ABB Industrial IT Provides the Business Value Proposition for Automation

Executive Overview ................................................................. 3
The Business Value of Industrial IT ............................................ 4
Reducing Cost of Ownership from Engineering through Operations .. 9
Improving Productivity across the Enterprise, Not Just the Plant.... 17
A Lifecycle Approach to Reducing Risk & Improving Safety .......... 22
Industrial IT Strengths & Challenges ....................................... 29
ABB Translates Products and Solutions to Real Business Value Proposition through IndustrialIT

ARC’s CPAS Vision Calls for a Common Actionable Context for Information, Which is Supported by IndustrialIT
Executive Overview

ABB introduced Industrial IT in 2000. The goal of Industrial IT was to expand the role of industrial automation beyond that of a traditional DCS system by integrating the domain of traditional process control with the domain of IT technologies and applications. This combination of industrial focus and IT infrastructure would deliver a unified information system for control, engineering, maintenance, planning and more. This architecture would allow ABB to deliver an information platform, which could serve the entire lifecycle of an automation project, from design to startup and operations. This platform could integrate all of the applications necessary to optimize the performance of a running manufacturing plant, from control to asset management, process optimization, safety, and integration with business planning systems. Most importantly, the Industrial IT platform would provide contextual access to these applications -- the right information to the right people at the right time.

The purpose of this white paper is to show the bottom line economic impact and improved business performance that can be obtained through implementation of Industrial IT solutions. Automation end users today are increasingly making purchase decisions based on a business value proposition. New technology alone is no longer a sufficient justification for automation purchases. Even things like lower total cost of ownership are not enough. End users are developing comprehensive automation strategic plans that will provide them with standardization, optimum total cost of ownership, reduced maintenance costs, and many other metrics, both from a business and manufacturing standpoint.

The successful enterprise of the future will incorporate an automation environment that facilitates the execution of its overall manufacturing strategy to support the complete operational and lifecycle needs of the manufacturing process. ABB’s Industrial IT solutions provide this type of an environment. The company is also aware of the fact that this environment does not begin and end solely with automation or its own offerings.

This white paper will look at three specific aspects of Industrial IT’s value proposition:
• Improved plant performance and productivity
• Reduced total cost of ownership
• Reduced risk and improved safety

There are many facets to each of these areas. Reduced total cost of ownership, for example, can include elements such as integrated front-end engineering tools, reducing maintenance costs through the implementation of plant asset management (PAM) solutions, and providing an evolution roadmap for the installed base. Key examples of ABB products and services that enable these specific aspects of business value will be included. Several end user case studies are provided as examples of real world bottom line economic benefits.

The Business Value of Industrial IT

End users are finding it increasingly difficult to justify automation purchases. Technology alone is no longer sufficient to justify automation. Instead, automation must provide solid business value benefits based on a combination of metrics, such as enhanced asset availability, return on assets, reduced lifecycle cost, and many other strategic and financial objectives. ABB’s goal with Industrial IT is to provide this value proposition with an open technology platform that provides seamless access to data from all areas of the plant and the enterprise.

Industrial IT solutions deliver measurable increases in productivity that include and extend beyond plant automation. Industrial IT is ABB’s solution for collaborative process automation. Within this context, Industrial IT integrates System 800xA with other ABB and 3rd party products to support the complete operational and lifecycle needs of the customers’ manufacturing processes.
At the core of all Industrial IT solutions is the System 800xA Extended Automation control system. Extending the core of System 800xA hardware and applications are ABB and third party products that have been tested and certified (Industrial IT Enabled) to verify proper operation with an 800xA system.

A powerful object-oriented technology called Aspect Objects underlies all of the Industrial IT offerings and resides at the core of System 800xA. Put simply, Aspect Objects allow users to view any aspect of the automation scheme, from a pump or a valve to a process unit or pressure transmitter, as a software object. Each object in the system has a number of attached aspects that can include startup checklists, alarm and event lists, Standard Operating Procedures, faceplates, schematic drawings and trending information. Aspect Objects provides the key real-time linkage between equipment and applications.

**System 800xA Hardware and Software Support ARC’s Collaborative Automation System Vision**

A key aspect of ARC’s vision for Collaborative Process Automation Systems (CPAS) includes a single, unified environment for the presentation of information to the operator, as well as the ability to present information in context, to the right people at the right time from any point within the system. System 800xA provides these functions, with a single window environment for information access and context sensitive decision and action tools, and builds on a common environment for engineering, operations, information management, and asset optimization. System 800xA also provides a common operator environment for ABB’s entire portfolio of safety and process control systems, providing access to information across the enterprise as well as context sensitive decision and action tools that allow the right users access to the right information at the right time from any point within the system.
System 800xA Extensions Go Beyond Core Control Functions

Distributed Control Systems (DCSs) evolved into Process Automation Systems (PAS) by the inclusion of additional functionality beyond basic control. The evolution of PAS into the CPAS will add even more capability. In the next phase of their evolution, process automation systems will be considered the sentinel of plant performance. They will continue to facilitate process control but will also become the primary source of manufacturing data and information for Collaborative Production Management (CPM) applications all within a robust environment.

Similarly, a key strength of System 800xA is its ability to extend its reach beyond the traditional functions of the DCS to include functions such as production management, safety and critical control, advanced control, information management, smart instrumentation, smart drives and motor control centers, asset management, and documentation management capabilities.

