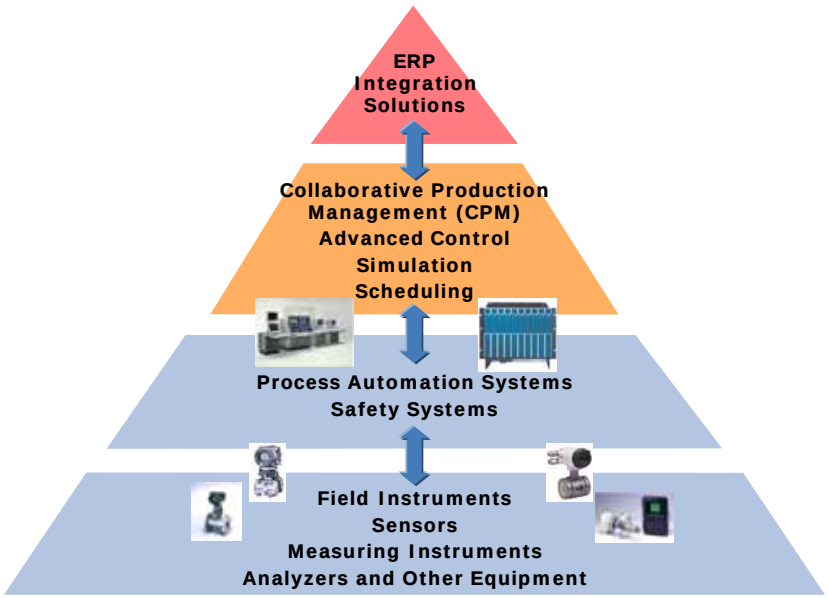
ARC WHITE PAPER

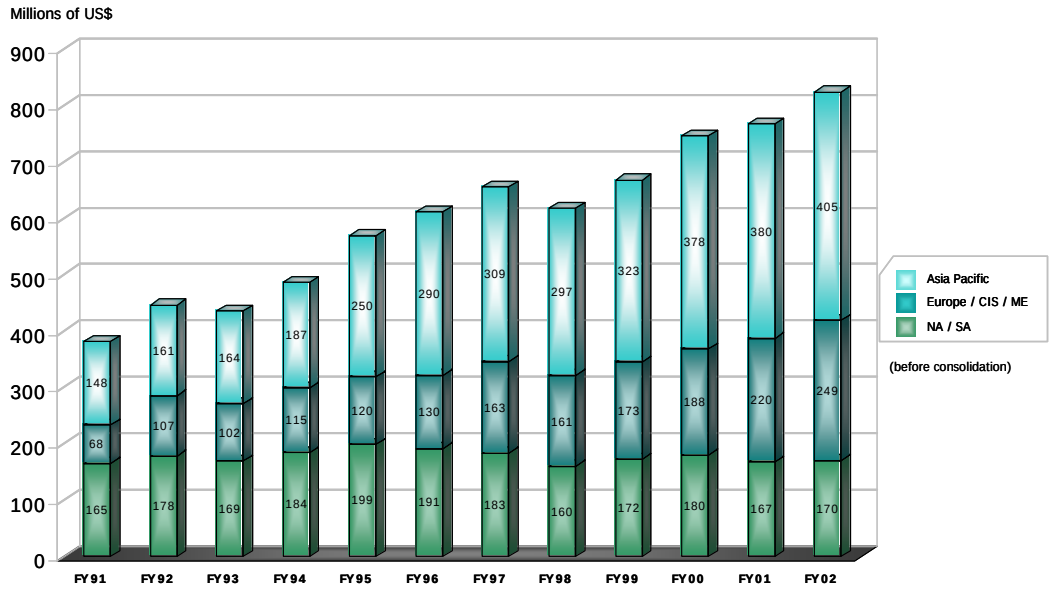
By ARC Advisory Group

OCTOBER 2003

Vigilance: Yokogawa's Roadmap for the Future



Yokogawa Product Scope



Yokogawa's Automation Business Outside of Japan Shows Significant Growth

Executive Overview

Yokogawa is a process automation leader with a strong presence in many markets, such as process automation systems (PASs), field instrumentation, analytical equipment, safety systems, and production management software. Yokogawa is also financially stable and in a much better position for market growth compared to its other Japanese counterparts as well as many other global automation suppliers.

The Vigilance campaign is the first attempt at putting a unified face on the total scope of Yokogawa offerings within a framework of operational excellence and real-time performance management.

While Yokogawa has a comprehensive suite of products and a large installed base of systems, the company is probably one of the quietest and most undermarketed in the automation industry outside of its domestic Japanese market. Lack of marketing prowess has been endemic in the automation business for many years, but as the market becomes more competitive a good, clear message is essential no matter how well your products are manufactured and supported. Yokogawa has embarked on a new campaign that it calls Vigilance, which is designed to increase its brand awareness and communicate its message of reliability and quality to the worldwide market, particularly outside of Japan.

Vigilance is not just a marketing campaign to increase awareness of Yokogawa's products. It is also a way of doing business and a way of bringing together several of the key operating principles at Yokogawa and make them a part of doing everyday business. Vigilance communicates a real value proposition to users in a cohesive way that creates a compelling reason to consider Yokogawa. Yokogawa has given substance to the Vigilance campaign by clearly outlining its value proposition, which is based on the three basic principles of quality, innovation, and foresight. Yokogawa's Vigilance philosophy emphasizes maximizing throughput while minimizing cost as well as providing a clear path for control system migration, evolution, and upgrade.

ARC believes that Yokogawa has the products and services in place that fulfill the Vigilance promise. High availability control systems, safety system offerings, and a focus on plant network security are all excellent ways of addressing the need for security and availability, as well as avoiding unplanned downtime and process upsets. The Vigilance campaign is the first attempt at putting a unified face on the total scope of Yokogawa offerings

within a framework of operational excellence and real-time performance management. Provided that Yokogawa can continue to execute its Vigilance message and articulate its value to the user community, the company should be a successful and formidable competitor in the automation market for many years to come.

Yokogawa's Long Term Commitment to Success in Manufacturing

Consistency has not been a hallmark of most automation suppliers over the past ten years. Industry consolidation and the wave of mergers and acquisitions both large and small have left many users confused about the future of their automation suppliers and platforms. Many process automation suppliers have had to invest millions in order to rationalize the many different automation platforms they have amassed through consolidation and acquisition.

Yokogawa is one automation supplier that has remained consistent over the past several years. The company is a process automation leader with a strong presence in many markets such as process automation systems (PASs), field instruments, Collaborative production management (CPM) software, and safety systems.

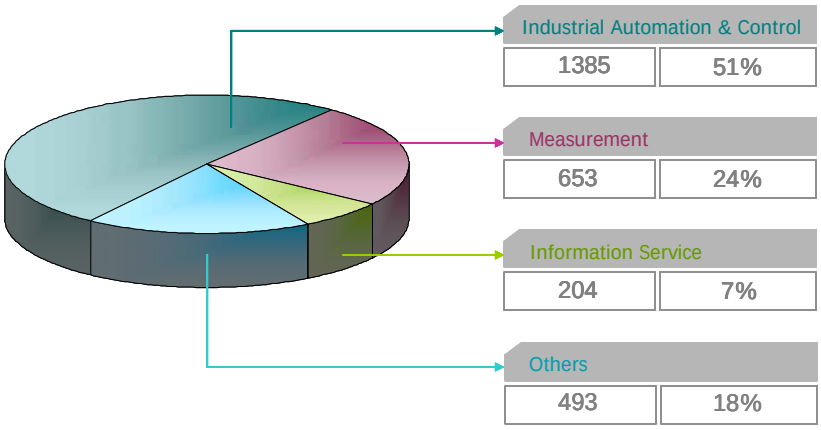
Yokogawa, however, is one automation supplier that has remained consistent over the past decade or more. Despite a challenging period after the Japanese bubble economy burst, the company is back on a growth path and has managed to avoid becoming a victim in the ongoing wave of merger and acquisition activity, while adding some of its own acquisitions to its stable of products.

