to easily create a functional operator interface.

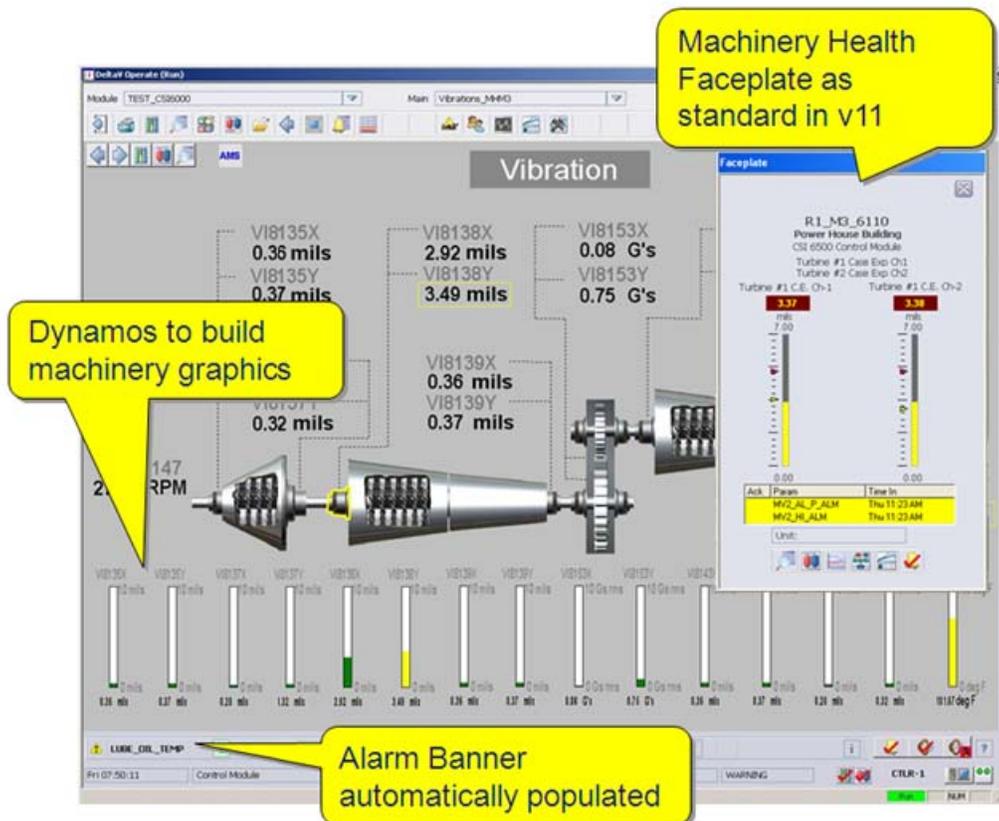


Figure 3 – DeltaV Operator Graphic with Integrated MachineryHealth Information

## **Machinery Health Diagnostics**

When machinery health alarms occur, they will automatically appear in the alarm banner of DeltaV Operate with no extra configuration required. When the alarm is selected, a CSI 6500 faceplate pops up with critical machinery health information that is useful for real-time decision making. The faceplate immediately provides operators with information like which sensor, bearing, or vibration parameter is in alarm. In addition, the faceplate includes a bar graph that shows the vibration levels proportional to full scale range in the appropriate engineering units. Built-in instrumentation alarms automatically synch alarm limits with Emerson's machinery health systems so immediate action can be taken before faulty measurements shut down the plant.

Function blocks are automatically created in the DeltaV Control Studio, which include out-of-the-box rules and allow you to build custom rules for plant-specific abnormal situation scenarios. This is an easy and fast way to give decision support to your operators.

## **No Effort!**

Compared with five days configuration and mapping, the ten minute setup for machinery health information in DeltaV basically requires no effort. Compared with 30 steps to map and configure even one of the most basic parameters, the 3 step process of scanning, selecting and importing data is effortless. However, all of the benefits of preventing failures, reducing maintenance costs and maximizing production are realized with DeltaV Integrated Machinery Health.

