HONEYWELL’S PETROCHEMICAL SOLUTIONS

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Honeywell Process Solutions
Petrochemical Solutions Whitepaper

September 2007
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EXECUTIVE OVERVIEW

Honeywell Automation and Control Solutions is the leading provider of a complete automation and security solution for the petrochemicals industry. We operate in close to 100 countries globally and are the leading supplier of Process Automation Systems to the Petrochemical Industry\(^1\). For example, Honeywell's presence in Ethylene Automation is shown in Figure 1.

![Honeywell Presence in Ethylene Automation](image)

Figure 1-Honeywell Presence in Ethylene Automation

Figure 1 shows Honeywell Distributed Control Systems (DCS) control greater than 55% of the world’s ethylene production. Additionally Honeywell controls:

- Over 60% of production in North America
- Over 60% of production in EMEA
- Over 70% of Recent Optimization projects\(^2\)

Honeywell, with the Experion\(^\text{TM}\) Process Knowledge System (PKS) as its foundation, enables petrochemicals manufacturers like you to improve your business performance by offering solutions that increase safety, reliability and efficiency. Our solutions: provide multiple levels of protection that help reduce incidents and promote safe operation; increase automation reliability that improves process availability; increase efficiency by integrating the field, the control room, and the supply chain to allow for better and faster decision making.

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\(^1\) 2007 ARC Process Industry Automation Study
\(^2\) Internal Honeywell Resources
Honeywell is like no other automation supplier to the petrochemical industry in that we are able to call on our deep domain expertise and our world class project execution capability to deliver automation projects on time and within budget. Our broad portfolio of offerings and global talent pool enables us to cost–effectively deliver solutions ranging from single unit DCS migrations, to large greenfield projects with complex, diverse components including DCS, safety, security and advanced applications.

Honeywell recognizes the importance of automation in your business and how you expects automation to continuously provide sustainable benefits. We will stand by our solutions ensuring that they stay up and running at their best at all times.

Trust Honeywell to improve your business performance through improved safety, reliability and efficiency.
**BENEFITS AND VALUE**

**KEY BENEFIT AREAS**

Honeywell’s broad automation and security solutions can have significant impact on the, safety, reliability, and efficiency of your petrochemicals manufacturing facility. The table below highlights several key benefit areas:

<table>
<thead>
<tr>
<th>Area</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety and Security</strong></td>
<td>Honeywell’s physical, cyber, and industrial safety and security solutions assure protection of personnel, data, and processes in a facility. The level of integration of Honeywell’s solutions allow for additional protection of people, processes, and equipment.</td>
</tr>
<tr>
<td><strong>Throughput Efficiency</strong></td>
<td>Increase throughput through the application of Advanced Control and Optimization to push your plant to a higher production capacity with existing capital resources. Increase effective capacity by improving reliability which in turn increases the number of days of production without a shutdown.</td>
</tr>
<tr>
<td><strong>Yield Efficiency</strong></td>
<td>Increase yield of by increasing conversion in furnaces without affecting run-length. Increase yield of by running reactors more efficiently.</td>
</tr>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>Reduce costs of production by more consistent operation of steam and other utilities and improving furnace combustion controls.</td>
</tr>
<tr>
<td><strong>Improved Reliability</strong></td>
<td>Honeywell’s solutions can help to improve equipment reliability by monitoring critical equipment, alerting to problems before they become severe, and by sensing problems using Honeywell’s portfolio of field sensors.</td>
</tr>
<tr>
<td><strong>Reliable and Consistent Practices</strong></td>
<td>Increase automation of procedures for infrequent activities like shutdowns/startup/mode or grade changes to capture best practices and increase consistency. Integrate procedural, manual and advanced automation solutions.</td>
</tr>
<tr>
<td><strong>Operational Reliability and Productivity</strong></td>
<td>Improve the effectiveness of operators and production engineers by shifting the focus from collecting and entering data to using information. Ensure that operators are well trained in handling abnormal situations so that plants disturbances don’t become major incidents.</td>
</tr>
<tr>
<td><strong>Continuous</strong></td>
<td>Collect information about plant performance in order to support continuous improvement. This information brings together</td>
</tr>
<tr>
<td>Improvement</td>
<td>Benefit</td>
</tr>
<tr>
<td>-------------</td>
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</tr>
<tr>
<td>Institutionalize best practices</td>
<td>Improve product consistency</td>
</tr>
<tr>
<td>Support for continuous improvement</td>
<td>Reduce Cost of Production, Improve yields of most valuable products</td>
</tr>
<tr>
<td>Improved alignment with business</td>
<td>Reduce raw material costs, Reduction in inventory</td>
</tr>
<tr>
<td>Increase production by pushing closer to multiple constraints</td>
<td>Increase available capacity</td>
</tr>
<tr>
<td>Reduce time to achieve full production after unit startup</td>
<td>Improved reliability and available capacity</td>
</tr>
<tr>
<td>Optimize Reactor/Furnace Run Length</td>
<td>Increase Effective Capacity</td>
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**Qualitative Benefits**

<table>
<thead>
<tr>
<th>Improvement</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make more timely, accurate information available</td>
<td>Spend less time collecting and scrubbing data, more time using the information, Free operating team to focus on business not ‘fire fighting’</td>
</tr>
<tr>
<td>Use supported applications and tools</td>
<td>Reduce cost of compliance and ownership (integrated tools), Reduced maintenance cost</td>
</tr>
<tr>
<td>Improvement</td>
<td>Benefit</td>
</tr>
<tr>
<td>-----------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Increased capacity when market demand is there</td>
<td>Ability to meet more market opportunities with less impact on overall production</td>
</tr>
<tr>
<td>Improved reliability may enable the plant to run longer between shutdowns</td>
<td>Reduction in operating costs and avoidance of unplanned shutdowns</td>
</tr>
<tr>
<td>Institutionalize best practices</td>
<td>Prepare for loss of experienced workers through retirement and be able to quickly and effectively train new employees for new construction in developing regions</td>
</tr>
<tr>
<td>Support for innovation</td>
<td>Reduce time to absorb new technology into normal operation.</td>
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INTRODUCTION TO PETROCHEMICALS

