Honeywell I-MAC Capabilities Provide a Path to Operational Excellence

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Executive Overview

Demand for Main Automation Contractors (MACs), which can provide a single point of responsibility for all automation related aspects of a project, has never been higher. Capital costs continue to soar, particularly in the process industries. What was once a capital expenditure boom in developing economies such as China and India is now an environment of uncertainty and unpredictability due to the global economic meltdown. Companies must work harder than ever to reduce risk and provide some level of predictability for the capital projects that are still underway. At the same time, end users are under more pressure than ever to find qualified people as they face a wave of retirements among their most experienced workers.

Some automation suppliers fill the role of MAC extremely well. In general, they have the best knowledge of their systems and how they work with other components of automation in the plant. Not all automation suppliers are equal when it comes to their MAC approach, however. When evaluating your supplier as a MAC there are several things that need to be considered, but foremost among these is the business value proposition provided by the MAC. Is the supplier focused only on project execution and completion, or is there more of a view toward the long-term operational readiness and business readiness of the plant? Honeywell expands the concept of MAC with its Integrated MAC (I-MAC) concept that provides this value in the form of operational readiness, business readiness, and project readiness from the early stages of a project through the operational phase of the plant.

However, I-MAC does not focus on the long-term view to the exclusion of project objectives. I-MAC is the three-dimensional approach that includes flawless project execution and completion, startup readiness (which includes both operational and business readiness), and planning for the full operational lifecycle and sustainable business benefits.

Operational readiness simply means that startup time is significantly reduced, and at startup, maximum production efficiency is reached as soon as possible, maximizing the return of investment for the project. This maximum production is achieved through a reduction in unplanned incidents, increased safety, and early implementation of APC and the application of
simulation technology. Business readiness enables optimized decision-making. A holistic approach to security means not just the security of the process through implementation of an integrated approach to safety. It also means a safety-minded approach to plant asset management and integration of physical and plant security. Rather than trying to move in on the scope of what EPCs have traditionally delivered, Honeywell’s goal is to help EPCs and owner-operators achieve their objectives more quickly, which are to finish the project successfully and move on to the next one. Honeywell’s experience with the operator, particularly in terms of providing asset information through its Plant Asset Management (PAM) solutions and built in procedure management, provide a good foundation for smooth transition to operations upon project completion.

Why an Integrated MAC Strategy?

Demand for Main Automation Contractors (MACs), which can provide a single point of responsibility for all automation related aspects of a project, has never been higher. This is due to factors on both the end user and supplier side of the business. End users are under increased pressure to lower the cost of capital projects, find experienced and qualified personnel to execute projects and operate their plants, and reduce operating costs. Accurately forecasting project costs for the process industries is becoming increasingly difficult in this economy. Even in the wake of the current economic crisis, capital costs continue to soar, particularly in the process industries. As of the end of 2008, many indicators were pointing to increasing capital costs, even in the face of reduced raw materials costs. What was once a capital expenditure boom in developing economies such as China and India is now an environment of uncertainty and unpredictability due to the global economic meltdown. Companies must work harder than ever to reduce risk and provide some level of predictability for the capital projects that are still underway. At the
same time, end users are under more pressure than ever to find qualified people as they face a wave of retirements among their most experienced workers.

There is also a trend toward larger and larger mega projects, into the tens of billions of dollars, which bring a whole new complexity to the role and the overall level of value that a MAC can provide. Even in a down economy, large infrastructural projects march ahead, and factors such as the US economic stimulus package will actually increase the level of infrastructural projects happening in the US. Today, the MAC must play an even larger consulting role to the owner/operator as well as be an integrated partner to one or more PMCs and EPCs in order to help each PMC and EPC manage their own schedules and cost risks. At the same time, the MAC must still ensure the client gets the standardized solution common across all EPC projects at the end of the day.

Then there is the issue of operational costs, lifecycle costs, and plant performance. For the end user, the project is only the beginning. Decisions made in the early stages of the project have an impact throughout the plant lifecycle, and data that is captured during plant construction must be seamlessly transferred through the operational phase.

End users and even EPCs no longer have the time or the resources to deal with many different automation suppliers on a project. We live in an increasingly open world, and any automation project is going to have several different suppliers for key building blocks such as control valves, production management applications, safety systems, and more. Relying on a single automation supplier as a single point of responsibility to coordinate efforts among multiple suppliers and subcontractors can increase precision, save considerable time and money, and lead to faster startup times.

