

‘InsightSuiteAE’ NEW SERVICES TO MAXIMIZE PLANT ASSET UTILIZATION WHILE MINIMIZING TOTAL COST OF OWNERSHIP

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The debut of FOUNDATION™ Fieldbus, which is based on bi-directional digital communication, enables the use of various measurement data collected from intelligent field devices. When FOUNDATION Fieldbus was first introduced, the merit for conventional instrumentation systems was that it reduced construction costs by reducing field cables, wiring cost, etc. However, the demand for Condition Based Maintenance (CBM) has increased. To achieve the ideal plant, it is essential to maintain assets in their best condition at the optimum cost. Yokogawa has proposed Asset Excellence (AE) as a solution for sophisticated asset management, and is now rolling out the service (InsightSuiteAE). This paper describes the overall features of InsightSuiteAE.

INTRODUCTION

As international price competition becomes increasingly fierce, high value-added, high-efficiency production is essential for the survival of production plants in the oil refining, chemical and other industries. On the other hand, if plant equipment, which is the foundation of these production industries fails, business opportunities will be lost due to loss of yield, environmental destruction, and weakened financial strength due to social compensation.

Yokogawa offers the Plant Resource Manager (PRM) integrated asset management software package for managing transmitters, control valves, and various plant equipment. Its philosophy is to manage plant equipment in the most sophisticated manner to create the ideal plant (referred to as “VigilantPlant”) by always maintaining the plant equipment, i.e., the basis of production, in the best condition at the optimum cost.

Accordingly, Yokogawa has started offering InsightSuiteAE, a new suite of services for adding even greater value.

These services differ from conventional services based on repairing defective devices and equipment or time-based equipment maintenance. This section outlines InsightSuiteAE.

InsightSuiteAE is a suite of services intended to maximize plant asset value by monitoring every piece of plant-wide equipment (Insight) utilizing a fieldbus, digitizing various metrics (Key Performance Index: KPI) linked to the health of the equipment, and achieving and exceeding reference values (benchmarks) by running a continued Plan-Do-Check-Act (PDCA) cycle.

Example applications of intelligent sensors, control valves and control loops that make the most of the fieldbus’ advantages in a real plant are being prepared. Here, we introduce the overall features of InsightSuiteAE and its core functions.

Figure 1 shows an example of the screens presented by InsightSuiteAE.

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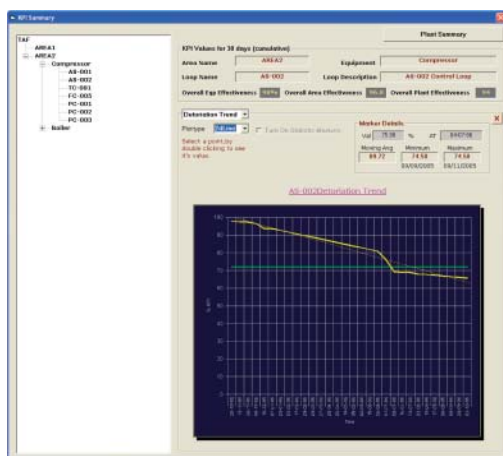


Figure 1 GUI Indicating the Trend of Asset Deterioration

OVERALL EQUIPMENT EFFECTIVENESS IMPROVEMENT MODEL OF InsightSuiteAE

InsightSuiteAE maximizes plant asset value through the three-tiered services shown in Figure 2.

In the tier-1 service, we build a platform for managing devices and equipment, set and measure (digitize) their key performance indexes (KPI), and identify pieces of equipment with measured values below given benchmarks as needing improvement (“bad actors”).

In the tier-2 service, we analyze earlier events, operation logs, and alarms of equipment in need of improvement, identify relevant effect factors, etc., and eliminate possible causes of health degradation (bottlenecks).