According to ARC, the Chemicals Industry in 2006 spent approximately $3.05 billion on process automation systems. This spending, which covers DCS, advanced applications and safety systems is expected to grow at a rate in excess of 10% through to 2010. This is largely driven by the current upswing in the world economy that started in 2003, the improvements in the chemicals market since 2004 and the strong growth and expansion in Asia.3

Chemicals spending can be categorized within the following segments: Petrochemicals, Plastics and Fibers, Inorganic Chemicals, Fertilizers, and Specialty Chemicals. Approximate spending in each of the areas is shown in Figure 2:

Figure 2: PAS Spending Chemicals in 2006 – TOTAL $3.05 Billion

PETROCHEMICALS SEGMENT SUMMARY

Petrochemicals are organic chemicals derived from petroleum or natural gas. Oil refineries and natural gas processing plants provide the feedstock, which ranges from methane and ethane to higher molecular substances such as naphtha and gas oil. Methane is used for the production of methanol and ammonia. NGLs such as ethane, propane and butane are cracked at high temperatures to yield primary petrochemical building blocks such as ethylene, propylene, butylenes and butadiene. Cracking crude

3 Automation for the Process Industries Worldwide Outlook – 2007 ARC report
oil based feed stocks such as naphtha or gas oil yields higher ratios of the ethylene co-products propylene, butylenes and butadiene plus the aromatic products benzene, toluene and xylenes. Primary petrochemicals are reacted to form chemical intermediates and monomer derivatives.

The Petrochemical industry converts refinery products such as naphtha, liquid gas (LPG), and heavy gas oils into the following basic and intermediate organic chemicals:

- **Primary petrochemicals**: Through the application of heat and pressure or by reaction with other raw materials the petrochemical feedstock is converted into primary petrochemicals. Some examples include:
  - Olefins: ethylene, propylene, butylene, butadiene,
  - Aromatics: benzene, toluene, xylenes and
  - Methanol.
- **Intermediate petrochemicals**: They are generally produced by chemical conversion of primary petrochemicals to form more complex basic petrochemical products. Examples of intermediate petrochemicals are: ethylene oxide, ethylene dichloride, acrylonitrile, phenol, cyclohexane, propylene oxide, styrene, purified terephthalic acid, vinyl chloride, etc.

Figure 3 shows how the primary and intermediate petrochemicals relate to each other.
INDUSTRY CHALLENGES

Many Petrochemicals manufacturers like you are facing significant challenges while competing in a global marketplace. With increased competition and rising feed stock prices for many petrochemical products, there is renewed interest in improving and sustaining the performance of existing assets. As an established producer, the challenge comes from increased capacity coming on-line in regions with significant cost advantages, forcing you to focus relentlessly on reducing costs while serving your customers better. Plants in mature regions where demand growth is low are being asked to reduce costs, while in developing regions large capacity increases occasionally outstrip demand.

Meanwhile, workforce reductions and increasingly complex technology are making it harder to retain the necessary skill sets in mature markets or to establish those skill sets in evolving markets. You realize that you must continue to address ever more stringent environmental and safety mandates. To meet business demands, it is critical that your business and plants collaborate to squeeze as much agility and efficiency as possible out of the available assets. Honeywell has systems, applications and services that address the continual changes in the petrochemical market space.

The top tier manufacturing companies are responding to these challenges by addressing a variety of needs that will improve their safety, reliability and efficiency – as shown in Figure 4.

Figure 4: Safety Reliability and Efficiency wrt Need Functionality

- **Efficiency**
  - Improve Productivity, Reduce Cost
  - Optimize the Supply Chain
  - Improve Workflow
  - Measure Performance
  - Improve Process Performance

- **Reliability**
  - Improve Availability
  - Increase Process Availability
  - Operate Consistently
  - Improve Asset Management
  - Enhance Asset Lifecycle

- **Safety**
  - Protect People, Assets & Environment
  - Improve Emergency Response
  - Reduce Human Error
  - Reduce Equipment Failures
  - Maintain Stable Control
  - Maintain Secure Facility
SAFETY

Plant managers consider safety to be their highest priority because safety-related incidents can cause injury to personnel, equipment, and the environment, as well as interrupting production. To mitigate these risks it is important to consider safety from all aspects of a plant’s operation. Plant safety today requires a comprehensive approach including managing operator effectiveness, constant monitoring of distress indicators, personnel tracking and mustering applications, and ongoing asset monitoring and maintenance for asset health.

Well designed procedures and well-trained operators help reduce human error that can cause plant upsets. On the rare occasions that an incident does occur, rapid detection followed by quick and decisive action is critical. You know how important it is that your safety system automatically acts to protect your plant and that everyone knows what they should be doing and where they should be. You need multiple layers of protection that can first help you avoid the incident, then, if that fails help mitigate the impact and in the final event help protect your people and assets.

In addition to the inherent risk associated with operating petrochemical facilities, in today’s challenging times, many have been identified as potential targets for terrorist activity. You have to be able to anticipate and respond to threats both against the physical plant and against the process control network. In terms of physical security, this means being able to monitor your perimeter and all access points including waterways – and be able to respond quickly to an intrusion. It means knowing where all your people and any visitors are at any time and being able to quickly get them to a mustering point in the event of an emergency.

In terms of cyber security, you realize that insufficiently protected networks can leave you open to attacks from viruses, denial of service attacks and other network issues. You have to think about security as an integral part of the network design; how the process control network can be protected from the broader business network without losing necessary communication links. Even though new technology such as wireless protocols make more data available at lower costs, so can these same technologies make your network less protected if they are not introduced with security in mind.