Yokogawa is a process automation leader with a strong presence in many markets, such as process automation systems (PASs), field instrumentation, analytical equipment, safety systems, and production management software. Yokogawa is the leading PAS and instrument supplier in Japan. Out of all the Japanese process automation suppliers, Yokogawa has established the strongest installed base of systems and instruments outside of Japan, particularly in North America and Europe.

Yokogawa has recently reorganized its automation business into 8 primary business segments: Communications & Measurement; ATE Electrical Test Equipment; Control Products; International; Industrial Solutions; Information Systems; Aerospace; and internal Sourcing & Manufacturing.

Yokogawa's automation related businesses reside in the Control Products; International; and Industrial Solutions divisions. Control Products is home to Yokogawa's field device and sensor business, while the International business is home to all control systems, software, and engineering services outside of Japan. Domestic control system sales in Japan are handled through the Industrial Solutions business.

With the domestic Japanese market still offering little in the way of new opportunities, Yokogawa has focused on expanding their international systems business, so far with considerable success. In ARC's view, no other Japanese supplier has been as successful as Yokogawa at promoting and selling their process automation system outside of Japan, particularly in Europe and North America, with the International systems business rapidly approaching the domestic Japanese business in revenues and far exceeding it in growth.



Yokogawa Revenues by Business Segment for FY 2002 (Percent of US Dollars)

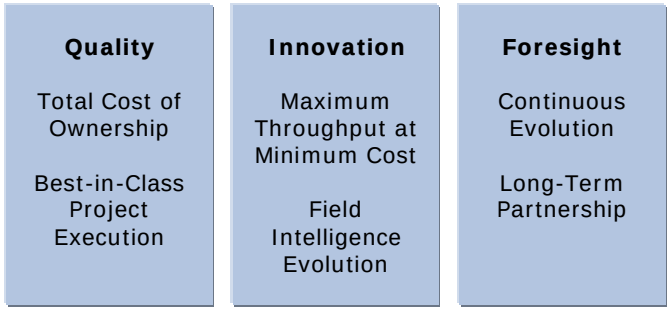
Yokogawa's position as a Japanese supplier gives it some unique advantages in the automation market. Most automation suppliers outside of Japan are not interested in acquiring companies in Japan, making Yokogawa almost acquisition-proof in an industry that has both benefited and suffered from consolidation. Yokogawa itself, meanwhile, has the freedom to make targeted acquisitions where appropriate. Yokogawa has made several acquisitions over the past few years to fill gaps in its product offerings. ARC believes that Yokogawa will continue to make strategic acquisitions and alliances.

Yokogawa is also financially stable and in a much better position for market growth compared to its other Japanese counterparts as well as many other global automation suppliers. Consolidated sales for Yokogawa's business outside of Japan grew by over 7 percent over the past several years. Yokogawa has managed to increase its international business with key clients such as Shell, Schering Plough, Chevron Texaco, Degussa, and Saint-Gobain. One of Yokogawa's key strengths is its loyal customer base. The

company is now making efforts to connect that customer base together through a Yokogawa user community.

Foundations of Yokogawa's Vigilance Philosophy

While Yokogawa has a comprehensive suite of products and a large installed base of systems, the company is probably one of the quietest and most undermarketed in the automation industry outside of its domestic Japanese market. Lack of marketing prowess has been endemic in the automation business for many years, but as the market becomes more competitive a good, clear message is essential no matter how well your products are manufactured and supported. Yokogawa has embarked on a new campaign that it calls Vigilance, which is designed to increase its brand awareness and communicate its message of reliability and quality to the worldwide market, particularly outside of Japan.



Three Central Concepts of the Vigilance Philosophy

Vigilance is especially focused on Yokogawa's product quality and reliability. Yokogawa prides itself on being a perfectionist company with a high level of commitment to making high-quality, "bulletproof" systems and products and providing a high level of service with them. Yokogawa's main problem in this regard, however, has been getting its message across.

Yokogawa has always had a good reputation for reliability and service. The company's primary problem has been one of recognition and visibility. Yokogawa has an extremely loyal customer base and most of its business comes from its existing customers, but there are many users, especially outside of Japan, who have never heard of Yokogawa or are just too unfamiliar with them to consider them.

Articulating a Value Proposition

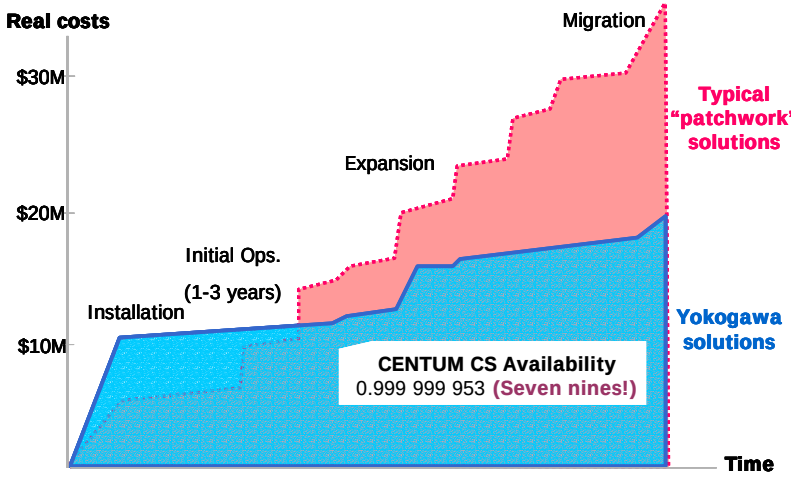
Vigilance is not just a marketing campaign to increase awareness of Yokogawa's products. It is also a way of doing business and a way of bringing together several of the key operating principles at Yokogawa and make them a part of doing everyday business. Vigilance communicates a real value proposition to users in a cohesive way that creates a compelling reason to consider Yokogawa. Yokogawa has given substance to the Vigilance campaign by clearly outlining its value proposition, which is based on the three basic principles of quality, innovation, and foresight.

Quality represents Yokogawa's ability to minimize total cost of ownership for users and the company's ability to provide best-in-class project execution. Innovation represents the company's ability to maximize plant throughput and asset utilization at minimum cost. Foresight provides a secure path for the future in the form of continuous product evolution and long-term partnership.

Vigilance Quality: Reducing TCO and Flawless Project Execution

Vigilance Means TCO Reduction and High Availability

ARC believes that users should look at their automation purchasing decisions from a total cost of ownership perspective. Most users, however, do not have a complete methodology in place for measuring control system lifecycle costs. Most suppliers have some way of measuring aspects of lifecycle cost, but lack a cohesive, holistic picture.