Using a MAC as a single point of responsibility for integration also results in increased design reliability. One of the key differences between MACs and main instrumentation vendors (MIVs) is the greater level of collaboration and communication with the end user.
larly true when it comes to control system engineering and design, since the MAC is typically the primary automation system supplier and should be able to draw from a significant resource base to perform this task. Early involvement of the MAC in the project means even further reduction in the risk of miscommunication on the project between the suppliers, EPCs, and end users.

The increasing pressure faced by end users and EPCs also means that projects need to be finished as quickly as possible. Quicker time to startup means quicker time to profitability. In industries such as fine chemicals and life sciences, faster time to startup is a matter of competitive survival. Automation suppliers with the right capabilities can provide a single point of responsibility for project management – coordinating activities among multiple automation suppliers and subcontractors and freeing up the end user and EPC to focus on what they do best.

How many plants do you know of that have started up on time and running at full capacity? Plants today are taking too long to commission, and there is poor handover to operations, which means that the user is usually experiencing sub-optimal operations once the plant is commissioned, in some cases for years. According to a recent survey conducted by Honeywell, 75 percent of companies ranked on time completion as a critical success criterion.

Automation itself does not count for much in terms of total spend on a capital project. Depending on the industry, it could account for as much as 6 percent or as little as 1 percent of a total project. Automation’s impact on plant operations, however, is huge and can account for up to 30 percent of total plant operations. The opportunity for risk reduction via a sophisticated approach to automation at the design phase of the plant can be significant.

Of course, a large part of Honeywell’s strategy is based on the notion that automation suppliers are better at doing automation projects than the end users or EPCs, and in ARC’s view, they generally are. The suppliers have the best knowledge of their
systems and how they work with other components of automation in the plant. Suppliers have the benefit of a large database of experience, they have increasingly large groups of experts, many of who have been recruited from the end user companies themselves, and they have a vested interested in the long-term performance of the system.

Honeywell’s Three-Dimensional Approach to I-MAC

Honeywell has always had a strong project services business, and is already one of the process automation industry’s leading MACs. Honeywell’s expanded Integrated Main Automation Contractor (I-MAC) approach focuses on the business objectives of the client through automation at the process, operational and business layers of the plant. I-MAC strives for a holistic approach to the entire lifecycle of plant assets in addition to managing costs and reducing risk during project execution.

What does the “Integrated” in I-MAC stand for? In Honeywell’s case, it means integration with the client’s overall business objectives of the new facility, including people, products and processes. Business objectives include not only the short-term objectives of the project, but also the operational and business readiness that is required for startup. An integrated approach to asset management is also important. Integrated people means having an integrated project team consisting of the client, the PMC/EPC(s), Honeywell, and other parties involved in the project. It also means integrating the expertise of partners such as IBM, SAP, and even other Honeywell businesses such as UOP. Integrated products mean an integrated approach from process automation systems to enterprise systems and IT, all of which must be wrapped in a secure environment. Honeywell has been a leader in its approach to automating and managing work processes, and integrates these into its Integrated-MAC philosophy.
I-MAC Project Philosophy Aligns to Business Objectives

Having an integrated approach is good, but aligning to the client’s ultimate business objectives is always the goal of the project. Technology and its implementation have no inherent value to manufacturing if it does not possess a business value proposition. Leaders in the process automation world acknowledge that determining the incremental value of a process automation initiative can be a difficult first step in the qualification of a project. They also acknowledged that, except for very large or complex projects, the initial qualification should be done by the stakeholder before the project contends for other projects for funding. In Honeywell’s view, every project’s execution strategy should provide a path to process readiness, operational readiness, business readiness, and overall safety and security.

Operational readiness simply means more than just reduced startup time and maximum efficiency at startup. Operational readiness addresses the issues that typically cause delays in startup or slow startups due to unplanned incidents. The key components of this are ensuring the operations personnel are ready through the use of an online training simulator (OTS). The OTS is also used to develop and validate the startup procedures. The design of the operator process interface is also critical, ensuring best practices are incorporated into the automation system design based on recommendations from the Abnormal Situation Management (ASM) consortium. Maximum production is achieved through a reduction in unplanned incidents, increased safety, and early implementation of APC. Business readiness enables optimized decision-making. A holistic approach to security means not just the security of the process through implementation of an integrated approach to safety. It also means a safety-minded approach to plant asset management and integration of physical and plant security.