ABB and Third Party Certified Products

ARC believes that one of the primary functions of CPAS will be to support a mixed supplier environment. Interoperability, however, continues to be a concern for suppliers that want to offer an open system environment where users can seamlessly plug in third party products and applications. ABB’s Technology Partnership Program provides the framework for the integration and certification of third party products. These products fall into three categories: intelligent devices, connectivity packages (for controllers), and software applications. Each product type integration is fully tested in the System 800xA test system to validate that the integration performs as designed and documented, meets the interface requirements, and does not affect the performance of System 800xA. The certification is an assurance to users that the integration packages perform as documented and deliver significant business value as part of an Industrial IT solution.
Under the Industrial IT umbrella, ABB and third party certified products provide customers with a means to implement a continuous improvement strategy that reduces cost and improves profitability and productivity. For example, integrated front end engineering tools deliver lower total cost of ownership through streamlined workflows, Alarm Management solutions reduce risk of operator error and integrated CMMS systems improved productivity and plant availability by reducing mean time to repair (MTTR).

**Business Value Proposition of CPAS Meshes Well With Industrial IT**

The three core areas where Industrial IT provides business value are reduced total costs of ownership, increased productivity, and enhanced safety through reducing risk and providing a high level of security. These three core value propositions mesh well with the key concepts behind ARC’s CPAS vision.

**Reduced Total Cost of Ownership and Enhanced Asset Utilization**

The value proposition of an automation system rests in its ability to provide enhanced asset utilization and reduced total cost of ownership (TCO). Companies are in business to make money through adding value. The amount of profit resulting from this endeavor is directly related to the asset utilization rate. In a recent ARC survey conducted with 107 operations and management personnel, 86 percent from the process and hybrid industries, we saw a definite shift toward making return on assets (ROA) the primary criteria in justifying process automation.

ABB offers a path to reduced TCO through reduced engineering and design costs through things like integrated front end engineering tools, standardized workflow processes around the ISA 95 standard and standard ERP/CMMS connectors. Capital deployment is reduced through a planned evolution path for installed systems and use of Overall Equipment Effectiveness (OEE) tools. Maintenance costs can be reduced through integration of operations and maintenance data, integration of control systems with ERP systems, and embedding operator knowledge about maintenance into the process auto-
mation system. Daily operating expenses can be reduced by offering contextual data access, reducing cycle times, and consolidating multiple data sources.

**Increased Productivity Not Just About Cutting Costs**

From another perspective, the Chemical Manufacturer Association estimates the average chemical company is improving their productivity 3 percent per year on a compound basis. The winners will exceed this benchmark and it will not be a result of cutting costs. Collaborative process automation and a continuous improvement plan utilizing performance feedback and the benefits associated with automation are the keys to automation’s contribution to increasing manufacturing productivity, not the latest and the greatest technology. As part of an overall program of workflow and process improvements, Industrial IT solutions and tools can significantly improve plant reliability and availability, and thus the bottom line.

- **Oil Refining:**
  - **Current Downtime: 1 – 8 %**

- **Petrochemical:**
  - **Current Downtime: 2 – 5 %**

- **Food & Beverage, and Pharmaceutical:**
  - **Current Downtime: 1 – 10 %**

According to an ARC Survey on the Value Enabled by Automation, Downtime Still Represents a Significant Percent of Production Lost

Industrial IT enables increased productivity by facilitating predictive and preventative maintenance strategies that maximize uptime. ABB’s ability to integrate the planning and production process maximizes uptime, while decreasing ERP transaction costs. ABB can also provide performance analysis capabilities that allow users to identify areas for improvement. Providing information in context reduces information overload and improves operator reaction time.

**Increased Safety & Security Has Direct Impact on Profitability**

Unscheduled downtime – unexpected stoppages resulting from equipment failure, operator error, or nuisance trips - is the nemesis of all manufacturers. Providing a path toward better safety and security also means providing a path toward increased reliability. Implementation of a critical condition management (CCM) strategy, for example, provides significant economic benefits to manufacturers. Typical gain from advanced process optimization in a large continuous process such as an oil refinery or a pet-
rochemical plant averages 3 percent, whereas a CCM application can add 5 percent or more to profits by detecting and avoiding critical conditions before they occur, thus reducing the need for emergency shutdowns. CCM can also significantly reduce the number of unplanned shutdowns and boost asset utilization.

Implementation of an integrated control and safety system, such as the integrated critical control capabilities of ABB’s System 800xA High Integrity, allows users to significantly reduce risk and realize the benefits of CCM. Aside from the safety aspect, ABB reduces risk by providing a single point of responsibility through its Main Automation Contractor (MAC) capabilities. On the software side, ABB has embedded functionality such as secure design practices, patch programs, audit trails, and advanced access control.

**Reducing Cost of Ownership from Engineering through Operations**

Over the past decade, primary end users concerns and purchasing criteria have shifted from technology and cost oriented issues to more straightforward economic issues. With a growing and constantly aging installed base of automation systems in the marketplace today, a fundamental issue for end users is prolonging the life of existing assets and providing optimal asset utilization at all times. Of course, this all results in reduced total cost of asset ownership and improved productivity.

Industrial IT solutions reduce the total cost of asset ownership through unique approaches from the engineering and design phase of the plant through operations, workflow processes, and maintenance. The company augments this approach with a sound strategy for evolution of its installed base and a unique approach to enhancing asset utilization using such key performance indicators as Overall Equipment Effectiveness (OEE).
Reducing Engineering and Design Cost through an ISA 95 Based Approach to Production Management and Interoperability

Any manufacturing operation consists of a series of work processes that should be standardized, streamlined, and optimized. Integrating the plant floor with the rest of the business has been a struggle for some time. Fortunately, the ISA 95 standard can lead to cost effective interoperability when used to define implementation standards that leverage existing and new technologies.