TCO Analysis of Yokogawa Customer Ethylene Refinery

Total cost of ownership is comprised of several factors, including the ability of a system to eliminate production loss and elimination of unplanned downtime. Yokogawa has long specialized in making control systems that are highly reliable and

offer a high degree of redundancy and fault tolerance for use in critical process applications such as refining and petrochemical. This reputation for reliability and robustness has won the company some demanding customers in key process industries such as Shell and Chevron Texaco in oil & gas and refining, Degussa in chemicals, Schering Plough in pharmaceuticals, and Saint Gobain in glass and specialty materials.

The term Vigilance connotes reliability and steadfastness, and the high availability of Yokogawa control systems is a central point behind the vigilance philosophy and value proposition. The CENTUM control system, for example, has an extremely high availability rate of "seven nines", or 0.999 999 953 availability, which greatly reduces the lost opportunity cost associated with unplanned downtime.

MTBF Rates for Yokogawa Field Devices vs. Competitor

This high level of availability is especially valuable if it can be sustained not just through the installation and initial operations phase of a plant, but also through the expansion and migration phases. According to one of Yokogawa's refining customers, the high availability of Yokogawa control systems can translate to ownership costs that are as little as half that of other systems. Many other systems typically have "four nines" availability. While this may not seem like much of a difference, this can translate to over $65 million in lost opportunity over the 12 year lifecycle of an Ethylene refinery and downstream petrochemical complex.

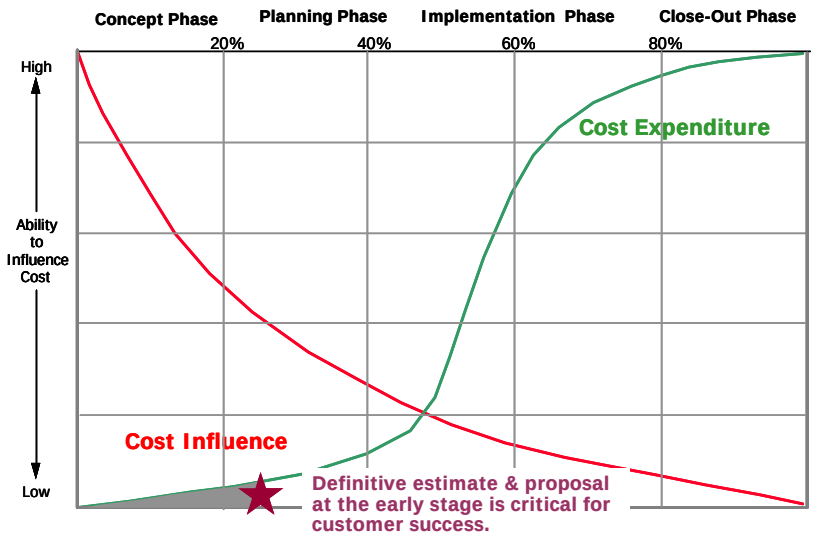
Yokogawa applies the same level of reliability to its field devices as it does to its control systems. Yokogawa's EJA pressure transmitters, for example, have a mean time between failure (MTBF) of 1,249 years. Rates are similarly high for the company's magmeters and vortex flowmeters. This translates into a significant enhancement in performance metrics and a significant savings in replacement costs versus products from other manufacturers that can have higher MTBF.

Yokogawa also offers a high degree of redundancy in its CENTUM systems. Yokogawa makes the distinction between true redundancy and the dual hardware configurations that are offered by many suppliers. Yokogawa's redundancy technology encompasses bumpless CPU switchover within 100

microseconds, duplex hardware, real-time abnormality detection, and hot swapping modules.

Yokogawa's Services Offer Excellence in Project Execution

Yokogawa has always relied heavily on its service capabilities. As a Japanese automation supplier, a high degree of services are expected not only in the project execution phase but also throughout the lifecycle of the system. The ability of the customer to influence project costs diminishes as the project nears its latter phases, but these latter phases are also where the bulk of project costs start to accrue. The ability to have a single point of responsibility in an automation supplier that acts as a primary automation contractor is essential to controlling project costs, especially when it comes to preparing expert proposals that portray a realistic and honest view of project costs so they can be managed effectively.



Adept Project Execution Reduces Increased Cost Expenditure toward the End Phases of a Project Where Customer Cost Influence Is Lowest

Yokogawa certainly has the expertise to provide this level of project execution. The company generates close to $400 million in services from its process automation systems business alone, and has made service-related acquisitions over the past several years. Yokogawa is particularly well-positioned to handle very large turnkey automation projects. In addition to Yokogawa's service capabilities, CENTUM CS 3000 is well suited for control applications ranging up to a million tags per system and 64 stations per domain with full redundant configuration.

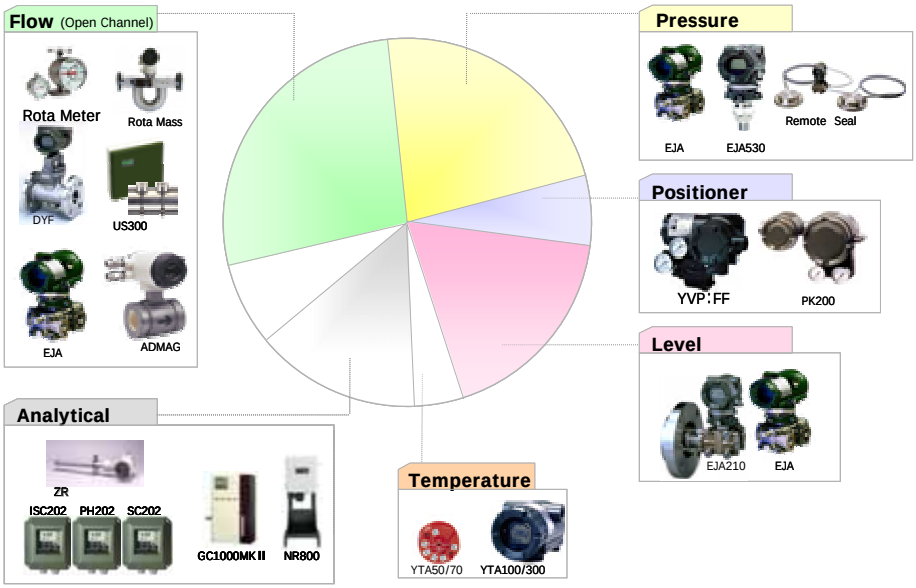
Yokogawa has developed four centers of excellence in the US, Japan, Europe, and Asia to provide increased support and services. Through these centers, Yokogawa provides system integration, design, implementation, installation, and maintenance services. This goes beyond the traditional level of service provided by Yokogawa, particularly in markets such as

North America. Recently, for example, Yokogawa combined the project management skills of its US center of excellence and its representatives in Asia to provide a turnkey FDA validatable solution for a pharmaceutical company that was building a plant in Singapore. Singapore is also the site for advanced process control (APC) and Yokogawa's Global Engineering Center, which coordinates international projects for the refining and petro-chemical industries. The Global Power Center in Australia was formed to respond to increased demand for projects in the power industry.

Yokogawa's goals through the Project Execution aspect of Vigilance are to accurately and clearly define the scope of work to be accomplished; accurately determine the project schedule through completion; identify areas of potential risk and develop migration plans; develop a detailed execution plan; and provide a project environment that encourages team building.

Vigilance Innovation: Maximizing Throughput and Asset Utilization

The innovation aspect of Yokogawa's Vigilance philosophy emphasizes maximizing throughput while minimizing cost as well as providing a clear path for control system migration, evolution, and upgrade. Yokogawa also has a full line of field instrumentation and is a market leader worldwide.