RELIABILITY

In mature regions, like the US and Western Europe, companies like yours are facing the loss of experienced people, while in developing regions like China and the Middle East, you may find it hard to hire experienced staff. In all regions this makes it more difficult to achieve consistent, reliable, safe production. As a result it is critical to capture best practices that provide a foundation for future operations. As plants become more integrated in terms of heat and material balances, an upset in one area can quickly spill over to others. Therefore consistent execution of infrequent tasks such as a furnace decoke is vital to maintaining operational excellence.
You also recognize that maximizing and maintaining process and equipment availability is necessary to achieve your production targets. It is impossible to implement a quickly changing production plan if the changes in operating mode result in the product quality going off-spec. Likewise, using optimization strategies to maximize throughput will not capture benefits if they also cause a compressor trip. You need to be able to recognize how hard you can push the unit without risking the integrity of key pieces of equipment and to be able to accurately plan for equipment turnarounds as they become necessary. This requires a tight connection between process data and equipment health monitoring so that boundary limits are recognized even though operating modes and equipment demands are constantly changing.

EFFICIENCY

Manufacturers, like you, are focused on making the most effective use of the capacity they have at their disposal and delivering the lowest manufacturing cost per pound of product. New plants have much larger capacities to gain economies of scale and are often located in regions where feed-stock is cheap and abundant. Existing plants add capacity incrementally and manufacturers focus on operational efficiency to minimize off-spec, minimize energy consumption and maximize yields of the most valuable products.

You have to make sure that you have a good plan to do the right things to impact your business results. Then you need to make sure that you execute that plan as efficiently as possible. But you know that the only way that you can compete with plants with, for example, feedstock cost advantages, is by constantly striving for improvement – measuring how well you have done and looking for ways to do it better next time.

As the industry focuses on driving down costs, rationalization of assets and consolidations have occurred so that only the larger plants can remain competitive. Since the price of many bulk petrochemical products depend upon the price of downstream end products like polymers, many producers are increasingly integrating their supply chain both upstream and downstream to make sure that they have a low cost source of feed-stock and that they can realize greater margins through the sale of end use products. The opportunity exists, but it requires a better understanding of your supply chain and improved workflow practices to really take advantage.

As the cost of raw materials increases, alternative routes to petrochemicals are being developed or resurrected. Regions that have limited availability of crude oil and/or natural gas are turning to other raw materials, such as coal, as a starting point for producing chemicals. Others are considering different reaction paths, such as Methanol to Olefins to produce desired products at the lowest possible cost. You have to use your increased focus on achieving operational excellence to manage the introduction of new technology; integrating and supporting it so that it helps achieve your operating goals.
Honeywell Automation and Control Solutions is the leading provider of a complete automation and security solution for the petrochemicals industry. More than 50% of the world’s ethylene production and more than 30% of the world’s polyolefins production is controlled by Honeywell products while 70% of the world’s aromatics production is licensed from UOP, a Honeywell company. Honeywell’s solutions, anchored by the Experion Process Knowledge System allow petrochemicals manufacturers to improve their safety, reliability and efficiency while maximizing the lifecycle of their automation assets. In the following section you can see how Honeywell translates your requirements into solution sets that can help you meet your needs. Note that many of Honeywell’s solutions can address more than one area depending upon how they are applied so it is important to realize that there is not only one solution for each requirement.

Figure 5: Industry Needs and Honeywell Functionality

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4 Internal Honeywell and UOP Resources
FIELD SOLUTIONS

Honeywell’s Field Solutions portfolio is focused on bringing you increased value through a variety of differentiated sensors and solutions. Whether this means using Honeywell technically advanced smart field devices such as corrosion sensors, or our OneWireless mesh network to connect low cost wireless sensors and handheld data collection devices into a larger process control network, Honeywell has solutions that enable you to turn more information into knowledge across the plant, leading to optimized productivity, improved safety and compliance and asset reliability.

Examples of field solutions most relevant for petrochemical producers include:

- **Smart Transmitters** – Honeywell offers a broad range of pressure and temperature transmitters that deliver exceptional reliability, accuracy, and stability along with the industry’s best warranty.

- **Corrosion Sensors** – Honeywell’s unique corrosion sensor can help you to avoid costly equipment problems, to relate corrosion and pitting rates to process variables, and ultimately, to avoid costly capital caused by increased corrosion rates.

- **OneWireless Solutions** – Honeywell’s OneWireless universal mesh network supports multiple industrial protocols and applications simultaneously, providing a single wireless network that is simple to manage and efficient to operate. OneWireless helps optimize plant productivity and reliability, improve safety and security, and ensure regulatory compliance. Supporting both XYR 6000 and XYR 5000 wireless transmitters, this network delivers a global solution with robust security, predictable power management and multi-speed monitoring.

- **PKS Advantage Program** – This industry-unique program delivers open, integrated process knowledge solutions to our customers. Working with best-in-class suppliers of field measurement and control valve solutions, Honeywell collaboratively delivers solutions that allow you to choose the best devices for the job.

INDUSTRIAL SECURITY

In today’s challenging times, many kinds of industrial facilities have been identified as potential targets, including petrochemical plants. That’s why comprehensive security strategies for these facilities and other critical infrastructure are escalating in urgency worldwide.

Given these realities, you need a strong partner who can stand with you through the maze of challenges that you face in providing an effective security solution for your industrial sites. Honeywell understands that when it comes to something as important
and complex as the security of your industrial plant, your employees and perhaps even the surrounding community—the company that you choose to partner with is a critical decision.

Working across the various layers of protection, a plant or facility must operate in a secure and protected atmosphere, including protection of the perimeter, facility, people, and assets. With the correct work practices and technology in place, in the event that an abnormal situation occurs disrupting safe operations, an emergency response plan can be executed, controlled and monitored to minimize the impact of the incident.

Honeywell is uniquely qualified to deliver industrial security solutions because we have broad and unprecedented expertise in this area. We own chemical plants like yours and understand the importance of keeping these facilities safe and secure. We also appreciate the challenges you face when investing in security and meeting regulatory requirements. In addition, we have over three decades of experience in the process and automation control business and we are one of the world’s leading manufacturers of security products.

Honeywell’s Physical Security Solution includes a variety of solutions including:

- Security and Access Control
- Perimeter Monitoring and Fence line Detection
- Digital Video Monitoring
- Mustering Solutions
- Visitor Management
- Waterway Security and Radar Video Surveillance
- Fire and Life Safety Solutions

With physical security, we understand the need to include the protection of key assets such as property, people, and the environment. With cyber security, our concerns are focused on the preservation of different sets of criteria such as maintaining confidentiality of information, integrity of data and availability of systems.