Integrated Machinery Monitoring delivers prediction, protection, and performance monitoring for a comprehensive solution:

- Machinery Protection with full API 670 protection to avoid catastrophic failures, increase safety, and satisfy insurers
- Predictive Diagnostics to maximize availability, increase dependability, and reduce maintenance costs
- Performance Monitoring to maximize production, reduce energy consumption, and minimize emissions

Machinery Health Integration with DeltaV delivers critical machinery health information to operators, which can reduce the number of equipment breakdowns. Operators become aware of how their process changes affect equipment performance and health. In turn, the reduction in the number of equipment failures reduces the risk to personnel safety and increases the likelihood that production schedules will stay on track. Emerson's Integrated Machinery Protection and Prediction solution is one part of the PlantWeb® digital plant architecture, which provides appropriate information from the process, instrumentation or other assets to the right people.

## **Total Monitoring Solution**

Operations and Maintenance groups working together on plant Asset Management also need information from plant equipment other than turbomachinery. Easy access to, and understanding of, all plant information is possible with Emerson's AMS Suite® – an integrated family of applications for predictive maintenance.

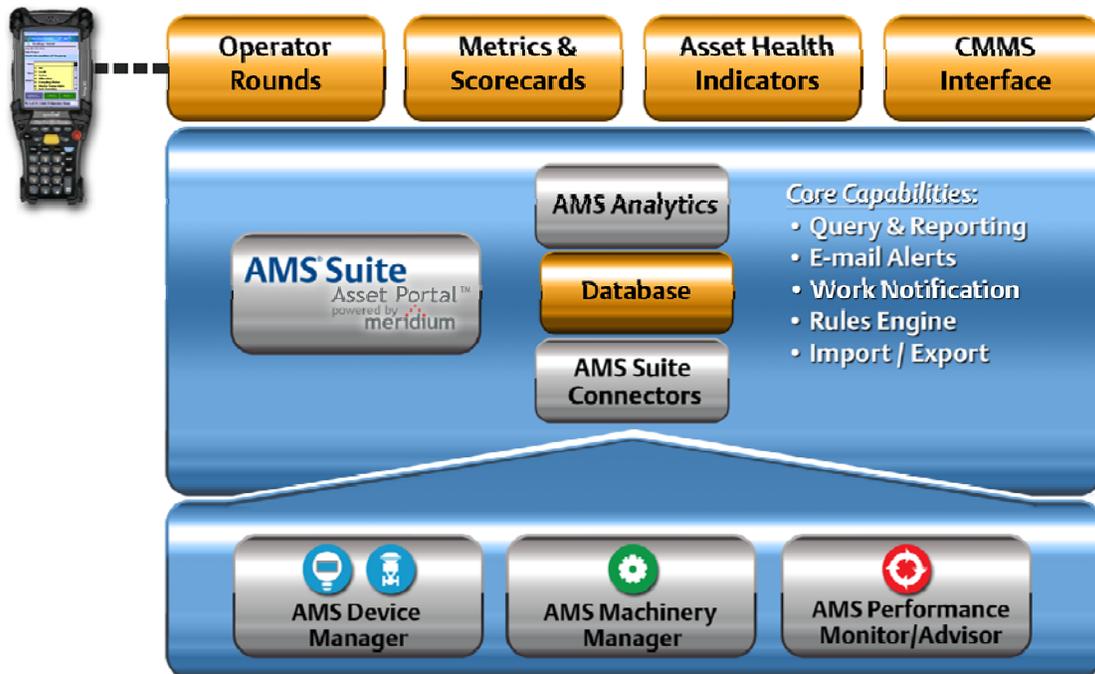


Figure 4 – AMS Suite of Applications

## Identify and Prioritize Production Risks

AMS Asset Portal™, powered by Meridium, maximizes asset performance, mitigates risk, and optimizes maintenance costs in the enterprise. A core component of Emerson's PlantWeb digital plant architecture, AMS Asset Portal consolidates data from assets in a facility and allows users to define, view, and measure metrics to analyze your asset performance.

AMS Asset Portal integrates data from the thousands of assets throughout your plant into a single application. Everything from process variables and transmitter health to a wealth of information on machinery or drive health can be monitored. With all of this asset information, unplanned downtime can be avoided and maintenance expenditures can be kept within budget.