The ISA-95 specifications standardize terminology, concepts, and models for integrating manufacturing operations functions with enterprise functions. The integration focus is on the connection of production scheduling processes, which are spread over both enterprise level products and production level products. Of course, the detailed production plans, status, and reporting that are passed back to the enterprise applications are also included. Each manufacturer typically has multiple production management applications from different suppliers, making integration complex and expensive to implement and maintain. The ISA-95 specifications are intended to reduce the cost by encouraging commonality in terms and models across software supplier products and end user reference architectures.

ABB has embedded ISA 95 functionality into its suite of production management and enterprise connectivity applications in a very effective manner. ABB’s 800xA Batch Management software, for example, allows users to access production management functions from the Batch Overview window. This window provides a summary of all the batches in the current production queue. The Batch Schedule dialog is used to add batches to the real-time production schedule or queue, in an efficient and user-friendly way. Functions available from the Batch Schedule dialog include:
• Select recipe procedure
• Schedule an individual batch or a campaign of multiple batches
• Duplicate a previously run batch
• Automatically generate a batch ID, or manual entry
• Optionally enter Lot & Campaign ID’s
• Optionally enter scheduled start time
• Enter batch specific parameter values

All of these scheduling commands, as well as runtime status feedback, are available via a web-service interface to third party applications.

**ABB’s Industrial IT Enterprise Connectivity solution Provides SAP Connectivity and ISA 95-Based Approach to Enterprise Integration**

Built on System 800xA and based on ISA 95 and other standards, ABB’s Industrial IT Enterprise Connectivity solution provides an OPC-based method for connecting real-time systems with transaction based ERP systems. It takes a product-oriented approach to integration of enterprise and automation systems.

The Enterprise Connectivity solution is interesting in several ways. First, it provides a comprehensive approach to enterprise integration with automation systems. A user can take the product out of the box and configure a system in a reasonable amount of time, without the need for custom engineering and programming. It also provides a method for implementing ISA 95 by importing data from both the control system and enterprise system. Once the data is available within System 800xA as an object, it can be displayed in the operator environment, it can have business logic applied to it, or it can be used in one of the System 800xA core functional areas (such as Batch Management, Information Management, or Production Management).
The solution is ABB’s standard for SAP connectivity. It provides configuration based connectivity to any SAP module (such as PM or PP/PI). It can also be used to interact with any SAP business object as described above. The value of the Enterprise Connectivity approach is that it takes a significant portion of the customization out of enterprise level integration, while at the same time providing a common environment for the implementation of ISA 95 within an object-based structure.

**Reducing Cost of Ownership through Planned Evolution**

Evolution of control system architectures is a burgeoning concern for end users. While the threat of downtime can be a major factor in the decision to enhance or expand an installed system, the evolution process itself can also cause interruption in process operations.

The market for process control systems has changed. Most PASs used to be sold for new installations in heavy process industries like refining, petrochemicals, power, and pulp & paper. Today, reduced capital spending, a more competitive global marketplace, and more focus on getting more out of existing assets means that most systems sold are for upgrading applications.

ABB has successfully risen to the huge challenge of evolving the largest and most diverse installed base to a common automation platform and architecture while maintaining a high degree of backwards compatibility. After ABB acquired Elsag Bailey, the big question was how ABB would deal with their many different control system platforms. ABB has always been committed to supporting its customers and having its evolution roadmap firmly rooted in the Industrial IT vision of a common architecture, applications, and control hardware platforms enables not only lifecycle support of the installed system but an evolution path for adding the latest functionality.

**ARC Recommendations for Selecting a Control System Evolution Partner**

- Openness of the system for your specific needs
- Ability to preserve existing assets that still offer value
- Avoid replacing hardware assets that add no value
- Effective database & control strategy conversion
- Level of control functionality replacement should be equal to or greater than existing system
- Effective graphics conversion
- Accommodation of advanced applications
- Offer solutions for existing customized integration such as installed gateways
- Offers effective training solutions
- Offers solid path for the future
- Can provide references
Evolution is ABB’s way to add ongoing value to their installed systems. ABB’s approach is to allow customers to make incremental changes to their system that allow them to reduce risk, lower cost, and meet their business objectives. Customers made major investments when they purchased their automation systems. Throughout its history, ABB has enabled customers to extend the useful life of their control system investment and protect their investments in hardware, software, and intellectual property.

ABB offers evolution paths from its current control system installed base through its common HMI, Information Management, Asset Optimization software, as well as controllers, and I/O subsystems. In addition to its products, ABB has a global services group that works with customers to plan and execute evolution programs according to the customer’s needs and schedule. ABB works closely with customers to use their investments as a foundation to extend the functionality of their system continuously as new capabilities become available. New technology is introduced in a way that allows stepwise incorporation into previous versions.

**Increasing Asset Availability & Plant Performance through Reliability Integrated Solutions**

Any discussion of achieving operational excellence (OpX) in plants would be incomplete without discussing the mechanisms that are used to measure plant performance. Asset availability and asset utilization are two of the most important issues facing users. Underperforming assets contribute to unplanned shutdowns, decreased productivity, higher maintenance costs, and a host of other issues that can cost a plant or enterprise millions in lost profits. Users are increasingly concerned about achieving maximum asset availability from their large installed
base of legacy assets. To control and improve the performance of installed assets is impossible, however, without an effective means of measuring the performance of these assets.