Cyber Security is particularly important to industrial and petrochemical companies like yours that are reliant on process control systems. You have long understood that there is a difference between protecting facilities and data, and protecting processes that are operated or controlled with information technology. Security measures that are appropriate for business data networks will likely not be sufficient, and could be disastrous if a compromised process control network threatens to damage productivity, capital assets, and possibly human life.
Honeywell Process Control Network Security Services suite evaluates system vulnerability and risk, recommends appropriate changes, develops the best design for specific requirements, and implements that design.

EXPERION AS A FOUNDATION

Process information truly comes to life when it’s shared. We all know that having the right knowledge at the right time is the key to making the right decisions. But like most facilities, yours has probably grown organically—creating valuable, but independent, information silos. As an inevitable result, you and your people only ever see part of the whole picture. Meanwhile, simultaneously maintaining efficient operations, while gathering facility-wide data, making sense of it, and performing analyses can take weeks or months—by which time, situations have probably changed. It’s this ability to turn data into information, to support knowledgeable decision-making that makes the difference to your business performance. The Experion Process Knowledge System from Honeywell makes sense of everything. As a technology break-through, Experion is a process automation system like no other—integrating an advanced automation platform and innovative software applications to improve your business performance and peace of mind.

The Experion platform provides the foundation for the Experion Process Knowledge System, integrating all process control and safety management (including non-Honeywell systems) into a single, unified architecture. Robust and scalable, the Experion platform is built on Honeywell’s 30+ years of experience in delivering process control and safety system expertise. It takes customers well beyond Distributed Control System capabilities by providing next generation automation control through embedded decision support and diagnostic technology that drives information to the decision maker. The safety component maintains the security of an independent environment from the mainline control system, increasing security and system dependability. The result is a **unified automation platform** that elevates safety and process availability, as well as production and profitability.
Experion PKS delivers the following features that petrochemical producers like you find useful:

- **Common Protocol** – Experion’s ability to support redundant I/O for both Foundation Fieldbus, and Hart DE devices provide investment protection for customers that have existing facilities.

- **Highly Scaleable Architecture** – Experion can be used for both small applications (such as a small unit or a utilities plant) or with Honeywell’s patented Distributed System Architecture (DSA), it can also cover very large petrochemical complexes - allowing thousands of points to be seamlessly and easily connected together.

- **C300 controller** – The C300, takes the well-regarded C200 to even greater heights and is built with Honeywell’s typical attention to detail. Release 300 provides a faster more powerful and robust controller and embeds Honeywell’s proven and deterministic Control Execution Environment (CEE) software. Together with the new vertically designed Series C I/O, Release 300 minimizes
the control room footprint; reduces energy, installation and maintenance costs; and delivers optimum performance.

- **Control Firewall** – This protects critical systems from cyber security breaches and ensures system availability.

- **Integrated Safety System** – Safety Manager combines Honeywell’s proven Quadruple Modular Redundancy (QMR™) 2oo4D technology with over two decades of Honeywell process safety management expertise in integrating process safety data, applications, system diagnostics, and critical control strategies. Honeywell’s TUV IEC 61511 and IEC 61508 certified solution provides the optimal level of safety and process integration while still maintaining functional safety separation.

- **Integration of Experion with TPS** – While always well renowned for backwards compatibility to its older DCS, Honeywell, in focusing on continuous evolution, provides significant advantages in the completeness and simplicity of its seamless integration with TPS. All TPS data, events, and operator messages are incorporated into Experion, such that TPS appears as an extension of the Experion architecture.

Unifying people with process, business, and asset management, Experion helps process manufacturers increase profitability and productivity. It’s the only automation system that focuses on your people—making the most of the knowledge they hold. It’s a coordinated effort of better connecting your assets, optimizing your process, involving your people, and increasing your business agility.

Experion applications are a broad portfolio of advanced software applications designed to improve business performance and peace of mind. You can realize annual sustained benefits in the millions of dollars. Applications are uniquely configured to capture the domain knowledge of your people and display it in a systematic and useful way. Applications are tightly integrated with the Experion platform to create a best-in-class Process Knowledge System. Tight integration allows process knowledge to be shared across your organization for better decision-making, breaking down the silos of knowledge that can exist in a facility. Many Experion applications are platform independent to meet the diverse needs of customers around the world. Experion applications continue Honeywell’s 30+-year tradition of providing best-in-class advanced software to help improve your overall business performance.

**ASSET EFFECTIVENESS APPLICATIONS**

Honeywell Asset Effectiveness Solutions are aimed at one thing…increasing process availability. One of the primary ways to achieve this is to use your Experion system to pull asset, process and operator information into a common view to help identify problems early. This process—
centric approach to asset management helps make Experion truly unique. Experion breaks down barriers and proactively manages the health of all your assets. Not only does it monitor your equipment in real time, it also helps you discover the areas most likely to negatively impact performance, and in greatest need of repair.

Asset Manager provides a best-in-class infrastructure that allows your plant personnel to make key decisions that increase uptime and improve production quality. As a comprehensive decision support component of the Experion unified architecture, Asset Manager connects the right people across the supply chain with the right knowledge when it is needed, improving operational effectiveness and reducing maintenance costs.

Examples of asset effectiveness applications that are embedded into this infrastructure are:

- **Asset Scouts** – Honeywell’s Loop Scout service monitors your DCS based control loops, detects and prioritizes problems, intelligently diagnoses and resolves root causes, and proactively notifies appropriate personnel to take action.

- **Mobile Tools** – Honeywell’s Intelatrac system employs wireless technology to deliver reliable field data faster and more reliably to the right people. Intelatrac allows operators to perform computer guided field inspections and, instantly, make available to the Experion system, data that was previously stored on paper.

**PEOPLE EFFECTIVENESS APPLICATIONS**

Another key method of improving plant availability is avoiding human errors. You already know that your people are the best source of knowledge for improving business performance. Capturing and sharing it is what adds up to real results. Often however, significant legacy and anecdotal data resides locked-up in your personnel’s experiences. And in the absence of a facility-wide system, people are prone to focus knowledge exclusively on the area most familiar to them. Worse still, studies show 25% of plant incidents are caused or made worse by operators who simply didn’t have access to the data they needed to succeed.