In the tier-3 service, we further improve plant and equipment effectiveness (proactive effectiveness improvement) based on an analysis of the present state, including improving benchmarks and visualizing information on equipment that are in a normal

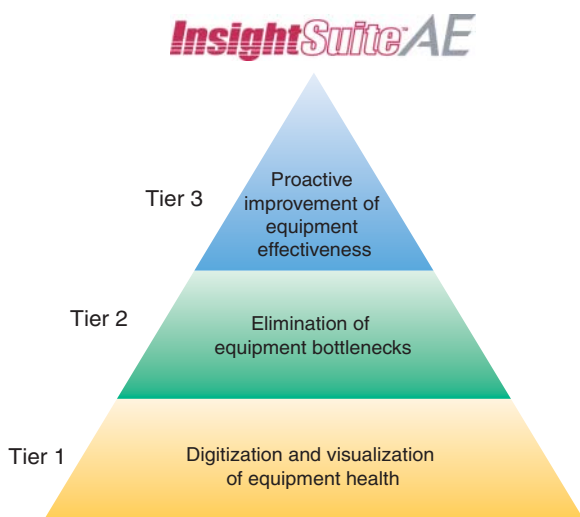


Figure 2 Three-tiered Productivity Improvement Service Model

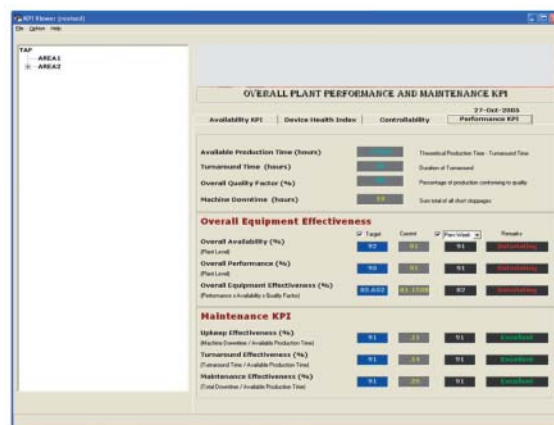


Figure 3 Overall Equipment Effectiveness View

range of performance but are liable to deteriorate drastically.

At higher tiers, Yokogawa collaborates more closely with the user to achieve given objectives by running a continued PDCA cycle.

By implementing 24/7 remote monitoring of equipment using InsightSuiteAE even in such sites as oil wellheads, both attended and unattended, Yokogawa aims to promptly detect abnormal trends in equipment that is difficult to monitor.

Digitization and Visualization of Equipment Health (Tier 1)

In conventional 4–20 mA signal field devices, a single device can measure or control only one process variable. However, the advent of bidirectional fieldbus digital communications enables large quantities of measured data from an intelligent device to be used. It is now possible to remotely know detailed data on the internal condition of devices and data on the environment surrounding them, something that was almost impossible in the past. By applying these types of data, it is now possible to digitize the condition of a device itself, as well as the condition of a peripheral area of a plant.

One index used to gauge the health of equipment is overall plant effectiveness (OPE) or overall equipment effectiveness (OEE), as suggested by the Japan Institute of Plant Maintenance in its Total Productive Maintenance concept (compulsory productive maintenance). The overall equipment effectiveness is defined as “OEE = Availability × Performance × Quality Rate.” InsightSuiteAE maximizes plant asset value by maximizing mainly “Availability” and minimizing associated costs.

With InsightSuiteAE, Yokogawa is focused on measuring environmental stress to assets and digitizing it into a KPI, in addition to generic maintenance KPIs, such as Mean Time Between Failures (MTBF) and Mean Time To Repair (MTTR). On the other hand, Yokogawa considers isolating equipment problems by using operational KPIs since control loop deviations can occur due to device or equipment deterioration.

Methods for visualizing problematic parts of assets as bad actors include using values recommended by vendors and employing industry-by-industry average values or values adopted by each industry’s top-ranking user, as benchmarks. Users can