ABB’s Reliability Integrated Solutions (RIS) business provides end users with performance-based approach to maintenance that mitigates risks and consequences such as unplanned downtime and plant incidents. RIS fosters collaboration between production, maintenance, and engineering through interoperable solutions and benchmarking techniques. The goal is implementation of a site-based strategy for optimum maintenance practices that focuses on the areas of health, safety, environment, quality, reliability, productivity, and operational requirements.

ABB offers a toolset as part of the solution that combines asset information from the company’s plant asset management applications (PAM), Dynamic Overall Equipment Effectiveness (OEE), maintenance planning and scheduling and CMMS applications, inventory data, and alarm and alert information. The company combines this application expertise with services such as ABB Full Service contracts, its own World Class Reliability benchmark assessments, Total Plant Reliability Implementation, Reliability and Maintenance outsourcing, and education and training.

RIS zeroes in on the financial impact that maintenance has on the manufacturing enterprise and business performance. Things like unscheduled maintenance and maintenance overtime can be a real productivity drain. Most companies do not operate at a world-class level when it comes to these metrics (most operate well below these levels). Some companies estimate that as much as 63 percent of maintenance labor results in no action, and the money spent on unnecessary maintenance can equal the size of plant’s entire profit.

Source: Shell Global Solutions

According to Shell Global Solutions, Most Maintenance Labor Results in no Action!!
ABB’s approach is unique in that it addresses industry segments across the board – from oil and gas to automotive and electronics production, which includes remote diagnostic centers with expertise for targeted industries. The company takes a consultative approach that ideally begins with the front-end engineering and design process and integrates design data with operational data and maintenance data. This is in line with ARC’s Design, Operate, and Maintain (DOM) concept for plant performance management. ABB has a large database of benchmarking information collected from hundreds of customers, allowing end users to measure themselves against “world class” performance measurements. The company’s “Integrate to Mitigate” approach to Dynamic OEE is gaining ground in both process and discrete industries, and ABB can effectively illustrate to customers how even a small change in OEE can have a big impact on plant profitability.

**Overall Equipment Effectiveness**

The measurement of Overall Equipment Effectiveness (OEE) is an important tool for identifying and removing the primary causes of lost time in production operations and maximizing asset availability. OEE breaks production performance into three key factors (Yield, Rate, and Utilization) and provides a formula that captures their aggregate effect. OEE derives its power from the fact that it is based upon factors that everyone understands and can use to guide improvement efforts. There is little question of the value of OEE for driving improvement of production operations. While OEE has primarily been a measurement that been applied to discrete manufacturing, ARC believes it has underutilized value in process manufacturing as well. Even a small change in OEE for a plant can have far-reaching implications for plant overall plant performance and profitability.

ABB’s RIS solution analyzes and reports the Overall Equipment Effectiveness (OEE) in real time to better understand production line shortcomings, thus implying measures aiming to increase productivity. ABB’s OEE solution is the KPI for implementing the TPM strategy. When OEE indicates poor performance, RCA is utilized to determine what the problem is and where it is located so that the corrective action can be taken.
Pfizer Animal Health Achieves Operational Excellence through Real-TPI

Pfizer Animal Health in Louvain-la-Neuve, Belgium decided to invest in the ABB Optimize IT Real-TPI software to follow the efficiency of one of its packaging line. Pfizer Animal Health is one of the major players in the business of animal vaccines, and has around 2400 employees in Belgium.

Pfizer Animal Health was already following the OEE of this packaging line using a rudimentary OEE reporting tool. This system was slow and was not adequate for long-term data logging but it was able to show that there was a need to follow OEE closely and accurately. Pfizer decided that it was time to use a complete and scalable OEE follow-up tool and Real-TPI was chosen to fulfil this mission.

The ABB team implemented this state-of-the-art system. Real-TPI retrieves production data from a central PLC that gathers signals from each machine through a Profibus network. Operators are allowed to justify production events on each machine via Touch Panels that are also linked to the Profibus. Real-TPI also exchanges also information with Pfizer’s ERP system (MAPS) in order retrieve product and batch data. The packaging line is also equipped with a display that shows the operators the current batch, product and the expiry date.

Managers, maintenance foremen and production team leaders have access to online production data and history from their desktop. Detailed Pareto and Chronogram graphics allow the equipment manager, to quickly and easily identify efficiency increase opportunities. He can then take actions that lead to problem reduction and/or eradication. The system also reports on production, batches, set ups, and changeovers. Real-TPI provides information that allows Pfizer to enhance the productivity of the whole packaging process and does not just focus on the equipment.
Improving Productivity across the Enterprise, Not Just the Plant

In most cases, manufacturing assets are capable of performing to design specifications. Reliability & utilization, however, are suffering from constrained human performance. According to ARC, over $20B or almost 5 percent of production in the process industries is lost to unscheduled downtime. Up to 78 percent of that is readily preventable. Forty percent is a result of human error, primarily operator error. This can be addressed by using both the operator and the automation more effectively.

The biggest change in plant performance improvement for the 21st century and a key vehicle for reducing this unplanned downtime will come from the empowerment of the knowledge worker. Operators of the future will play a pivotal role in operations decision making. Manufacturing will undergo fundamental organizational changes because of operators becoming knowledge workers empowered with information. This proliferation of information is causing organizational structures to flatten, pushing down the authority and responsibility associated with the distribution of information. A higher level of coordination at lower levels is also required.