Experion helps everybody have the information they need to be most effective. It is the only automation system that embeds advanced application technologies based on research by the Abnormal Situation
Management (ASM®) consortium. Our open, collaborative decision support tools help to prevent abnormal situations and minimize disruptions by allowing your operators to reliably and systematically make sense of alerts, detect faults and probable causes, and implement corrective measures early.

Inevitably, though, incidents do occur and it is then that the operator needs to get the right information as quickly as possible. Honeywell offers solutions that reduce the number of alarms that require operator intervention and help to maintain and enforce alarm limits. These applications work with the control system to ensure that the correct alarm limits are enforced for the current production order. At the same time they are linked to the process so that they are consistent with production safety limits, equipment constraints, operational targets, corrosion limits and other limits for each mode of operation or product in your plant.

Whether you are operating an existing plant with an aging workforce about to retire or starting up a brand new facility and looking to hire new operators, making sure that you have a skilled workforce with the right qualifications and domain knowledge is critical to improving and sustaining plant profitability.

Honeywell’s UniSim Operations Suite provides a dynamic simulation solution that can help you train and develop operators on procedures and systems that are safe, tested and optimized prior to being exposed to the real plant. Our dynamic simulations and learning management systems assess an individual operator’s readiness by testing against tailored exercises representing real process upsets. In this way an operator can practice responses to abnormal situations such as a furnace shutdown or a breakthrough in an absorption unit. Such assessment will give your team the confidence that your procedures have been validated against the dynamic behavior of your process and controls.

**PROCESS PERFORMANCE APPLICATIONS**

Optimization can often mean running the plant outside of your operator’s comfort zone. More than simply pushing your facility to its current limits, Experion addresses your entire manufacturing process, and identifies ways to safely enhance production results through facility wide process optimization. More than likely, there are hidden opportunities in your system. Honeywell can help take advantage of them, achieving optimal process control and profitability. Achieving peak performance safely is the overall goal. As a result of actively managing and raising process performance through Experion, you’ll improve efficiencies, maximize production, and optimize the return on your investment.

To improve plant process performance you must first achieve consistent product quality and then drive for improvement. If economics demand increased production, advanced process control and optimization applications can work to remove bottlenecks in the reactors, feed purification towers, cracking furnaces, etc. At other times, advanced controls can improve the production yields without, for example, affecting furnace run-lengths, through tighter control of furnace conditions. In addition to increasing
production and reducing operating costs, advanced process control strategies also control the purity of products and by-products.

Honeywell’s Advanced Process Control (APC) and Optimization solution (Profit Suite) employs a unique layered approach to advanced control and optimization—an approach that effectively matches your plant needs with the appropriate, scaleable optimization solution. Profit Loop is a single input/single output (SISO) model predictive control application specifically designed with the operating simplicity of a standard PID controller. Because Profit Loop is tightly integrated with Experion, you can incorporate Profit Loop into complex and custom control strategies, driving better control of your processes. Profit controller is based upon Honeywell’s patented Robust Multivariable Predictive Control Technology (RMPCT) and it is ideal for unit-based advanced control such as the cracking in the furnaces or the quality and production leaving the purification section. At the upper level, Profit Optimizer can link several multivariable controllers to cover a broader process area stretching across multiple units. Combined with a first principles plant model, this optimization level can provide non-linear dynamic optimization for large petrochemical plants such as ethylene or aromatics complexes.

Even where advanced control applications are not justified, Honeywell provides Operations Monitoring tools for your operations department to establish the engineering limits and constraints, to monitor performance against those limits, and to follow-up on performance problems. This allows you to see how well the plant is performing and categorize deviations that have occurred in order to support a continuous improvement process.

Procedural Operations integrates best practices for batch turnarounds, system startup, and shutdowns to improve operator performance and reduce cycle times. Designed with members of the Abnormal Situation Management Consortium, Procedural Operations software and services prevent downtime by capturing knowledge gained by your operators over years of performing cyclic procedures – knowledge that would otherwise be lost as the workforce transitions.

**BUSINESS AGILITY APPLICATIONS**

Improving your business performance means not only running your plant more efficiently but running your whole business more efficiently. As you try balance your customers’ requirements with your inventory levels you realize that when you act on timely and accurate information, you get better results. You need to be able to decide quickly whether your plant can profitably make a newly submitted order and how that
will impact the rest of your production schedule. You also need to be able to get that information to the plant on time. Experion helps make your facility a true business engine that’s tuned to proactively respond to opportunities as they arise. With Honeywell’s set of business agility applications, you have access to comprehensive performance data in real-time. Our applications also tightly interface with business software, to deliver robust business analysis and execution. We’ll help you manage the manufacturing process from planning and scheduling through the entire supply chain.

Many petrochemical complexes make relatively few high purity commodity products that are often intermediates for further processing in downstream units. Honeywell’s planning solutions allow you to select the right combination of feedstocks at the right price to make the optimal mix of products. As prices change or customer demand alters, you can quickly adjust your production mode to meet the new requirements.

Once the production plan has been determined, it now has to be scheduled into the plant operation. Honeywell’s Production Scheduler automatically calculates a set of logistically feasible solutions that will meet constraints associated with inventories, production limits, receipts and withdrawals, and finished product qualities. Instead of being satisfied with finding a single feasible solution, you can now look to see which of the feasible solutions is optimal.

At the same time, it is vital that changes in the plants capability to produce particular products are reflected back into the production schedule. A shutdown in a unit, or a drop-off in yield cased by a process upset can be readily incorporated and may result in a new production schedule being generated.

As you focus on operational excellence, you realize that you must strive for continuous improvement. Honeywell can help you collect the appropriate metrics around your operation to help you perfect your performance. KPI Manager automates the collection of both target and actual values from a wide-variety of production and business systems; then calculates and reports the actual performance throughout the business – via intranet. KPI results can be calculated and reported on an ongoing basis – even before the official measurement period is complete. Production Balance and Production Analyst enable the comparison of planned production versus actual. This leads to an improved planning model and a better understanding of the plant’s true capabilities.