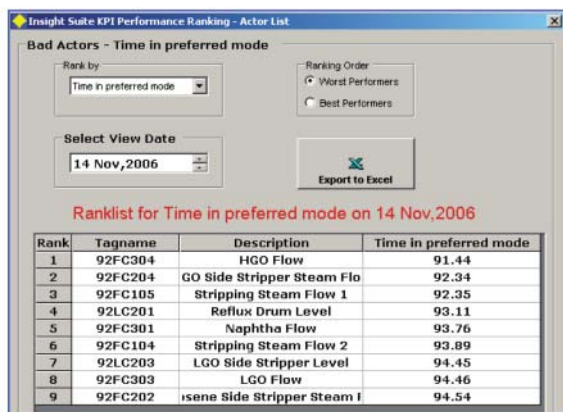


Figure 4 Bad Actor Extraction View

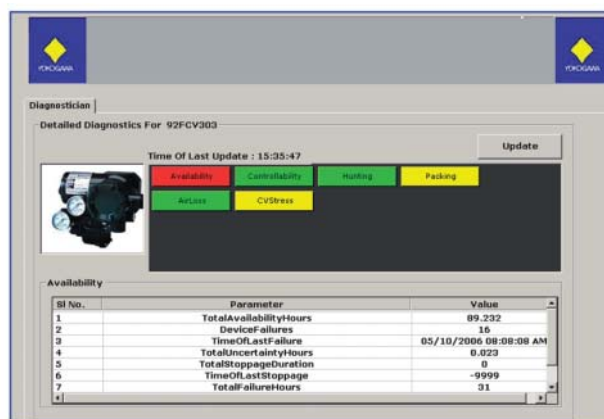


Figure 5 Device/Equipment Health Status View

thus set their targets for the foreseeable future.

A core solution in this tier is the KPI and Asset Health Navigation (AHN) Viewers, which comprise the following three groups of views classified on a subjective basis:

- Overall equipment effectiveness views (Figure 3)
- Bad actor extraction views (Figure 4)
- Device/equipment health status views (Figure 5)

Elimination of Equipment Bottlenecks (Tier 2)

For parts of assets that need improvement identified in tier 1, experts discuss the issues with the user and analyze various

chronological event logs (e.g., work history and inspection history), etc. to identify and eliminate possible root causes (bottlenecks).

Since precise descriptions are required for event logs to be referenced, Yokogawa will make information entry management the norm.

We will apply an algorithm for early device/equipment abnormality detection, clarify the mechanism of abnormality occurrence by comparative analysis of behaviors between normal and abnormal states of process, and make early prediction and notification by applying diagnosis algorithms.

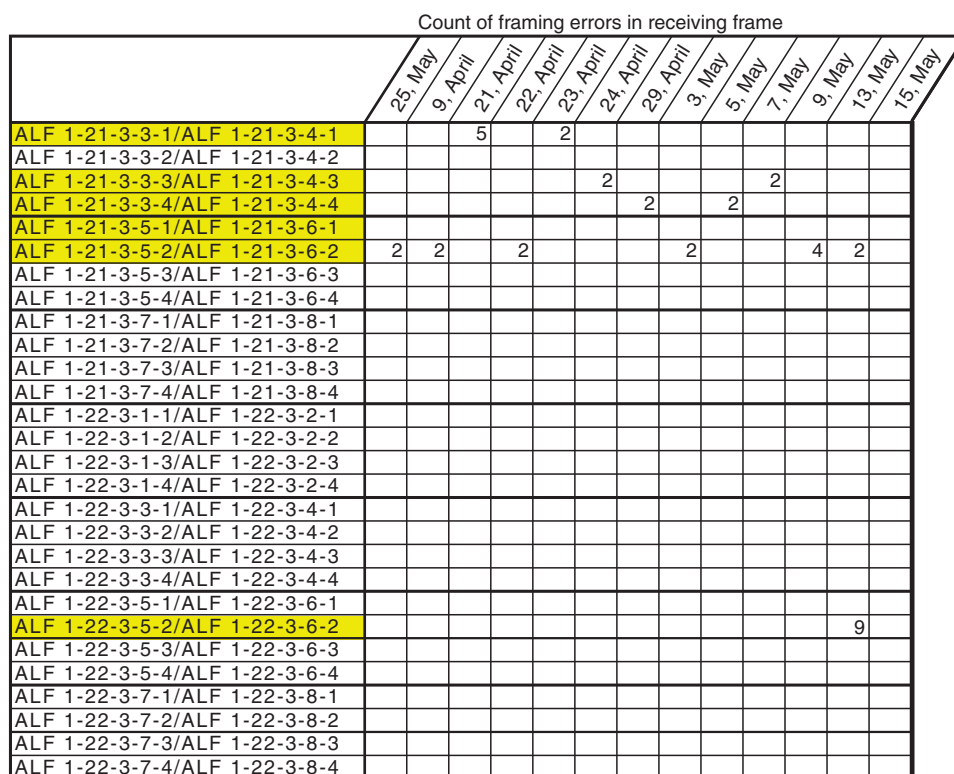


Figure 6 Example of Monitoring FOUNDATION™ Fieldbus H1 Segment Communication Error Trend