ABB’s Industrial IT solutions enable knowledge workers in several key ways, but probably the most important factors include providing information in context and providing a unified platform for plant and asset maintenance management that also automates the transactions between the automation system and computerized maintenance management systems (CMMS), also known as Enterprise Asset Management (EAM) platforms.
Information Provided in Context Empowers the Knowledge Workforce

Information empowerment leads to internal synchronization and supportiveness. Supportiveness simply refers to each employee’s accurate understanding of their responsibility in the context of the big picture and ability to understand their contribution in the context of the success of the overall enterprise. Information empowerment should elevate the role of the operator and significantly change his future contribution. The CPAS needs to support the operator in this new role, and therefore information empowerment is a fundamental CPAS Issue. In order to achieve information empowerment, information must be provided in context. In other words, the right information gets to the right people when they need it, regardless of where that information resides in the system.

Industrial IT provides information empowerment and provides information in context by providing a unified framework, which includes Process data from ABB and third party controllers, OPC servers, and intelligent instrumentation and fieldbus networks including Foundation Fieldbus, Profibus, and HART. ABB is also unique in its ability to integrate information from drives and motor control centers.

Information is also provided from engineering tools, batch management systems, production management systems, and asset optimization systems. All of these applications are managed in System 800xA Operations allowing contextual views of objects in the system that are only relevant to the user that needs them. Maintenance personnel, for example, only see the relevant maintenance data that they need to see, but they have an expanded view of this data from multiple sources throughout the plant.

ABB does not create one single data model, or object model, to represent the real world object in the system. Instead, one object is modeled at a time. This means that the model object serves as a container of references to different aspects in the system that contains the data (or aspects). Each aspect in turn is implemented by the various software systems that store, manage, and present information in a way that is optimized for the user.
software systems are referred to as aspect systems, and the result is a system of integrated yet independent software systems.

The System 800xA Operations environment also provides a high degree of familiarity to any operator knowledgeable with Windows operating systems. A common environment also significantly reduces training time and reduces the likelihood of operator error. The interface has the same basic look on every screen in the plant, so engineering, maintenance, and operations all have consistent views.

**Improving Productivity through an Integrated Approach to Maintenance**

Implementation of predictive and preventative maintenance strategies is a key component of reducing unplanned downtime. According to the CPAS vision, anything in the manufacturing process that can be automated should be automated. This includes not just basic automation of the sensor/actuator type, but automation of work processes, including maintenance.

Maintenance is one of the most significant and untapped areas of cost savings in plants today, and also one of the most overlooked. According to DuPont, for example, maintenance is the largest single controllable expenditure in the plant, with maintenance budgets accounting for around two-thirds of annual net profit. According to Dow, the cost of unnecessary maintenance is about the same size as the total plant profit. Shell Global Solutions estimates that about 63 percent of maintenance labor results in no action at all.

In most enterprises today, tight, real-time coordination between the control system and maintenance system is seldom achieved. These systems have been designed to support different functional environments with very different objectives and constraints. One of the issues that inhibits free interchange between these functional areas is their different naming conventions. An asset often has one name in the operations environment
ABB’s Reliability Integrated Dashboard also provides business level information and KPIs about the real time performance of the plant.

and another in the maintenance environment. This is because these systems have vastly different focuses, purposes, and needs that their naming conventions must satisfy.

ABB’s approach to plant maintenance is to provide an environment where information is transparently accessible to users in both the process control system and the maintenance system environments, regardless of where the information has originated. This is consistent with ARC’s view that information should be provided in context, so the maintenance personnel have access to all the information they need when they need it, regardless of its source or location.

ABB’s Reliability Integrated Solution provides complete asset optimization of automation devices, plant infrastructure, plant equipment, and production processes. Features such as asset condition monitoring and reporting enable proactive implementation of corrective measures. Integrating the CMMS system with the real-time domain of CPAS also optimizes the maintenance cycle.

By linking assets as represented or controlled by System 800xA with the representations of these assets in the CMMS system, it is possible to provide System 800xA users with access to maintenance-specific information such as active work orders, work order history, maintenance schedule, and spare parts availability. Users can use the graphical views of System 800xA to navigate items and access them directly from the CMMS system without explicitly needing to log on.

ABB’s Reliability Integrated Dashboard also provides business level information and KPIs about the real time performance of the plant. Incorporating this type of information into the daily activities of operators, production managers, and maintenance engineers brings a new level of visibility into plant performance. It is this type of visibility that enables both sustained and increased performance over time.

**ABB Streamlines Plant Maintenance at Botany Complex**

Six plants owned by three separate companies (Orica, Huntsman Corporation, and Qenos) share one of Australia’s largest chemical and industrial sites -- the Botany complex. These plants produce chemicals and specialty surfactants, including raw materials for the automobile, mining, agricu-
tural, plastics, and rubber industries. The plant owners all shared similar concerns over plant downtime, safety, health, and the environment, and eventually joined forces to streamline and upgrade their maintenance operations.

ABB was chosen to direct this effort for many reasons, especially the company’s experience in change management, ability to handle health and environmental problems, and commitment and expertise in safety. Before ABB’s involvement with the Botany complex, each plant was responsible for its own maintenance. Forty independent contractors oversaw a staff of 200, generated reams of incompatible reports and invoices, with a budget of over US$10 million annually.

ABB’s task was to improve overall performance and safety, identify weaknesses, standardize on strengths, cut downtime, and cut costs. This began with a review of mechanical and electrical maintenance, shutdowns, and capital works at all six plants. ABB’s review encompassed equipment reliability and the effectiveness of reporting procedures, working methods, and organizational structure. The company audited the maintenance organization and its systems to identify their financial and environmental impact. Recommendations were made and implemented that changed the entire maintenance culture.