**AFTERMARKET SERVICES**

To truly improve your business performance, you know that whatever automation solution you choose that it must sustain and increase benefits throughout its lifecycle. Honeywell Process Solutions is a trusted service provider to petrochemical industry, offering the needed expertise to improve safety, reliability and efficiency. We can provide you with the competitive advantage you need by improving
your asset and operator effectiveness, and deliver superior process automation solutions.

What’s more, Honeywell pioneered the co-sourcing structure within the automation industry. Our proprietary methodologies both sustain and accelerate the benefits of your automation investments—yielding results up to five times faster than under a traditional bid-project structure.

No one makes your automation investments pay off like Honeywell Process Solutions. Honeywell is the only automation services provider that continues to support products developed and installed over 30 years ago—third-party systems as well as previous Honeywell products. Honeywell’s unique combination of Experion technology and continuous lifecycle support lets you decide how much longer you want to maintain your existing system and what new components you want to invest in.

When you do decide to migrate, Honeywell’s focus in delivering the solution is to understand the areas of opportunity for our customers and tailor the solution to deliver value. Most plants have existing applications in place. Honeywell will work with the customer to assess the value opportunity, determine the components of the solution that have the most value and determine an implementation plan to achieve and sustain the value.

Figure 7: Capital vs. Value Project relationship

Figure 7 indicates an ideal value curve. Some key characteristics worth noting:
**Scope** – Honeywell will work with you to determine the best implementation plan to minimize time to value and optimize the use of capital. Honeywell’s innovative co-sourcing program combines your staff’s process knowledge with our automation industry experts to design solutions, based upon Six Sigma best practices, that will improve efficiency and maximize your plant’s profitability.

**Delivery** – Honeywell is able to leverage deep domain expertise on a global basis to help deliver consistent solutions. With more than two thousand trained and experienced engineers around the globe, Honeywell has completed successful control system installations in nearly 100 countries. Honeywell’s Project Engineering Services can provide the planning, design, construction management, implementation and startup services needed to deliver complex process control projects on-time and on-budget, with minimal downtime. Our documented track record of 98%+ on-time and on-budget delivery says it all.

**Sustained Value** – Honeywell provides services to help you sustain the value from your installed solution. Frequently, without this support, the value will decay over time. Preventing equipment failures and resolving problems quickly are the keys to consistent performance. Honeywell can help with proactive component monitoring and maintenance services that boost performance, extend component lifecycles, and lower your overall cost of ownership. Installations supported by Honeywell typically experience maintenance cost reductions as high as 30%. Experience such as ours can only advance your business if it’s backed by a dedication to excellence. That’s why we invest heavily in the knowledge development of all Honeywell personnel serving our customers, and why we staff our support centers around the world with technical experts who average more than 20 years of experience in the business of process automation. Honeywell also provides applications and support to help sustain your software applications. For example Profit Expert monitors the performance of your Profit Controller applications, determines whether they are working towards maximizing unit profitability and can identify when controller models need revising.

**Continuous Improvement** – by providing better information, Honeywell’s integrated solution enables you to build on the improvements made and look for additional areas of opportunity. Many companies have made significant improvements based on the heroic effort of individuals. Sustaining these gains without improved tools and processes can be very difficult and time consuming – leaving little time for additional efforts. We can think of a continuous cycle of planning, execution (perform) and improvement (perfect). In order to make this more systematic, we need additional information such as Key Performance Indicators (KPIs) that cover business metrics such as sales, customer service metrics, delivery metrics, safety, etc and manufacturing metrics such as availability, production rate, energy consumption, product quality, etc. Using tools developed out of our infused Six Sigma culture, Honeywell helps you move from
collecting and scrubbing data to using information that can help you institute best practices and achieve operational excellence.
PETROCHEMICAL SOLUTION EXAMPLES

In the following section, you can see examples of how Honeywell has solved a variety of petrochemical industries problems. A small subset of Honeywell’s experience, they have been chosen to enable you to see the broad cross-section of industries and solution sets that have been implemented over the years. Honeywell has implemented solutions in other primary and intermediate petrochemicals such as: ethylene, propylene, butadiene, aromatics, MTBE, acetic acid, acrylonitrile, ethylene oxide, ethylene dichloride, propylene oxide, phenol, cyclohexane, vinyl chloride, cumene, phenol, isocyanates, terephthalic acid, and many others.

PETROCHEMICAL COMPLEX MIGRATION TO EXPERION PKS

At its petrochemical plant in Argentina, Petrobras realized a number of significant benefits as a direct result of its migration to Honeywell’s Experion® Process Knowledge System (PKS). With a site containing a mixture of pneumatic controls and older DCS technology, Petrobras was experiencing poor process availability with difficult and costly maintenance. The resulting migration to Experion PKS, enabled Petrobras to improve process availability due to the robustness and reliability of the new system. They were able to train operators quickly on the new system so that they could take advantage of the greater integration of information across the complex and achieve increased productivity.

After an exhaustive review of automation solutions, Petrobras chose Honeywell’s Experion PKS. “The other products we evaluated didn’t even compare to Experion PKS in terms of communications, redundancy, architecture and safety system integration features,” said Fabio Fazio, Senior Maintenance Leader at Petrobras.

“With Honeywell’s help, we had a successful migration done in hot cutover with zero hours of lost production and zero abnormal situations,” concluded Fazio. “Due to the success of our Experion migration, Petrobras is now investigating other Honeywell solutions.”

PETROCHEMICAL COMPLEX OPERATOR TRAINING SIMULATION

At the SECCO petrochemical complex in Shanghai China, primary consortium members BP and Sinopec faced two major challenges.

- Since 50% employees of SECCO directly come from schools and universities, the whole force is relatively young and there is a general lack of experience.
- The entire project schedule was very tight and they realized that Operator Training Simulation (OTS) would play a vital role in the designing, construction and test running of the project.
SECCO felt that Honeywell had both the technical capability and the resources to deliver a very large OTS program over a very short timeframe. The contract was awarded for the delivery of operator training simulators for nine units, including ethylene, aromatics, styrene, polyethylene, polystyrene and butadiene.