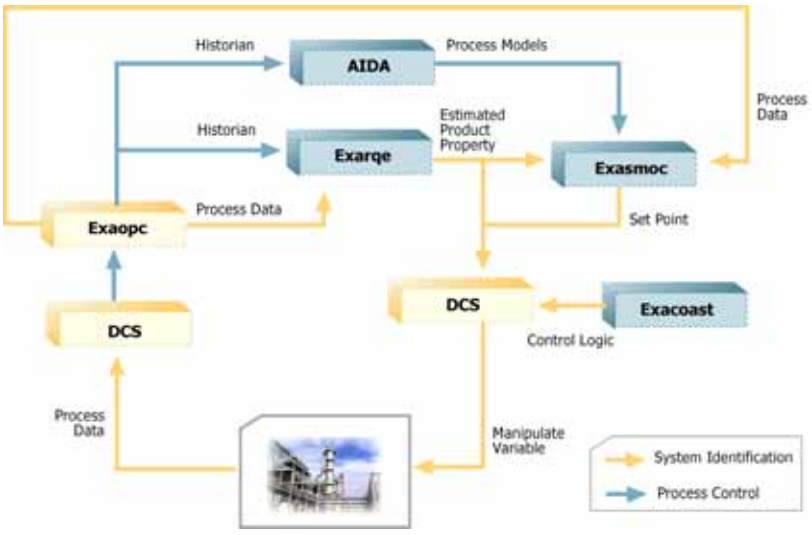


Yokogawa Field Device Offering

The ability to leverage the capabilities of its field instruments with its control systems and software to enhance asset utilization is a key differentiator for Yokogawa and has contributed to its leadership position in Foundation Fieldbus installations. Yokogawa's concept of Vigilance extends to its field device offerings, which offer high availability and durability.

Maximum Throughput at Minimum Cost

Yokogawa's strategic approach to maximum throughput for minimum cost centers around their offerings in advanced manufacturing software. These offerings feature a collection of Yokogawa developed technologies, acquired technologies and strategic relationships that leverage connectivity with Yokogawa's PAS platforms and value added services. The combination allows Yokogawa to provide clients with software and services for process information management, simulation and model-based control, integration with enterprise systems such as SAP, and other advanced applications.



Yokogawa's Advanced Control and Optimization Offerings Functional View

APC, however, has no value unless it reduces cost, increases throughput, and provides return. Yokogawa believes that this cannot be achieved unless the customer can sustain the advantages of APC, which Yokogawa is committed to do through its services organization. Yokogawa's APC deliverables reside on the CENTUM CS and Exa-OPC Server platforms, which provide the data to the advanced control software. APC deliverables include Exasmoc, AIDA, Exarqe, and Exacoast, all of which come from the alliance between Yokogawa and Shell Global Solutions (SGS). Through this alliance, Yokogawa customers can draw on both the internal APC implementation and ongoing service expertise of Yokogawa as well as SGS.

AIDA software is used to estimate a linear dynamic model for a process unit, which is required to implement a Model Predictive Control applica-

tion such as Exasmoc, which itself was jointly developed by Shell and Yokogawa and is designed for use by operators with minimal knowledge of advanced control theory. Exasmoc also has extremely high uptime rates. Exarqe is a soft sensor used to measure oil quality, while Exacoast is a library of control applications that includes functions for pressure compensated temperature, surge volume controller, column tray loading, furnace coil balancing, QMI check, and a signal filter for advanced noise rejection.

The payout period for Exasmoc has been measured in as little as four months with key Yokogawa refining customers. The Aromatics Public Company of Thailand, for example, deployed Exasmoc, Exarqe, ExaOPC, and Exacoast over their CENTUM CS control system and realized a 3 percent increase in feed maximization, higher process stability, and generated an annual benefit of close to US $5 million within a one year project delivery scale.

Field Device Offerings Capitalize on Sensor Technology, Durability, Diagnostics

Yokogawa's field device portfolio includes rotameters, vortex flowmeters, magnetic flowmeters, and ultrasonic flowmeters. Yokogawa also offers a complete line of pressure transmitters, temperature transmitters, and analytical equipment including process electrochemical analyzers, gas chromatographs, and infrared technologies. Yokogawa also has a relationship with Dresser for the joint marketing of intelligent, Foundation Fieldbus-compatible digital valve positioners.

ADMAG AXF™

Yokogawa's New ADMAG AXF Detects Electrode Adhesion and Provides Diagnostic Information

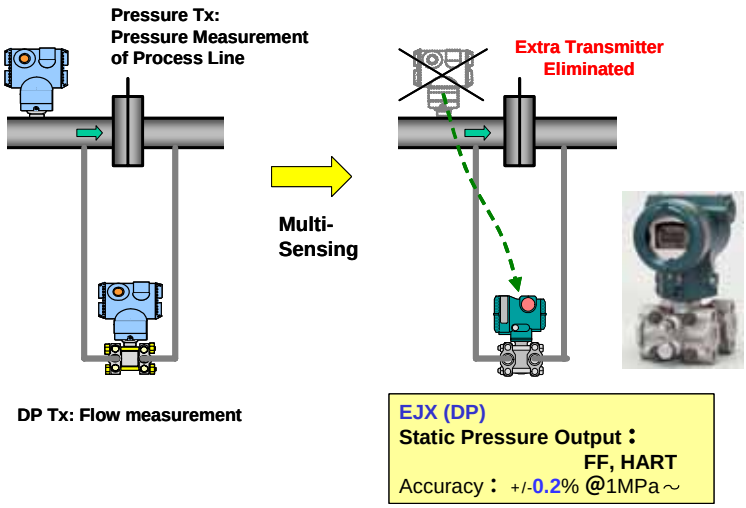
Yokogawa's field device offerings are known for their innovative sensor technologies, durability, and embedded diagnostics capabilities. Yokogawa's pressure transmitters, for example, are based on the DP Harp sensor, which provides a direct digital output from the device through single crystal silicon. This also eliminates hysteresis and drift, and eliminates the need for an A / D converter in the device.

DP Harp also provides extreme stability, with transmitters requiring no maintenance for up to 60 months. Yokogawa ADMAG magnetic flowmeters offer some unique features as well, such as dual frequency excita-

tion, which provides stable measurement in slurry conditions and low conductivity fluids. The ADMAG also comes with a ceramic lining that provides a high level of corrosion resistance.

Field Intelligence Evolution

As part of the Vigilance commitment to continuous evolution, Yokogawa has recently released a number of new field devices that combine innovative sensing technologies with embedded user-friendly functionality. The new sensors embody the company's continued drive toward "maintenance-free device technologies", a combination of high-accuracy stable sensing and advanced diagnostics and maintenance solutions.



New EJX Transmitter Eliminates the Need for Two Transmitters in Static Pressure Measurement Applications

The new ADMAG AXF magnetic flowmeter detects electrode adhesion and provides diagnostic information. Its replaceable electrode makes maintenance work easy and reduces process downtime. The sensor itself incorporates further evolution of Yokogawa's dual frequency excitation technology, pushing the frontier of magmeter applicability to low-conductivity liquids and high concentration slurry applications.

The new EJX digital pressure transmitter incorporates high-accuracy static pressure outputs, enabling users to do without additional pressure transmitters otherwise required to measure static pressure in various DP applications. Its compact body weighs only 2.7 kg, making it easy to stock, hand-carry, and install. The EJX family will also include a multivariable transmitter that enables mass flow measurement. For its sensing core, EJX incorporates Yokogawa's DP Harp sensor technology. Reference Class accuracy reaches 0.025% of Upper Range Limits.