The maintenance organization was pared down to one main contractor overseeing seven subcontractors, with a combined staff of 140. As standardization took hold, costs were significantly reduced, with maintenance costs falling 20 percent in the first year. No industrial actions have occurred on site since ABB’s arrival. Injuries have fallen, from 78 per 200,000 person-hours to less than half that amount, culminating in 500 days with no injuries at all.

The benefits from new maintenance procedures and tools have been felt throughout the plant. Plant administrators, for example, no longer have to deal with dozens of separate invoices. ABB introduced Maximo software and the maintenance organization now produces one invoice per plant per month. Plant management can now access information that lets them monitor and analyze the maintenance function. This information is enabling management at each plant to recognize opportunities for further improve-
ments in productivity and efficiency: the potential to save energy, upgrade equipment, automate, and consolidate.

**A Lifecycle Approach to Reducing Risk & Improving Safety**

ARC believes that end users must take an integrated approach to plant safety, plant security, and risk reduction. ABB provides through its approach to the integration of control and safety systems, enhanced plant security, and reducing risk through an integrated approach to project management where ABB can serve as the main automation contractor (MAC).

**Reducing Risk in Production through Integrated Control & Safety**

Any collaborative process automation system needs to have process safety options. In many process industry applications, systems with IEC 61508/S84 ratings have been required. This was emphasized in the industries dealing with toxic material subject to 1910 when OSHA ratified S84.

In the past, manufacturers required separate safety systems to satisfy the regulatory or legal requirements with adequate diversity and availability. Process automation systems that support safety system functionality on the same platform are now available. This trend will accelerate as suppliers acknowledge that safety and availability can be two different issues and they allow users to buy what they need.

Standalone safety systems have been the traditional solution of choice, which meant different design and operation requirements for basic process control systems and Safety Instrumented Systems (SIS). The primary function of a PAS is to hold specific process variables to predetermined level in a dynamic environment. An SIS, on the other hand, is static, waiting to take action to bring the process to a safe state when it is out of control and the PAS is unable operate within safe limits. As a result, separate systems were

<table>
<thead>
<tr>
<th>Benefits:</th>
</tr>
</thead>
<tbody>
<tr>
<td>No need for data mapping</td>
</tr>
<tr>
<td>Single set of engineering tools</td>
</tr>
<tr>
<td>Significant reduction in integration efforts</td>
</tr>
<tr>
<td>Lower lifecycle cost</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Challenges:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Putting hardware and software barriers between safety and control systems</td>
</tr>
<tr>
<td>Ensuring proper access protections</td>
</tr>
<tr>
<td>Ensuring visual differentiation between control and safety environments</td>
</tr>
</tbody>
</table>

**Benefits and Challenges: Integration of Safety and Control Systems**
developed for process control and safety with separate operator interfaces, engineering workstations, configuration tools, data and event historians, asset management, and network communications.

ABB’s Industrial IT System 800xA High Integrity is a IEC 61508 and IEC 61511 compliant Safety Instrumented System (SIS) that spans the safety loop, including SIL rated controllers, field devices, I/O modules, and field actuators. Embedded safety and control are within the same architecture providing a common high integrity system environment for production control, safety supervision, and production monitoring. This architecture provides the option of combining control and safety functions within the same controller or keeping control and safety functions separate within the same system. With safety and process applications executing within the same system environment, and even within the same controller, System 800xA offers safe, instant interaction between applications.

System 800xA safety systems are delivered and supported in accordance with the strictest standards. Among others, System 800xA complies with IEC 61508, IEC 61511, EN 954, NFPA 85 and NFPA 72 standards. In addition to product requirements, System 800xA meets these standards’ required procedures and routines specified for safety system lifecycle management. All product components in System 800xA High Integrity were certified by TÜV prior to their announcement for sale. TÜV Product Service is the foremost independent certification agency in the business.

ABB’s High Integrity controller was much anticipated when it was released for sale in January of 2005, and reflects many years of close collaboration between ABB and Dow Chemical Company on high availability and high integrity control. ABB's High Integrity offering supports ARC's view of "same but separate" high availability and safety control, where the safety instrumented system is logically separated from the process automation system yet physically integrated in terms of a common hardware platform and common software tools. The High Integrity system also incorporates all of
the key safety system standards that are prevalent today, including IEC 61511 and IEC 61508, as well as TÜV certification. ABB is also bundling the High Integrity controller with its SIL rated sensors and actuators to provide a complete safety instrumented system (SIS) solution.

**ABB Embeds Advanced Security Features into Industrial IT**

ABB is an active participant in major control system security standards committees, including S99 and IEC SC65c/WG13. ABB provides security guidance in system documentation and incorporates secure design practices into all phases of product development. ABB has embedded many advanced security features into Industrial IT and System 800xA. Security features such as audit trail and advanced access control are built into 800xA engineering software. ABB utilizes and extends the Microsoft Windows security scheme to meet the demands of automation applications. User access in 800xA is controlled by a three-dimensional model that incorporates the person, the object, and the function. With a motor for example, access to the object itself can be controlled as can access to specific function associated with the object, such as starting the motor. Any operator actions that are viewed as critical can be assigned to a single user authentication. All accesses and changes to system and data are logged and tracked in the audit trail.