Paul Bowdler, SECCO Production Director said that the OTS systems helped the operators to very quickly learn the units, enabling them to reduce their test run time for each unit by several days - a huge efficiency improvement to a complex as large as SECCO Shanghai.

One reason that the program was successful was because of Honeywell’s ability to commit global resources to it. In addition Honeywell were able to maintain close cooperation with other parties such as the SECCO staff and the engineering contractors involved in complex startup.

SECCO has initiated a continuation phase to the program whereby Honeywell will provide upgrade support and services to all the OTS systems. SECCO recognizes the need to maintain the simulators so that they reflect changes in the plant configuration. They want to be able to re-train operators as things change in order to maintain the safe and reliable workplace that they have established.

**PETROCHEMICAL COMPLEX PLANNING AND SCHEDULING**

Shanghai Petrochemicals (SPC) chose Honeywell to provide tools that would help them with feedstock selection for their refinery and petrochemical complex. They wanted to know what crudes they should run to maximize the profitability of their key refinery products as well as the ethylene, aromatics and butadiene products from the petrochemicals complex. SPC import 60-70% of their crude and as they had recently revamped their ethylene plant, they saw an opportunity to reduce costs of feedstock purchase while maximizing the complex profitability.

Honeywell implemented a planning model in RPMS of their two crude units, diesel production facility, two ethylene plants and an aromatics complex. They included their crude ASSAY application to allow SPC to identify the effects of different purchased crudes and also allowed them to choose what naphtha was fed to the ethylene crackers.

The result of the planning model to allowed SPC to increase profitability of the whole complex by 15%. This was achieved by helping them realize the value of buying lower cost naphtha and of feeding atmospheric gas oil (AGO) to the ethylene plants rather than selling it as diesel.

**PETROCHEMICAL COMPLEX ASSET MANAGEMENT**

SASOL, South Africa had a vision of how they wanted to leverage their investment in the HART enabled equipment purchased for their latest plants. Part of that vision also included a complete Asset Management strategy. Honeywell was able to deliver on this...
vision and was instrumental in providing and integrating various solutions from several providers resulting in the following benefits:

- Prevented three plant trips resulting in more than $1M cost savings
- Removed only those valves that should be removed from plant saving more than $100K
- Detected faulty or poorly optimized valve positioners resulting in $300K savings
- Captured changes on audit train of investments
- Reduced download time on settings when changing transmitters
- Reduced maintenance costs
- Empowered workforce to make critical decisions

Johan Claassen, Engineering Manager at SASOL said “We have had a long successful relationship with Honeywell and they knew how to help us remain at the forefront of technology – by implementing solutions that will continue to improve preventative maintenance technologies in the instrumentation field. We continue to work with Honeywell to develop solutions to tap the full potential that lies in HART field devices and expect to continue to reduce downtime and improve plant performance.”

ADVANCED CONTROL ON VINYL CHLORIDE

Formosa turned to Honeywell for help when they realized that, as their VCM plant in Point Comfort, Texas, grew in size, it also increased the complexity of operation. Honeywell’s Advanced Control Solution for VCM uses Honeywell’s flag-ship product, Profit Suite, designed to maximize a plant’s profitability.

Advanced Control applications for the VCM plant include those for the direct chlorination and oxychlorination reactor sections, the ethylene dichloride (EDC) purification section, the EDC cracking furnaces, and the hydrochloric acid (HCl) and VCM purification section.

As an example, In the EDC cracking furnaces (the heart of the VCM plant) Profit Controller:

- controls the overall VCM production rate by setting targets for EDC conversion.
- increases the stability of furnace operation by maintaining EDC conversion on each pass to a desired profile.
- maximizes run-length by controlling relative furnace pass coking rates to a desired profile.
• lowers operating costs by minimizing furnace air usage.

The furnace APC strategy directly incorporates within the multivariable controller a rigorous kinetic model, EDC CRACK from Technip, that provides predictions of EDC conversion, coking rates and maximum TMTs from inputs of feed flow and composition, coil inlet and outlet temperature and coil inlet pressure.

Honeywell implemented Profit Controller and EDC CRACK on each of their 5 furnaces (four liquid feeds and one gas feed) and also on the two downstream HCL recovery columns.

The results of the Formosa control project were:

• Increased VCM production and stability of unit’s operation
• Increased overall EDC cracking depth (conversion) and controlled to a target to help maintain relative furnace pass coking rates to a desired profile
• Reduced energy consumption in terms of furnace fuel gas and steam per pound of VCM produced
• Improved selectivity towards VCM production versus unwanted byproducts.

AROMATICS APC WITH UOP

Malaysia’s PETRONAS Penapisan Sdn Bhd, known as PP(T)SB, contracted Honeywell to implement complex-wide advanced process control (APC) to help maximize production of paraxylene and maintain product quality. Honeywell implemented a series of advanced control applications incorporating UOP process modules across the complex, resulting in a 2.5 percent increase in overall aromatics production and a reduction in energy consumption.

PP(T)SB appreciated that Honeywell’s APC technology could help maintain product quality and maximize effective capacity. The company also felt that by designing the APC strategies early, they would reduce costs by ensuring the correct instrumentation was in place as the unit was being constructed.

Honeywell used its extensive expertise to implement multivariable control solutions using Profit Controller on each of the units in the aromatics complex. By working with UOP, Honeywell incorporated UOP process models into the Profit Controller applications. A total of 12 Profit Controller applications were implemented which incorporated several UOP process models around the CCR, Tatoray and Isomar units into the overall control strategy.

“We are seeing the benefit from the APC program within two years of plant start-up which has considerably increased the complex profitability and provided a focal point for plant improvement,” said Kamrul Arrifin, Process Control Group Leader, PP(T)SB.
CONCLUSION

Honeywell is the leading supplier of automation and security solutions to the petrochemical industry in almost 100 countries around the world.

Find out how Honeywell can help increase safety, reliability and efficiency at your plant today.

For more information about Honeywell’s solutions for Petrochemical producers, visit our website at www.honeywell.com/ps or contact your Honeywell account manager.