Yokogawa also continues to invest in advanced diagnostics technologies that go beyond simple device diagnostics. Most recently, the company introduced flow checking for fluctuation and vibration in its DYF vortex flowmeters as well as abnormal flow detection. The company will intro-

duce impulse line blocking diagnostics and steam trace diagnostics in its EJA / EJX pressure transmitters in Q1 of 2004.

Yokogawa also plans on embedding orifice wear diagnostics into its pressure transmitters in the near future. Combined with the company's focus on its Plant Resource Manager (PRM) software PAM application, Yokogawa is committed to providing predictive and remote maintenance that helps users leverage the benefits of emerging fieldbus technologies.

SecurePlant Initiative Addresses Plant Security Issues

Security is a major concern for manufacturers today, especially with ubiquitous Internet connectivity and the large amount of commercial-off-the-shelf (COTS) components being incorporated into today's automation products and systems. Today, Yokogawa is one of the few automation suppliers that have launched an initiative to address the issues of both physical security and cyber security in the plant environment.

In the system design and construction phase, Yokogawa actively designs and constructs security measures using products that incorporate the latest security

Yokogawa's SecurePlant initiative is a comprehensive set of networked system security measures that address every phase of production system security from the planning stage to implementation of specific security measures. SecurePlant is currently available to customers in Japan, but the initiative will expand to include the rest of Yokogawa's operations. SecurePlant incorporates administrative security measures, such as security policy development support. SecurePlant also provides system design and construction services and 24x7x365 remote monitoring capabilities.

SecurePlant consulting services include risk analysis, security policy development support, and training. In the risk analysis phase, Yokogawa will research and clarify the risks the customers' systems are exposed to and the potential impact on operations. Yokogawa then proposes security measures. Working from the risk analysis, Yokogawa then provides support in developing security policy, and provides training for all personnel working on the networked production system with a focus on security. Yokogawa also provides security scanning services using their own software tools to identify vulnerabilities in the system.

In the system design and construction phase, Yokogawa actively designs and constructs security measures using products that incorporate the latest

security technology. In the remote monitoring phase, Yokogawa will install its Intrusion Detection System (IDS) in the customer's system. Yokogawa consultants will also propose appropriate countermeasures if there is a security breach.

Vigilance Foresight: Continuous Evolution and Collaborative Partnerships

The Vigilance concept of Foresight means that Yokogawa is committed to its customers for the long run and will continue to incorporate new technologies into their system as they evolve. Yokogawa continuously makes new enhancements to its control systems to address current user needs.

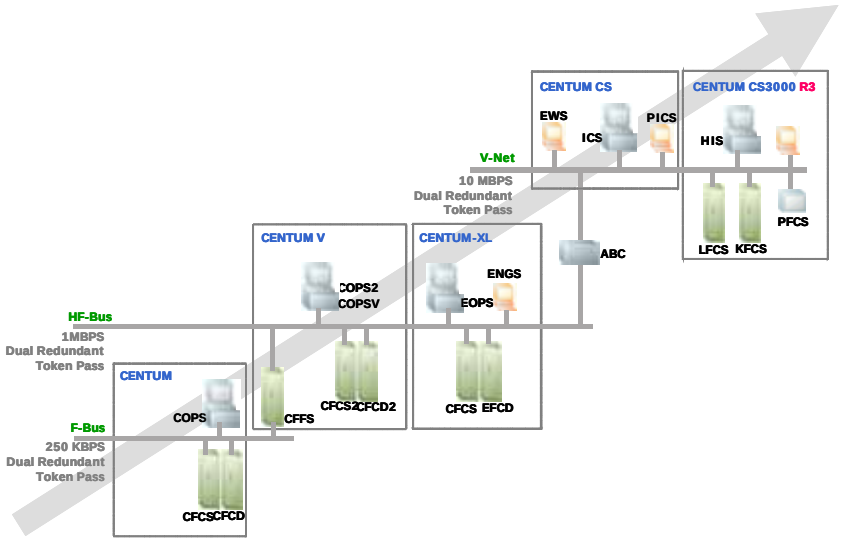
Continuous Evolution

As part of its evolutionary pathway, Yokogawa is assisting users in achieving 21 CFR Part 11 compliance through improved documentation. Yokogawa is focusing on providing clear audit trails and electronic documentation as well as electronic signatures to ease the compliance process. The new version of CS 3000 R3 includes an Audit Trail Server that provides extensive capabilities in the area of electronic documentation to help users meet FDA compliance requirements. The new package includes an engineering/configuration audit trail and an operation audit trail.

CENTUM CS 3000 R3 Highlights

Windows 2000 & Windows XP HMI
Fieldnetwork IO (FIO)
High Speed Ethernet-Based Remote Fieldnetwork
Redundant Foundation Fieldbus H1 Card
Integrated Foundation Fieldbus-H1 Engineering with PRM
Advanced Process Control Station APCS
FDA 21 CFR11 Compliance
Highly Scaleable up to 1 Million Tags
Migration Path from Centum V and Centum XL
FFCS Compact Field Control Station

As proof of their commitment to continuous evolution, Yokogawa has recently released a compact field control station (FFCS) for the CENTUM CS 3000 platform. This compact controller brings together their field network I/O node with their pair and spare CPU redundancy technology. With this new controller added to the CS 3000 family, users can ensure the same high level of reliability in small, single-node systems and field-distributed applications while securing scalability for future expansion of up to one million tags.



CENTUM Control System Migration Path Preserves Legacy Investments

Providing a Clear Migration and Upgrade Path

Control system migration is a primary issue among many automation users today. Few new plants are being built, and capital expenditures continue to shrink. With the increased focus on return on assets (ROA) and Operational Excellence (OpX), users must find ways to effectively migrate from one generation of control system to the next, whether it is from the installed supplier or a competitor. Suppliers are offering an increasingly varied range of migration options for users to choose from, and users must develop a migration strategy that supports their business requirements.

With so many older systems installed and so many new ones emerging, control system migration strategies are becoming important considerations for enabling increased plant performance and the adoption of new automation strategies. Migration is a critical step in the overall control system lifecycle, but it does not eliminate the need for due diligence and following a process automation selection best practice. Due to the relative maturity of their domestic markets, both customers and suppliers in Europe and Japan are traditionally more conscious about migration strategies.

Yokogawa has one of the longest continuous process control system identities in the industry with their CENTUM line. With an installed base stretching back to the mid ‘70s, they have a legitimate claim to be one of the first true DCSs on the market. Over the years they have offered various versions of CENTUM. The current CENTUM CS 3000 and 1000 systems

were introduced several years ago with a clear migration from older CENTUM systems such as CENTUM XL and Micro XL.

Today Yokogawa is focused on continuing the high reliability strategy of the CENTUM line that is popular with their heavy process industry customers such as refining, pulp and paper, and chemical industries. Yokogawa also offers migration paths from competitive systems that allow users to migrate to Yokogawa systems at less cost than through conventional point to point wiring schemes. Yokogawa offers flexible competitive systems migration strategies on a project-by-project basis. With their CENTUM system, Yokogawa approaches competitive situations from a high reliability point of view. They can also point to a large installed base of current CENTUM users.