Due to staff reductions and individual responsibilities being increased, plant personnel do not have the time to dig up asset and production data often enough to make it useful. A customized dashboard can be developed, but how many different versions will be needed? What will happen if there is a change in which data to analyze?

To quickly identify and prioritize risk to production, managers need to know the real-time condition of assets along with the production information. Imagine having immediate access to the status of instruments and valves controlling boilers, the health of a pump and motor train circulating the effluent, as well as a performance indicator for the entire boiler unit. At a glance, an overall status of the unit is known.

For items that require immediate attention, alerts can be setup to send an email to appropriate personnel – for action or information. A production manager may want an email when the plant is not running as efficiently as it should. An email is sent showing that the Overall Equipment Efficiency is beginning to dip in one of the process units. By clicking a link in the email, the production manager can go to his/her personal dashboard, which provides even more information on the declining efficiency. By looking at active alerts for the unit, a critical valve that has several travel deviation alerts is found. This is causing a problem with fluid levels down the line. Another link is clicked to view recommendations, including a historical record of actions taken when this issue happened before. A work order can be created right then, with attached recommendations, and send it to the EAM/CMMS system for immediate attention by maintenance. Progress can be monitored until the issue is resolved.

Think about current processes. Wouldn't access to this crucial information support decisions and enable improvements to plant operations, reliability, and profitability? AMS Asset Portal delivers immediate, actionable information that allows management focus to be on business goals.

### Relevant Information

AMS Asset Portal provides relevant information that is needed to keep plants running smoothly. Users are able to:

- Gain a broad view of critical asset details across your enterprise to guide decision-making
- Immediately focus on the areas that need attention with information targeted to your job function
- Schedule and create meaningful reports to discover trends and identify bad actors
- Receive real-time mobile alerts on problematic assets to manage production risks
- Establish goals and key performance indicators (KPIs) to drive improvements that deliver business results
- Collaborate with PlantWeb Services to maximize the value of smart devices and AMS Suite

### Key Asset Details

AMS Asset Portal makes finding information simple and efficient. A user homepage is customized with the information used most, including charts, graphs, and links to more details. Queries enable users to delve deeper into the asset data to target specific problems and identify root causes.