Load-Evaluate-Go is a feature that sprang from ABB’s relationship with Dow and is a key requirement for Dow. It enables customers to modify, download, and evaluate a “revised” application without interfering with the running or “current” application. The “revised” application can then be put on-line, further modified, or discarded.

Load-Evaluate-Go provides many end user benefits in the area of reducing risk. Aside from reducing the overall risk of unplanned downtime, Load-Evaluate-Go reduces the risk during application changes in running processes applying erroneous application changes to the process.
Reducing Risk and Increasing Safety through Innovative Services

ABB’s Automation business has a large services component that cuts horizontally across all product and vertical industry business areas. There are currently over 20,000 people working in ABB’s total services organization in 100 countries. ABB’s service portfolio consists of Product & Systems Services and Reliability Services. The Product & Systems portfolio consists of six basic offerings – Maintenance and Field services, Optimization services, Parts & Repair services, Support & Remote services, Migration & Retrofit services, and Training services. The Reliability Services portfolio consists of four offerings – Benchmarking, Consulting, Equipment Performance Management, and Reliability Performance Management (ABB Full Service).

Service Business Scope

ABB always had a strong focus on the product and system lifecycle management, and assists its customers in evolving their automation systems and products to the latest technology. System lifecycle management is extended with ABB’s lifecycle services. These service capabilities run the scope from process application consulting in industry-specific business areas to call centers for product services, parts and logistics, and training and education. ABB also offers a maintenance outsourcing business that combines all site maintenance activities or individually selected asset classes (i.e. motors, drives, analyzers, etc.) in a performance-based management agreement. ABB Full Service provides maintenance management for all production assets regardless or supplier, while Equipment Performance Management services are offered horizontally across all ABB product-focused business areas such as Instrumentation and Control.

ABB always had a strong focus on the product and system lifecycle management, and assists its customers in evolving their automation systems and products to the latest technology. System lifecycle management is extended with ABB’s lifecycle services. These service capabilities run the scope from process application consulting in industry-specific business areas to call centers for product services, parts and logistics, and training and education. ABB also offers a maintenance outsourcing business that combines all site maintenance activities or individually selected asset classes (i.e. motors, drives, analyzers, etc.) in a performance-based management agreement. ABB Full Service provides maintenance management for all production assets regardless or supplier, while Equipment Performance Management services are offered horizontally across all ABB product-focused business areas such as Instrumentation and Control. Both sets of services are offered to all vertical industry groups: Automotive, Power and Utilities, Pharmaceuticals, Pulp & Paper, Oil & Gas, Refining & Petrochemicals, Chemicals, Mining, and Marine.

ABB’s Evolution & Lifecycle Policies Provide Investment Security

A significant part of ABB’s Evolution strategy is their Automation Lifecycle Management Policy. With customers striving to better understand and predict their automation lifecycle costs, ABB has launched a comprehensive
program targeted at Evolution and System Lifecycle management. The main components of this program include:

- Asset Optimization (high asset utilization with optimal maintenance investment)
- Equipment Lifecycle Management (planned replacement intervals to avoid obsolescence)
- Managing Software Versions (balancing software upgrade frequency with business needs)
- Services & Support (evolution planning, training and maintenance)

System 800xA integrates ABB’s installed base and provides an evolution path that enables users to enhance the functionality of their automation system while preserving their existing assets. As part of their Evolution program, ABB has committed to keep the 800xA featured controllers active until 2015.

The Value of Consulting Services
In ARC’s view, the majority of ABB’s value-add in services comes from its process application and maintenance consulting offerings. ABB helps clients improve profitability by increasing productivity and reducing manufacturing costs, and increasing production through implementation of maintenance and reliability solutions for process, discrete and hybrid industries. These services include asset optimization services, technology migration services, advanced on-line services, operations process improvements, reliability consulting and support, business process improvements and complete management of the customer’s maintenance operation. The Process application consulting services are provided by several highly specialized industry specific Centers of Excellence. ABB’s ability to provide these high-level business consulting and project management services is a key differentiator from other automation suppliers.

Main Automation Contractor Capabilities are Crucial to Reduced Installed Cost
Process automation system supplier services have expanded in scope to the point where many suppliers can act as Main Automation Contractors (MACs), providing a single point of responsibility for all automation-related facets of a project. MAC capabilities reduce costs for end users that
no longer have the time or the resources to deal with multiple points of contact and responsibility for automation projects.

ABB has considerable turnkey capabilities and is increasingly filling the role of MAC. ABB’s competitive advantage is that it can go to market with a full scope of products and services on both the automation side as a Main Instrumentation and Control Contractor (MICC) and electrification side as a Main Electrical Contractor (MEC). ABB’s goal through its MAC capabilities is flawless project execution, from the front-end engineering and design phase (FEED) through detailed engineering and project completion. ABB’s approach as a MAC solutions provider can result in cost savings of up to 20 percent in automation projects, particularly in the engineering and installation phases.

**Dow’s Path to High Availability Control with Industrial IT**

Dow is one end user that has chosen ABB as a strategic automation partner because of ABB’s ability to provide highly reliable and secure control. Dow’s business principles are guided by three primary elements: safety,
minimizing impact on people, and minimizing impact on industry and community. These principles led them to create a highly secure control system architecture called MOD 5, which was designed to be as bulletproof as it could be made, while at the same time allowing Dow’s automation experts to continue to advance their application expertise.

This philosophy extends to the way they roll out projects internally at Dow. Today, they utilize their Six Sigma quality program in everything they do. Process control projects are no exception. As they evolved MOD, they made sure that the engineering tools developed to support the MOD system would allow them to deploy advanced applications with high reliability while still allowing operating plant personnel to troubleshoot locally without the help of MOD system specialists.