Hardware	
Systems Revision	CENTUM CS3000 R3.04
New Components	New Field Network Controller (FFCS), OPC-based Field Gateway Station (GSGW)
Software	
Batch/PIMS	Exaquantum Batch
SOE	Sequence of Events Manager
Asset Management	PRM Upgrade

Impending Yokogawa Deliverables

The newest version of CENTUM CS 3000 – Revision 3 –is a major upgrade over the R2 version, and integrates advances in the information technology framework with the rapidly evolving needs of the modern manufacturing environment. Key features of CENTUM CS 3000 include Windows XP HMI, Fieldnetwork I/O, native Foundation Fieldbus (FF) functionality, and a series of advanced functions such as embedded advanced control and Plant Resource Manager (PRM). The R3 is also backward compatible with older CENTUM versions and is easily upgraded in phases or replaced with minimal investment.

Yokogawa's New FFCS

Yokogawa's new CENTUM CS 3000 R3 field network I/O incorporates an Extended Serial Backboard (ESB) Bus with a speed of 128 MBPS. CENTUM CS 3000 R3 also incorporates a high-speed Ethernet-based control network. At the fieldbus level, CS 3000 R3 incorporates a fully redundant, four-port Foundation Fieldbus H1 I/O card.

It is the advanced features of CS 3000 R3, however, that provide the true value added functionality. The first of these is integrated Foundation Fieldbus engineering with Yokogawa's Plant Resource Manager (PRM) software. PRM is Yokogawa's plant asset management (PAM) solution. In

ARC's view, providing integrated PAM functionality is a key part of any effective Foundation Fieldbus Solution. CS 3000 R3 also includes also a new control platform called Advanced Process Control Station (APCS). Exasmoc multivariable control software has been embedded in the CS 3000 control architecture.

Collaborative Partnerships – NAM GLT Project

Yokogawa has always strived to create collaborative partnerships and today the company is more dedicated than ever to ensuring that it will retain its existing customers and form lasting relationships with new customers. ARC feels that developing collaborative partnerships with customers is necessary for the long-term survival of any automation supplier. A key driver in the spread of collaborative partnerships to wider range of industries is not just the increased solutions capabilities of automation suppliers, but more importantly, the increased productivity these suppliers can offer through advanced control, optimization, and enterprise production management software and services.

In conjunction with the company's strategy to expand its business outside of its core domestic Japanese market, Yokogawa has formed several key collaborative partnerships with end users in Europe, North America, and other parts of Asia.

In conjunction with the company's strategy to expand its business outside of its core domestic Japanese market, Yokogawa has formed several key collaborative partnerships with end users in Europe, North America, and other parts of Asia. One key European client that exemplifies Yokogawa's long-term commitment to collaborative partnerships is the relationship with oil & gas company NAM in the Netherlands. Yokogawa started its relationship with NAM in 1995 when the company planned on undergoing the first of a long series of modernization projects.

Yokogawa was chosen as the Main Automation Contractor (MAC) for the project, which means that Yokogawa would handle the coordination of all automation-related phases of the modernization project, including working with other suppliers and systems integrators. For the first phase of the project, Yokogawa was in charge of over 20 different companies as the MAC. In the case of NAM, Yokogawa served not only as the PAS supplier, but also as the field instrument, safety system, Yokogawa's Plant resource Management application, Exaquantum PIMS system, commissioning and startup services, and maintenance activities for all instrument systems.

NAM's oil & gas modernization projects involved the creation of remote, unmanned, and geographically distributed clusters that can be started, stopped, and controlled from a central station. The project involves 15 very large clusters with a maximum production capacity of 25 million cubic meters of gas per day, as well as 14 standard size clusters with a capacity of 15 million cubic meters per day.

EJA digital pressure transmitters and YTA temperature transmitters.
Rotamass mass flow meters.
CENTUM DCS (Including Network Design Engineering).
Prosafe safety management system.
Plant Resource Management (PRM) system.
From cluster 5 AMS will be replaced by Yokogawa's PRM System
Exaquantum (PIMS) including OPC Station.
Buy-out Items (Including System Integration).
Commissioning & Start-up.

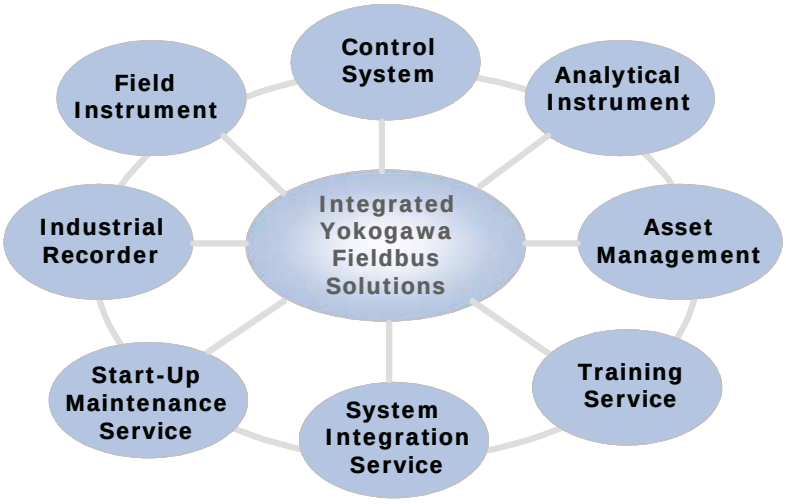
Yokogawa Scope of Supply for NAM GLT Project

The average number of tags per cluster is around 25,000. The modernization of the first cluster was completed in 1998 and the modernization of the remaining 29 clusters is continuing. Primary selection criteria for NAM included the high availability of Yokogawa control systems as well as minimum total cost of ownership.

Yokogawa Fieldbus Capabilities

Yokogawa Is a Leader in Large-Scale Fieldbus Project Implementation

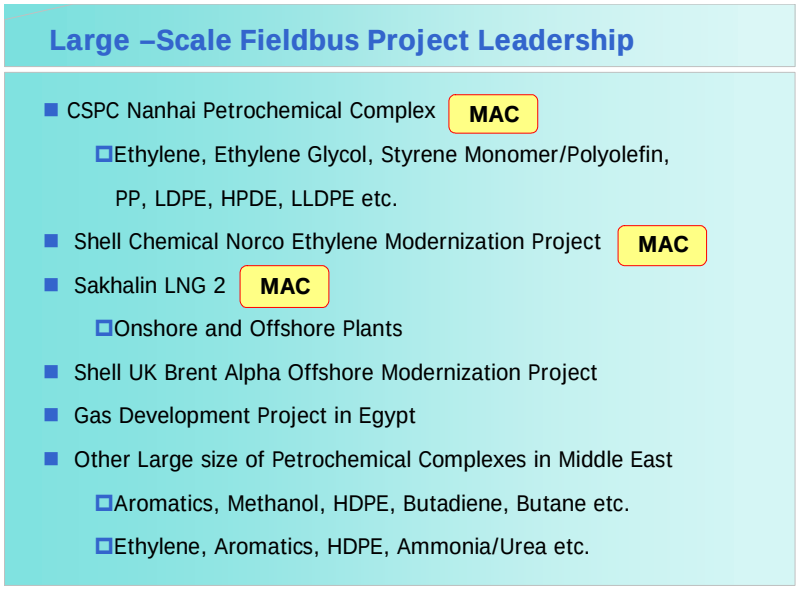
Yokogawa is a founding member of the Fieldbus Foundation and was one of the first suppliers to achieve the Fieldbus Foundation "check mark" on its instrumentation for interoperability and conformance to the Foundation Fieldbus standard. Yokogawa was also one of the first suppliers to receive Host Interoperability Support Testing (HIST) certification from the FF. Today, the company has a full line of Foundation Fieldbus-compatible instrumentation, including pressure and temperature transmitters, valve positioners, flowmeters, and liquid analyzers. In addition to connectivity at the system level and HIST certification, Yokogawa offers a suite of plant asset management (PAM) applications and engineering tools for use with Foundation Fieldbus.