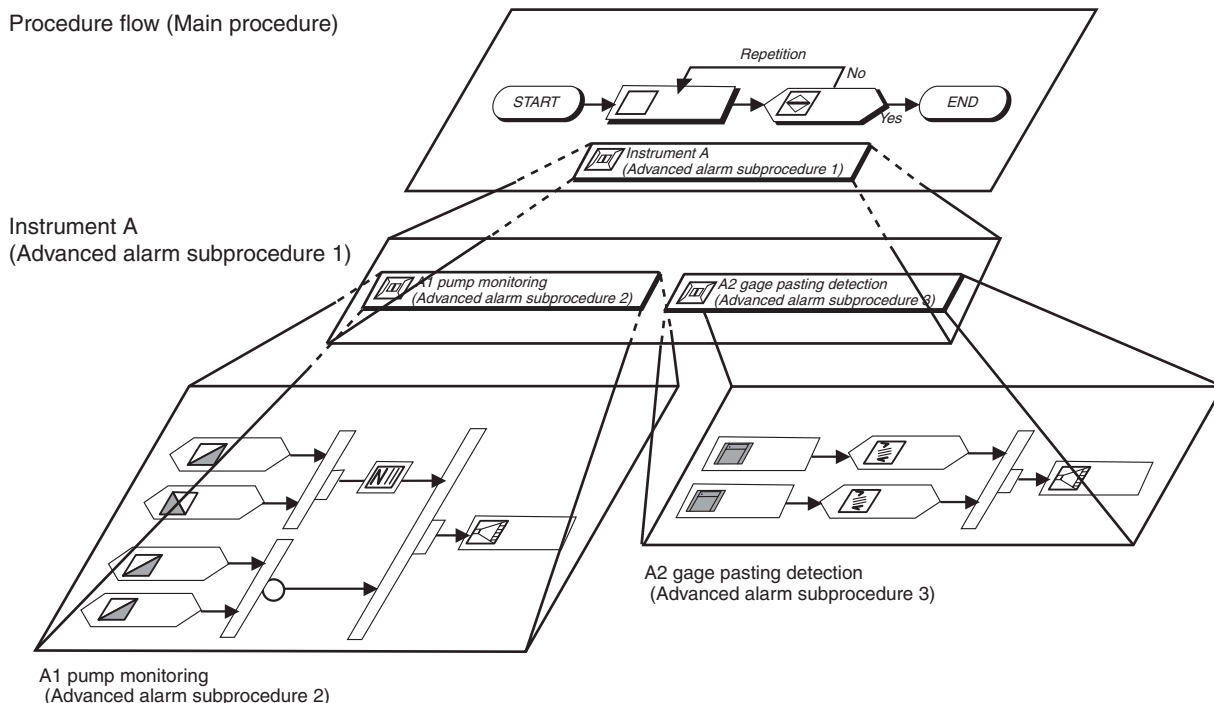


Figure 7 Example of Turning Operation and Maintenance Know-How into Articulate Knowledge Using the “Exapilot” Operation Efficiency Improvement Package

In addition to these health diagnoses, we have set KPIs for detecting abnormalities in devices and equipment within a control loop according to the behavior of the control loop.

Proactive Improvement of Equipment Effectiveness (Tier 3)

In this tier, implicated risks are identified and an improvement such as “increase health” is made, focusing on eliminating such risks.

One of such improvement activities is upgrading benchmarks, monitoring deteriorations in the health of “good actors” rated above benchmarks, and taking measures for improving the health.

This domain deals with improvements closely related to plant operation, including maintenance and improvement of the health of fieldbus communication lines (Figure 6), alarm optimization, controllability improvement, inheritance of operation and maintenance know-how (turning it into articulable knowledge) (Figure 7) and advanced process control (APC).

Needless to say, resources such as personnel and systems for efficiently using equipment (assets) also need to be improved.

CONCLUSION

Yokogawa has set four domains and started providing

solutions, in order to realize the ideal plant (VigilantPlant).

The four domains are: operation (production), equipment (asset), safety, and maintenance of these domains over their life spans (life cycle). The “excellence” initiatives in the respective domains must ultimately be systematically associated with each other.

InsightSuiteAE for realizing plant-wide Asset Excellence will develop into a suite of services in close association with other domains, thereby realizing VigilantPlant. Example applications of InsightSuiteAE to field sensors, regulating valves and control loops in a real plant are now being prepared.

In future, we will aim to broaden and enhance the coverage of InsightSuiteAE to include heat exchangers, rotating equipment, and processes and integrate the services with remote monitoring systems (response centers). We will also utilize useful leading-edge technologies to systematically integrate in-house and out-of-house resources and solutions to provide truly user-centric solutions. ◆

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