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<tr>
<th>OPERATIONS READINESS – SOURCES OF SAVINGS</th>
<th>Typical Startup Savings</th>
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<tbody>
<tr>
<td>Process Technology Training</td>
<td>5 days</td>
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<td>Simulator Based Training</td>
<td>5 days</td>
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<tr>
<td>Procedural Training for Operators</td>
<td>2 days</td>
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<td>Licensor prepared scenarios</td>
<td>2 days</td>
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<td>Licensor specific process models</td>
<td>1 day</td>
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<td>Operating Procedure Validation/Optimization on Simulator</td>
<td>5 days</td>
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<tr>
<td>Controls Check / Verification on Simulator</td>
<td>5 days</td>
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<tr>
<td>Safety Shutdown System Verification on Simulator</td>
<td>5 days</td>
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<tr>
<td>Better initial controller tuning from Simulator</td>
<td>1 day</td>
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<tr>
<td>Faster Start-up from Operations Readiness</td>
<td>26 days $US20M</td>
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<th>OPERATIONS EFFECTIVENESS</th>
<th>Startup Savings</th>
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<tr>
<td>Procedural Operations</td>
<td>1 day</td>
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<td>ASM Graphics</td>
<td>1 day</td>
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<td>Minimap avoidance from Operations Effectiveness</td>
<td>4 days</td>
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<th>PRODUCTION OPTIMIZATION</th>
<th>Improved Performance</th>
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<tr>
<td>APC delivered sooner through simulation program</td>
<td>6 months early $19.0M</td>
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**Early Incorporation of Technologies Like Simulation and APC Can Significantly Reduce Project Costs**

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**Flexible Relationship with EPCs**

Honeywell’s goal is not to replace the role of the EPC on projects. Rather than trying to move in on the scope of what EPCs have traditionally delivered, Honeywell’s goal with EPCs as part of their broader I-MAC approach is to integrate and align with the EPCs objectives for the project, which are typically aimed at finishing the project on-schedule and under budget, allowing the EPC to close out the project in a timely manner and move on to the next one.

Honeywell has a flexible I-MAC partnering strategy with EPCs that basically rests on three models. The first model allows the EPC to take control of the base automation infrastructure for the project, assuming the role of the traditional MAC while Honeywell supplies the automation technology and engineering support as required. In parallel, Honeywell works directly with the owner on the other aspects of the broader I-MAC engagement (such as simulation, applications, or security work), helping the client to ensure operational and business readiness planning for successful startup and lifecycle sustainability. A second approach is a hybrid model where the EPC and Honeywell share joint responsibility for the automation project. This ensures a smooth transition from the project to the operations lifecycle of the facility, allowing the EPC to efficiently extract itself from the project, while ensuring optimal operations during the first year of operations. The third mode involves total outsourcing of the Integrated MAC function to Honeywell, allowing Honeywell to deliver on the success of the project on behalf of the EPC while addressing readiness for facility and the startup and long-term sustainability of the business.

**Working Closely with UOP**

Honeywell Process Solutions has developed technology, services, and work process integration with UOP, following the full acquisition of UOP by Honeywell International, bringing new I-MAC value to industry, particularly to refining projects where integrated UOP and Honeywell value can at times be tremendous. This is good for Honeywell’s I-MAC business for many reasons. HPS and UOP collaborate in a multitude of product lines, across the project lifecycle and beyond to offer refiners a full portfolio of process technology and operational support services which drive operational readiness for faster, flawless start-up and improved first year operability, and continue to maintain operator effectiveness and process optimization for safe, reliable, and efficient operations over time.
Honeywell is also offering UOP Master Simulation Models, which are an exclusive series of UOP process technology-based operator training systems (OTS) delivered through Honeywell’s UniSim® family of process modeling and simulation technology. The UOP Master Simulation Models contain embedded UOP mathematics and (kinetics) and process knowledge in the UniSim framework, to improve plant safety and efficiency by allowing manufacturers to design and test fully understand their processes before they are implemented constructed in their plants, as well as train operators to use on those processes and reduce errors that could lead to plant incidents.

This early delivering of the Master Simulation Models not only enables in-depth training for plant operators but also allows the OTS to be used for development and validation of operating procedures and the development and pre-commissioning of advanced process control applications. This close collaboration with UOP also allows Honeywell to embed the detailed process design knowledge of UOP into the automation systems, allowing UOP clients to implement a project more quickly and extract far greater value from the licensed process technologies over the lifecycle of the facility.