Yokogawa Offers Complete Fieldbus Solutions

Yokogawa has already taken part in or are in the process of installing large FF-based systems around the world. Major Foundation Fieldbus projects recently awarded to Yokogawa include Sakhalin Energy Company and Shell Chemical NORCO. The real showcase Foundation Fieldbus project for Yokogawa, however, is the recent order for a new petrochemical complex that is a joint venture between Shell and the Chinese National Offshore Oil Corporation (CNOOC). The new petrochemical complex will be built in the Daya Bay Economic Development zone in the Municipality of Huizhou, China, and will include an 800kt/year Ethylene, a 240kt/year Ethylene Glycol (EG), a 560kt/year Styrene Monomer/Propylene Oxide (SMPO) and other related plants. The complex is scheduled to start operations in December 2005.

Yokogawa has been hired in the capacity of Main Automation Contractor (MAC) for this project, and is working closely with the Shell Petrochemicals Company Limited (CSPC) and the Project Management Contractor BSF (Bechtel, Sinopec Engineering, Inc. and Foster-Wheeler) in the basic design phase to unify the design philosophy and architecture for the control and information management systems. The project will use Foundation Fieldbus technology exclusively, including on-line device diagnostics and real-time, fully integrated plant operation data. This is one of the world's largest Foundation Fieldbus implementations to date.

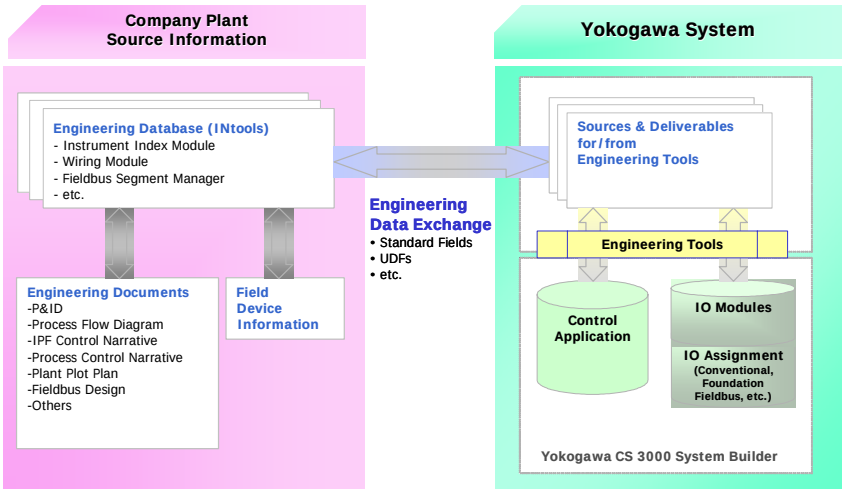


Advanced Engineering Tools Are Key Fieldbus Value-Add

Yokogawa's capabilities as an MAC are a good compliment to its fieldbus product capabilities, and ARC believes that good project management and a supplier partner with experience in fieldbus implementation are crucial for fieldbus project execution success. Perhaps just as important as experience and solutions capabilities, however, are the breadth and functionality that the primary automation brings to the table in the form of engineering tools. These include tools for engineering design, training, checkout, and factory acceptance testing (FAT).

One of the most value-added tools that Yokogawa offers for Foundation Fieldbus is its Intools interface. ARC believes that Intools from Intergraph is becoming a de facto standard for instrumentation databases. When it comes to instrumentation, the creation of a single engineering and design database for all instrumentation-related information is a key element in achieving operational excellence (OpX).

Since instrumentation is both an asset and a key indicator of other plant assets' behavior, it is perhaps the single most important component within the engineering and design database. Integration of Yokogawa fieldbus-based systems with Intools provides a path for the creation of a consistent instrumentation database to be used throughout the plant lifecycle.



Yokogawa Engineering Tool for Intools Interface Enables Creation of a Consistent Engineering Database

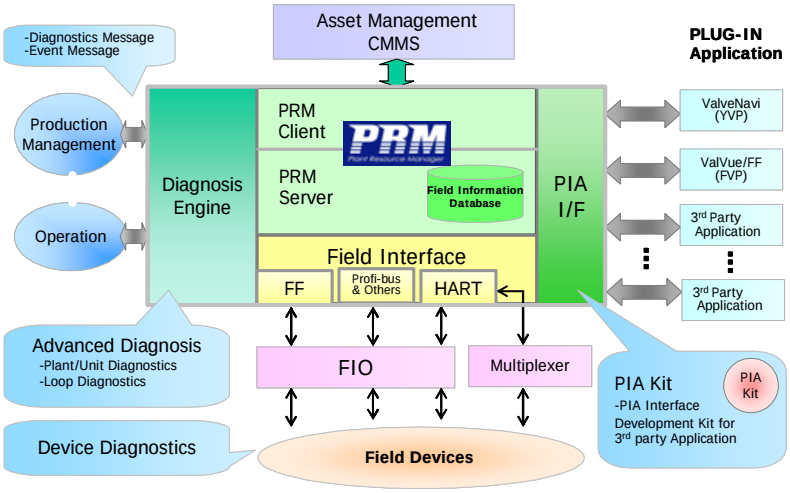
Vigilance Taps into PAM as Path to RPM

A clear Plant Asset Management (PAM) strategy is a critical component of any Real-Time Performance Management (RPM) model, because PAM systems bridge the gap between the transactional nature of business systems and the real-time nature of automation control systems. In ARC's view, the self-validation and diagnostics capabilities in instruments are becoming more crucial to achieving RPM than the physical design of the instrument itself. Yokogawa is making strides in the area with the release of its Plant Resource Manager (PRM) software PAM application. Yokogawa's PRM offering extends the Vigilance concept by offering increased field level reliability.

Unscheduled downtime is the largest single factor eroding plant performance. As an example, over $20 Billion, or almost 5 percent of total production, is lost each year in North America alone due to unscheduled downtime. More than one-third of this loss is attributable to equipment failure; a figure that can be cut drastically by developing an RPM solution that incorporates a clear, proactive PAM business strategy.

Best-in-class PAM systems include field devices with the intelligence to assess their own status and utilize a digital protocol to communicate data that can be accessed from anywhere in the world via web-enabled software. Individually these components are of little value. The combination makes a

powerful tool that will enable manufacturers to minimize operating costs and at the same time optimize plant performance.

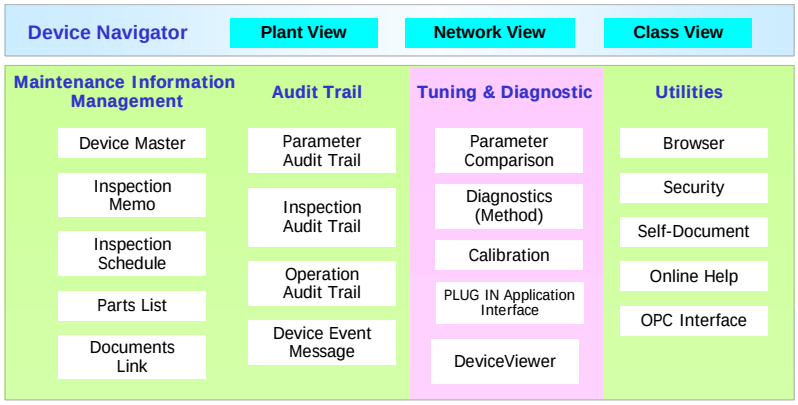


Yokogawa PRM Logical View

Yokogawa delivers on the promise of a PAM system with self-diagnosing intelligent field device connectivity through PRM, which has the ability to provide predictive and remote maintenance. PRM connects to intelligent field devices that are compatible with the HART or Foundation Fieldbus H1 protocols. There is also an interface for conventional I/O from CENTUM control systems. PRM provides alarming functions to the CENTUM system and connects to CMMS applications such as PSDI Maximo. PRM also supports valve set up and diagnosis packages from third parties such as ValveLink from Emerson and Valve Viewer from Metso Automation.