When Dow speaks of high availability, they are not just talking about control or computer systems. They mean the entire production and distribution process. This is ingrained in Dow’s culture as a way they have been doing business for decades. When one examines the implications of running an entire enterprise to have no disruptions in the supply chain, failures cannot be tolerated. At the base of high availability production is the need for high availability processes and supporting this are high availability control systems. Without completely dependable control, the reliability of processes cannot be guaranteed.

Dow’s transition from its proprietary MOD 5 process automation system (PAS) to ABB’s 800xA system through a 10-year formal agreement between the two companies was launched in 2001. Although Dow recognized the need to move to a more open system, the company still wanted to drive the functionality in the 800xA system to meet its own stringent process automation requirements, such as integrated regulatory and safety control, high availability, application loading without process disruption, and integration of engineering functions.

### Combined control and safety allows for more advanced control

| Improved communications between Basic Process Control System (BPCS) and Safety Instrumented System (SIS) |
| Higher BPCS reliability |
| Unified operations environment |
| Reduced implementation costs |
| Standardization |

### How much does combined control and safety save Dow?

| Reduce Application Project cycle time 45% |
| Reduce Support Costs 50% |
| Increase Value contribution to Dow businesses >$250MM |

**Integrated Control & Safety Results in Significant Benefits for Dow**
ABB and Dow are aligned well in several aspects. First, through their ongoing collaboration, ABB has “productized” key elements of Dow’s operating discipline and made them commercially available. Two examples of this are the integrated high availability control offered by ABB and the Load-Evaluate-Go functionality. This allows Dow’s highly skilled process automation engineers to focus on improving Dow’s processes and applications. Dow’s relationship with ABB is an excellent example of how users can work with suppliers to drive needed functionality into control systems and achieve sustained performance improvements in their own manufacturing operations.

**Industrial IT Strengths & Challenges**

End users are increasingly purchasing automation based on a business value proposition. The business value proposition of automation rests on its ability to increase plant performance, avoid downtime, achieve maximum return on assets, and reduce cost of ownership. ABB’s positioning of Industrial IT around the three primary domains of reduced cost of ownership, increased productivity, and reduced risk is a good fit with this increased focus on business value.

ABB also has the advanced capabilities in products, services, and vertical industries to help end users realize the business value and increased performance potential of automation. In terms of offering a high degree of functionality and a wide array of advanced applications, ABB is very strong and has a lot to offer. The future success of ABB depends largely on its ability to successfully provide its customers with sustained and measurable benefits from automation that provide a path to continuous improvement for business performance and profitability.

In the realm of reduced cost of ownership, ABB has made great steps forward evolving its installed base to the latest version of system 800xA,
ABB’s solutions for improving productivity are also formidable. As far as providing information in context and enabling a knowledge workforce, the 800xA system is extremely powerful and strongly corresponds to the ARC collaborative process automation system (CPAS) framework.

The company also provides an integrated approach to maintenance and plant asset management that can provide true bottom line results in terms of reduced maintenance costs and elimination of unnecessary maintenance.

One of ABB’s primary challenges, however, lies in making these solutions easier to implement and to use for their customers. The high degree of functionality offered by 800xA and Industrial IT and the wide range of asset management services offered by the company also require a significant component of implementation services, training, and vertical industry expertise, which ABB provides. A consultative selling approach is also required where ABB is ideally involved from the front-end engineering and design through project execution and the operational phase, which ABB also provides and must continue to strengthen and sustain.

Integrated safety and high availability control are both key concerns for end users today, and ABB is a leader in this regard with its 800xA High Integrity platform. ABB also takes a leading approach to security with its Load-Evaluate-Go functionality, audit trail, and other features. As with the company’s other offerings, however, a sophisticated approach to security, high availability control, and risk mitigation requires a sophisticated approach to the end user in the form of a consultative sale and an ability to effectively articulate the benefits. Industrial IT can help end users achieve a sustained economic benefit from automation. ABB must continue to build on its services and solutions expertise and increasingly focus on ease of use to help end users realize that vision.
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/C13/IndustryTerms/

AI  Artificial Intelligence
API  Application Program Interface
APS  Advanced Planning & Scheduling
B2B  Business-to-Business
BPM  Business Process Management
CAGR  Compound Annual Growth Rate
CAS  Collaborative Automation System
CMM  Collaborative Manufacturing Management
CNC  Computer Numeric Control
CPG  Consumer Packaged Goods
CPAS  Collaborative Process Automation System
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
OpX  Operational Excellence
OLE  Object Linking & Embedding
OPC  OLE for Process Control
PAS  Process Automation System
PLC  Programmable Logic Controller
PLM  Product Lifecycle Management
ROA  Return on Assets
ROI  Return on Investment
RPM  Real-time Performance Management
SCE  Supply Chain Execution
WAH  Web Application Hosting
WMS  Warehouse Management System

Founded in 1986, ARC Advisory Group has grown to become the Thought Leader in Manufacturing and Supply Chain solutions. For even your most complex business issues, our analysts have the expert industry knowledge and firsthand experience to help you find the best answer. We focus on simple, yet critical goals: improving your return on assets, operational performance, total cost of ownership, project time-to-benefit, and shareholder value.

All information in this report is proprietary to and copyrighted by ARC. No part of it may be reproduced without prior permission from ARC. This research has been sponsored in part by ABB. However, the opinions expressed by ARC in this paper are based on ARC’s independent analysis.

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