### The Value of Early Involvement

There are many other reasons why early involvement in projects on behalf of the automation suppliers makes sense for end users. 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. Through early involvement, for example, Honeywell can work with the end users to develop automation philosophies to support the smooth efficient startup and enable lowest cost of ownership of the operational life of the facility. Decisions made early on projects around
technology selection such as the use of dynamic simulation, alarm system
design processes and plant optimization all have major impact on the op-
eration of the facility.

Early involvement is also crucial to the success of PAM implementation and
fieldbus implementation. Honeywell also fills a consultative role in the
early stages of a project and conducts collaborative workshops with opera-
tions representatives to define requirements for human factors design,
operational and business system integration, and lifecycle sustainability.

I-MAC Targets Operational & Business Readiness

Operational readiness is probably the single most important element of
Honeywell’s I-MAC value proposition. ARC defines operational readiness
as the state when a new facility, or major upgrade, is being operated at its
desired production rate (which may or may not be the maximum de-
signed), producing product of required quality, within designed operating costs,
for an extended period. To reach this state,
the engineering, sourcing and construction
of the physical asset have been completed
and all tests made to verify compliance
with the capital project scope. Operational
readiness is also just as much about the
readiness of the operations personnel – the
people assets -- as it is about the plant and
physical assets.

Operational readiness is generally consid-
ered the point when the asset is finally
beginning to provide returns at the level
expected for the investment. Delays in achieving operational readiness for
major upgrades or greenfield facilities can be incredibly expensive. Mod-
ern plants can cost billions of dollars and just the interest on these funds
makes every day of delay very expensive.

As can be expected, integration is a key aspect of achieving operational and
business readiness. Often startup is the first time that all of the new sys-
tems installed on a project are operated together. Validating that all systems play together correctly from the process automation layer to the operational and business automation layers prior to startup is a core component of Honeywell’s I-MAC approach.

**How is Operational Readiness Achieved?**

Asset information exchange is critical to providing the process knowledge required for operational readiness. Organizational and contractual issues can make it difficult to get around all the roadblocks. It is important that a proper management structure and workflows are established before attempting to transfer any needed information across project and operations boundaries. Operational readiness responsibilities must be established for all groups. This includes a clear delineation of overall responsibilities and authority. For example, if the operations group is to be made responsible for attaining operational readiness, then groups like engineering, design and construction need to understand that they are expected to support them in this effort by making sure that all information deemed to be necessary is made available as required by operations.

Honeywell as the Integrated-MAC has the advantage of having not only the project capabilities but also the operational expertise, particularly when it comes to areas such as the plant operations and business systems. Another crucial aspect of I-MAC resides in the maintaining of asset information and process knowledge through the project handover to the operations lifecycle.

Training, or people readiness, is perhaps the most important aspect of the success of operational readiness. If your operators are not properly trained, they cannot run the plant to the optimum degree of efficiency. Analogous to an autopilot, APC typically removes the reactive actions required by a process operator to allow more time to be spent on optimizing production. However, from time to time operators also need to be able to take control of the process to manage an upset. This is where an OTS, like a flight simulator, can prove to be extremely valuable, allowing the operator to continually develop skills, make mistakes and learn in a safe simulated environment.

Often overlooked on a project are the benefits of that dynamic simulators can also provide during the delivery phase of the projects. These benefits
can also have a large impact on reducing startup time. Startup and operating procedures can be developed and validated using the OTS along with HMI design. Simulators can be used during factory acceptance testing (FAT) to test and effectively pre-commission automation systems. APC can also be step tested on simulators.

**Information Handover is Crucial**

Successful information handover is crucial to the success of any project. So much so that NIST and Fiatech have published a guide outlining best practices for capital facilities information handover. Much of the information needed for operational readiness is created as part of the workflows of both the EPC and the MAC. Unless care is taken at the outset, transfers of this information will naturally follow the project development timeline, which may be too late in the process to support a smooth transition from commissioning to full operational readiness. One of the activities that Honeywell initiates very early in I-MAC projects is to hold collaborative workshops with the operation teams to clearly define requirements for the information that they will need. Requirements in this case should include content, timing and format for all information to be transferred.

Honeywell’s experience with the operator, particularly in terms of providing asset information through its PAM solutions and built-in procedure management, provide a good foundation for successful handover upon project completion. Honeywell also has close relationships with the major EPCs and its flexible approach to working with EPCs means that information handover can be effective in cases where the EPC assumes full responsibility for the automation project, or if the responsibility is shared with Honeywell and EPC or if Honeywell assumes full responsibility.