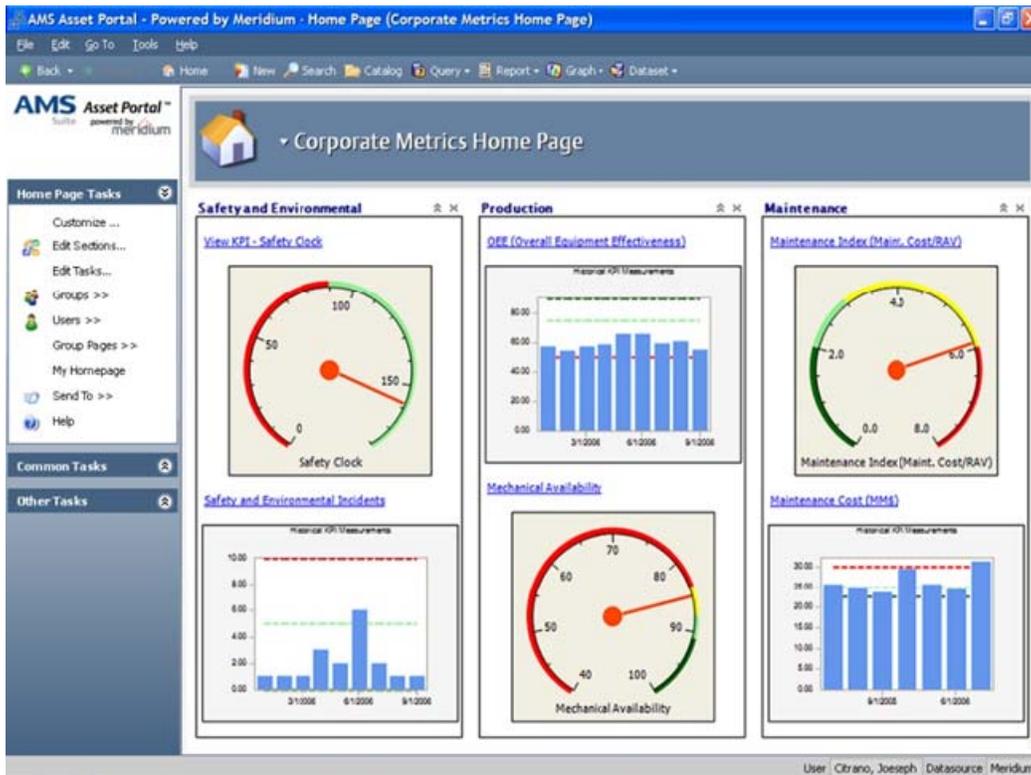


Figure 5 – Customized Home Page

Custom metrics are created and tracked to reveal under-performing assets and to develop world-class maintenance strategies and practices. KPI results are displayed graphically in charts, graphs, and dials, so actual performance can be easily compared to performance goals.

Reports can be generated from any query or data options in the AMS Asset Portal database. For reports that will be reviewed on a regular basis, a scheduled report generation for common reports can be created. And when unique situations come up, manual reports are easily created. Furthermore, collaboration is easily achieved by emailing reports to colleagues or posting them to the AMS Asset Portal homepages for online collaboration.

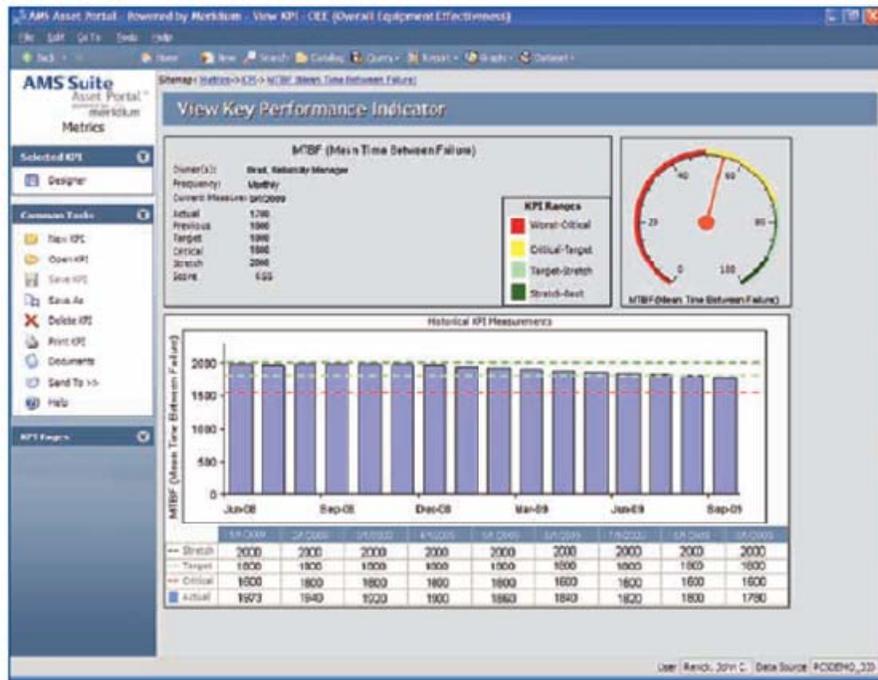


Figure 6 – Reports Provide an Easy Way to View Key Performance Indicators

### Improve Business Results

AMS Asset Portal can integrate with maintenance management systems, to have work notifications created, based on asset condition and performance. Integration with these systems enables entire organizations to drive common goals by combining asset information with business data to create key metrics.

### Summary

Turbomachinery health information is increasingly important to process facilities in order to have a maintenance strategy around equipment and to meet production requirements. Providing machinery health information to operators is no longer precluded by the excruciating tasks that were formerly required. The PlantWeb architecture enables operator access to the machinery health in minutes. Process data, along with machinery health and other plant equipment information, can be pulled together with AMS Asset Portal, powered by Meridium, to provide plant management with tools needed to run the most efficient facility.

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