PRM's diagnosis engine is at the heart of the solution, and interfaces with the operations domain of the control system and the collaborative production management domain, which ARC sees as being inherently bonded to the overall Collaborative Process Automation System (CPAS) architecture. This is where the diagnosis messaging and event recording takes place for field device and control valve health and predictive maintenance.

PRM device navigation includes plant views, device views, and class views. PRM provides maintenance information management functions such as inspection memos, inspection schedules, parts lists, and document links. It also houses the audit trail functions such as parameter, inspection, and operation audit trails as well as device event messages. PRM also supports tuning & diagnostic and utilities functions such as parameter comparison, calibration, self documentation, and online help.



PRM Functional View

ARC's model of Real-Time Performance Management dictates that the real-time data sources from the manufacturing process must be integrated with the transactional domain of the enterprise to create a measure of true plant performance. PRM essentially serves as a conduit of information to both the real time domain of the CPAS and the transactional domain of CMMS. Yokogawa PRM fulfills this requirement by integrating with PSDI's Maximo CMMS application.

Yokogawa Vigilance Strengths and Challenges

With the Vigilance campaign, Yokogawa is communicating their longstanding message of extreme reliability, security, and focus on reducing total cost of ownership in a unified manner. Yokogawa has long been known as a "quiet" company, and many of its potential customers are unaware of the many initiatives that are taking place at the company to fulfill the Vigilance vision.

We believe that Yokogawa's renewed focus on communicating its message, particularly to markets outside of Japan, is a necessary step in the right direction. As with any new attempt to bring a message to customers, however, Yokogawa itself must remain vigilant and ensure that its message remains consistent and articulates a compelling value proposition to its customers.

Vigilance Strengths	Vigilance Challenges
Close Customer Relationships	Develop Stronger Executive Level Sales Force
High Availability Systems	Grow International Business
Strong Advanced Control Solutions	Continue to Evolve CENTUM and STAR-DOM PAS System Architectures
Strong Production Management Solutions	Build Worldwide Market Presence in Production Management
Strong Safety System Offering	Continue to Integrate Safety System Functionality with PAS
Full Line of Highly Reliable Instruments	Continue to Build Advanced Diagnostics and Intelligence into Instruments
Fieldbus Solutions Expertise	Continue to Build Compelling Value Proposition for Fieldbus Implementation
Ability to Coordinate, Manage & Execute Large Projects	Enhance Project Management Capabilities as Customer Base Grows
Advanced PAM Solution	Continue to Focus on Implementation of RPM Solutions
SecurePlant Network Security Initiative	Continue to Build Security into Automation Infrastructure
Focus on Reduced Total Cost of Ownership	

Yokogawa Vigilance Strengths and Challenges

One of Yokogawa's key strengths is its long-term commitment to its customers. ARC believes that customer/supplier relationships should become more collaborative and long-term for users to get any real value out of them, and this has been part of Yokogawa's philosophy from the beginning. As Yokogawa continues to expand outside of its traditional served markets, however, it will also need to invest in more resources to support a growing customer base and create relationships with new customers that will foster collaboration and long-term partnerships. Yokogawa is already headed in this direction with the creation of a new user group that will foster communication between Yokogawa and its customers.

Of course, to build a strong user community, more customers are needed. In order to successfully sell to automation users today, suppliers need both a strong presence in the field as well as a good executive level sales force. While Yokogawa has traditionally been strong selling at the executive level in Japan, its presence at the executive level in other geographic markets

needs to be strengthened, and Yokogawa is presently in the process of developing this international C-level sales force.

ARC believes that Yokogawa has the products and services in place that fulfill the Vigilance promise. High availability control systems, safety system offerings, and a focus on plant network security are all excellent ways of addressing the need for security and availability, as well as avoiding unplanned downtime and process upsets. Yokogawa is also investing heavily in new technologies that enable Real-Time Performance Management (RPM) through its initiatives in Foundation Fieldbus, Plant Asset Management (PAM), and Collaborative Production Management (CPM). All of these elements are essential aspects of ARC's vision for a Collaborative Process Automation System.

Of course, the success of all of these initiatives within Yokogawa depends largely on the success of the company's ability to communicate its value to its existing and potential customers. ARC has always believed that Yokogawa offers a good value proposition to users and that the company has a solid foundation of technology that is continuously evolving, but many of the technological "gems" under the Yokogawa umbrella have gone unnoticed because of lack of communication and messaging.

The Vigilance campaign is the first attempt at putting a unified face on the total scope of Yokogawa offerings within a framework of operational excellence and real-time performance management. Provided that Yokogawa can continue to execute its Vigilance message and articulate its value to the user community, the company should be a successful and formidable competitor in the automation market for many years to come.

Analyst: Larry O'Brien
Editor: Dick Hill

Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/Community/terms/terms.htm

AI	Artificial Intelligence
ANSI	American National Standards Institute
API	Application Program Interface
APS	Advanced Planning & Scheduling
B2B	Business-to-Business
BPR	Business Process Reengineering
CAGR	Compound Annual Growth Rate
CAN	Controller Area Network
CMM	Collaborative Manufacturing Management
CNC	Computer Numeric Control
CPG	Consumer Packaged Goods
CPM	Collaborative Production Management
CRM	Customer Relationship Management
EAI	Enterprise Application Integration
EAM	Enterprise Asset Management
ERP	Enterprise Resource Planning
HMI	Human Machine Interface
IT	Information Technology
LAN	Local Area Network
MIS	Management Information System
MRP	Materials Resource Planning
MSPC	Multivariate Statistical Process Control
OLE	Object Linking & Embedding
OPC	OLE for Process Control
PAS	Process Automation System
PLC	Programmable Logic Controller
ROA	Return on Assets
ROI	Return on Investment
SCE	Supply Chain Execution
TMS	Transportation Management System
WAH	Web Application Hosting
WMS	Warehouse Management System

Founded in 1986, ARC Advisory Group is the leader in providing strategic planning and technology assessment services to leading manufacturing companies, utilities, and global logistics providers, as well as to software and solution suppliers worldwide. From Global 1000 companies to small start-up firms, ARC provides the strategic knowledge needed to succeed in today's technology driven economy.

You can take advantage of ARC's extensive ongoing research plus experience of our staff members through our Advisory Services. ARC's Advisory Services are specifically designed for executives responsible for developing strategies and directions for their organizations. For subscription information, please call, fax, or write to:

ARC Advisory Group, Three Allied Drive, Dedham, MA 02026 USA
Tel: 781-471-1000, Fax: 781-471-1100, Email: info@ARCweb.com
Visit our web page at ARCweb.com

3 ALLIED DRIVE DEDHAM MA 02026 USA