**Business Readiness & Lifecycle Sustainability**

Honeywell’s definition of business readiness includes integrated systems that enable efficient business operations, this includes integration and planned information flows between the process automation system and the enterprise system. For a process manufacturing plant, there is no point in
producing product on the first day of operation if you cannot invoice it. Business readiness also means a plan for sustainability and maintainable business systems over the lifecycle of the facility. Again, early involvement is essential to provide effective business readiness. In many cases, business system planning is often started months or years after the infrastructure project is initiated.

I-MAC also addresses lifecycle support planning. Many of the large I-MAC capital projects are done in locations with little support infrastructure, and the end users are looking for a MAC partner who has a vested interest in the total lifecycle of the facility and formation of a long-term business relationship. Through Honeywell’s “Program Office” model, the knowledge and experience gained through the project are seamlessly transitioned to the operational phase of the lifecycle. This work process ensures an optimal project close-out by the EPC and enables a partnership approach to automation for the end user client.

Lifecycle sustainability as it applies to automation means keeping automation solutions continuously up to date, maintaining knowledgeable staff, and addressing the challenges of keeping up with the pace of technology. It also means driving standardization into the automation system. These are all basic tenets of Honeywell’s I-MAC approach.

**I-MAC Helps Freeport LNG Realize Its Business Objectives**

Freeport LNG is one of the more notable success stories around the I-MAC approach. One of the first LNG terminals built in continental US in more than 25 years; Freeport LNG delivers gas to ConocoPhillips and Dow Chemicals pipelines that have distribution capacity throughout Texas. With about 80 employees, Freeport LNG has long-term relationships with ConocoPhillips, Mitsubishi, and Dow.

As a regasification project, Freeport LNG faced many of the same challenges that all end users face in the process industries. Lack of experienced personnel, capital cost issues including materials and labor, and the fact that it is a highly visible and regulated industry were major concerns, not to mention stringent requirements for safety and security. To add to this, many EPCs have limited experience when it comes to LNG projects.
The LNG regasification process itself seems relatively simple, consisting of a receiving operation, storage management, regasification, and pipeline distribution. The business requirements, however, are extremely complex, spanning everything from fleet requirements, berthing requirements, security, automation infrastructure, and the enterprise, as shown above. Given these business considerations, Freeport LNG needed to execute the project well and achieve flawless startup given its constraints in resources and personnel. Freeport LNG also wanted total operational readiness on day one, and to them this meant having integration between the automation system and the business system.

Honeywell was chosen for this project because of its I-MAC approach and ability to provide the complete solution to meet Freeport LNG business needs. This included the traditional MAC scope for control and safety systems, the operations and production management systems, operator training simulator, EPC design and installation of physical security systems, and overall project management. Honeywell also brought services to the table that were specific to achieving the goal of operational readiness, such as supporting workshops prior to startup.

Freeport LNG’s vision was to have a single contract that ensured integration from the field level through the DCS through the ERP system, including MES. Honeywell’s partnerships with IBM made this happen. Honeywell was the primary automation supplier for this project as well as the MAC, providing a full turnkey solution for field instrumentation, fire and gas detection, integrated control and safety systems, and an integrated security system. Honeywell also provided the full suite of MES applications including the laboratory information management system, energy balance, operations execution, LNG receipt coordination, process analysis,
performance management, enterprise data historian and system integration layer.

The Honeywell environment was split into three primary domains; development, test and production environments. Having three dedicated environments greatly enhances security and reliability. Applications can move from the development environment to the test environment, which is a mirror of the production environment, so the impact on the production environment can be simulated and if necessary changed before they are actually deployed in the live production environment.

Freeport LNG and Honeywell were able to overcome some major challenges in the project by adopting a business readiness approach. Freeport LNG’s business processes were relatively immature, as is the case for many newly created operating companies. Honeywell was able to work with Freeport LNG to implement a training system for their operators and other end users while the plant was being commissioned, ensuring that people were properly trained on day one.

In preparation for startup, Freeport LNG also requested support from Honeywell for a business readiness workshop called “A Day in the Life of Freeport LNG” to help identify and close functional gaps. In order to provide a realistic environment, Freeport LNG asked Honeywell to tie the operator training simulator up to business systems and simulate a day of production. This allowed Freeport LNG to validate that business processes defined during the project would actually work. The workshop enabled Freeport LNG to validate and identify gaps in their business processes, and
enabled the management of the company to fill any gaps prior to operational startup. Freeport LNG also credited the timely and effective response from Honeywell’s globally coordinated experts in the success of the project, who added their expertise to the project through remote desktop access and web conferencing technologies.

The Honeywell operator training simulation (OTS) aspect of the project was equally important. To train the Freeport LNG operators before project startup Freeport LNG chose to use a high fidelity model to cover all their operations. The model represents key operating scenarios such as startup, shutdown, and normal operations. In Freeport LNG’s view, the OTS and Honeywell’s integrated approach to its deployment and training were a huge benefit for the Federal Energy Regulatory Commissions (FERC) evaluation of Freeport LNG’s ability to train its personnel. OTS also drove a 25 percent reduction in the overall training cost for Freeport LNG, uncovered design flaws that would have delayed startup, and reduced overall startup time from three days to one.

Honeywell’s approach to integrated site security also provided benefits for Freeport LNG, which hired Honeywell as the security contractor in addition to being the main automation contractor. Freeport LNG awarded a contract directly to Honeywell to supply a complete, turnkey solution for physical security for the new terminal operation — the largest project of its kind to date in North America for Honeywell. Freeport LNG signed a risk/reward contract with Honeywell to help them drive the schedule and improve the cost position of the security system implementation. Honeywell was able to reduce project integration costs by executing the scope of the design on an accelerated schedule that met Freeport LNG’s project deadline. Honeywell’s approach prevented significant project delays.
In Freeport LNG’s opinion, Honeywell’s Integrated-MAC approach paid off for them in several ways. Through I-MAC, the project was delivered on time, within budget and operationally-ready for startup. Through the business readiness workshop, Freeport LNG was also able to identify several business process gaps to be remedied before startup. Ensuring application reliability before startup provided true business readiness, allowed for the prioritization of the implementation sequence and increased acceptance of the applications by the operators and plant personnel. In addition to the successful startup, deliveries to customers have occurred on time and without incident.

**Honeywell I-MAC Strengths & Challenges**

Honeywell has always been a leader when it comes to project implementation and engineering capabilities for the process industries. However, in today’s market, competence in project execution is no longer enough by itself to provide a competitive advantage. Through I-MAC, Honeywell has been able to leverage its strengths in advanced applications such as APC and OTS, production management, and control system to business system integration along with its ability to drive tight integration of these applications into the control system layer. The company also has a long history in integrated safety and security and field instrumentation and networks, but providing these technologies in an environment that promotes operational and business readiness is really what provides Honeywell with an advantage.

ARC repeatedly talks about the economic value proposition of automation. Technology in and of itself has no value unless it provides a bottom line economic benefit that is also measurable. In the case of Freeport LNG, Honeywell was able to provide this value proposition through reduced startup time, running the end users through the business simulation scenario that identified potential problems before startup, and achieving operational readiness at startup without incident and running at full potential from day one.

Of course, Honeywell must continue to make this argument for bottom line economic benefits to its customers. Many customers in the process indus-
tries today still do not take a bottom line approach to automation. Many view the project as a separate activity from the rest of the plant lifecycle, and in this regard Honeywell has some work to do to appeal to business level management at end user companies to convince them that a strategy for operational and business readiness is the right way to go. As the company continues to build success stories such as Freeport LNG, this task will become easier.
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Editor: Dick Hill

Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/C13/IndustryTerms/

API Application Program Interface
B2B Business-to-Business
BPM Business Process Management
CAGR Compound Annual Growth Rate
CAS Collaborative Automation System
CMM Collaborative Manufacturing Management
CPG Consumer Packaged Goods
CPM Collaborative Production Management
CRM Customer Relationship Management
DCS Distributed Control System
DOM Design, Operate, Maintain
EAM Enterprise Asset Management
ERP Enterprise Resource Planning
HMI Human Machine Interface
IOp Interoperability
IT Information Technology
I-MAC Integrated Main Automation Contractor
MAC Main Automation Contractor
OpX Operational Excellence
OEE Operational Equipment Effectiveness
OLE Object Linking & Embedding
OPC OLE for Process Control
PAS Process Automation System
PLC Programmable Logic Controller
PLM Product Lifecycle Management
RFID Radio Frequency Identification
ROA Return on Assets
RPM Real-time Performance Management

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