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APPENDIX – HONEYWELL PRODUCTS

The following sections describe some of the products used by Honeywell to provide solutions to the Petrochemical Industry.

FIELD SOLUTIONS

Honeywell Pressure and Temperature Transmitters

Honeywell’s pressure transmitters encompass a complete line of differential pressure, absolute pressure, gauge pressure, draft range, remote seals, and level transmitters. Honeywell’s new Lifetime Transmitters™ for pressure measurement offer unsurpassed accuracy, stability, reliability, and rangeability as well as the industry’s best warranty.

Self-diagnostics and two-way communications greatly reduce the time and expense associated with start up and maintenance. Honeywell’s technically advanced instruments offer big advantages for improving a process, meeting regulatory compliance, and attaining high quality standards.

Honeywell’s Smart Temperature Transmitters meet a broad range of temperature measurement needs. With three product lines — STT350, STT250, and STT150 — the STT 3000 portfolio can meet the price/performance requirements of almost any application. Honeywell’s top-of-the-line Lifetime Transmitters™ for temperature measurement deliver exceptional reliability, accuracy, and stability along with the industry’s best warranty.

Wireless Sensors

Honeywell has a broad suite of differentiated sensors. Honeywell’s XYR 5000 suite of wireless sensors can help you to reduce the cost of installation of new sensors, allowing you to improve process efficiency and to reduce cost – all without wiring or external power.

XYR 5000 Wireless Transmitters break down the barriers to monitoring variables in areas where traditional hard-wired transmitters are too costly, difficult or time consuming to implement. These instruments are designed for applications with no access to power, that are remote or difficult to access, that require frequent changes in instrumentation schemes, or where manual readings are typically taken.
The Honeywell XYR 5000 family includes instruments for accurately monitoring gauge pressure, absolute pressure, differential pressure, temperature, and ultrasonic noise (for detecting steam and gas leaks). The line also includes an analog input interface for adding wireless capabilities to 4-20 ma devices, a discrete inputs and outputs option and optional external antennas.

**Honeywell Corrosion Sensors**

Another differentiated sensor that Honeywell provides is our unique Honeywell corrosion sensor. The process industry spends an average of US$50 billion a year on corrosion problems that can hinder their abilities to operate at optimal levels. Honeywell’s unique corrosion sensor can help you to avoid costly equipment problems, to relate corrosion and pitting rates to process variables, and ultimately, to avoid costly capital caused by increased corrosion rates.

**PKS Advantage Program**

With the PKS Advantage Program, Honeywell and its program participants work together to identify, understand, apply and integrate the domain knowledge of field devices and plant assets with Honeywell’s Experion systems. This industry-unique program delivers open, integrated process knowledge solutions to our customers. Working with best-in-class suppliers of field measurement and control valve solutions, Honeywell collaboratively delivers solutions that allow customers to choose the best device for the job. When adding a PKS Advantage Partner device to Experion, the device is automatically discovered and added to Experion’s asset information. Then, fault and symptom models can be automatically uploaded to the Experion Asset Management System, Asset Manager.

Honeywell’s PKS Advantage partners are shown below:

Advantages for Honeywell customers include the freedom to choose from a wide number of vendors and the assurance that devices from PKS Advantage partners will integrate into Experion easily.

**CONTROL SYSTEMS**

Experion PKS is a process automation system like no other — integrating an advanced automation platform and innovative and integrated software applications to improve your business performance and peace of mind. Unifying people with process, business, and asset management, Experion helps process
manufacturers increase profitability and productivity. It’s the only automation system that focuses on your people — making the most of the knowledge they hold.

By integrating disparate data across your facility, making the most of your resources and people, and feeding it all into a unified automation system, you can achieve an operation that’s more proactive, efficient, and responsive. It’s a coordinated effort of better connecting your assets, optimizing your process, involving your people, and increasing your business agility.

Process information truly comes to life when it’s shared. We all know that having the right knowledge at the right time is key to making the right decisions. But like most facilities, yours has probably grown organically—creating valuable, but independent, information silos. As an inevitable result, you and your people only ever see part of the whole picture. Meanwhile, simultaneously maintaining efficient operations, while gathering facility-wide data, making sense of it, and performing analyses can take weeks or months—by which time, situations have probably changed. It’s this ability to turn data into information, to support knowledgeable decision-making that makes all the difference in your business performance. The Experion™ Process Knowledge System (PKS) from Honeywell makes sense of everything. As a technology break-through, Experion is a process automation system like no other— integrating an advanced automation platform and innovative software applications to improve your business performance and peace of mind.

The Experion™ platform provides the foundation for the Experion Process Knowledge System (PKS), integrating all process control and safety management (including non-Honeywell systems) into a single, unified architecture. Robust and scalable, the Experion platform is built on Honeywell’s 30 years of experience in delivering process control and safety system expertise. It takes customers well beyond Distributed Control System capabilities by providing next generation automation control through embedded decision support and diagnostic technology that drives information to the decision maker. The safety component maintains the security of an independent environment from the mainline control system, increasing security and system dependability. The result is a unified automation platform that elevates safety and process availability, as well as production and profitability.

Experion is extremely scaleable – it can be used for both small applications (such as a small unit or a utilities plant) or with Honeywell’s patented Distributed System Architecture (DSA), it can also cover very large systems - allowing thousands of points to be seamlessly and easily connected together.
**Experion Release 300.** Experion™ R300 is a reshaped and enhanced version of the field-proven automation and control platform hardware and software of the Experion™ Process Knowledge System (PKS). This latest release is another example of Honeywell’s ongoing commitment to continuously innovate and provide best-in-class solutions that protect customers’ existing investments.

**SAFETY SYSTEMS**

Safety Manager combines Honeywell’s proven Quadruple Modular Redundancy (QMR™) 2oo4D technology with over two decades of Honeywell process safety management expertise in integrating process safety data, applications, system diagnostics, and critical control strategies.

Honeywell’s TUV IEC 61511 and IEC 61508 certified solution provides the optimal level of safety and process integration while still maintaining functional safety separation. Through operational integration with
Experion, safety systems are unified into one safety system architecture, assuring a unique opportunity to improve both safety and process availability.

Experion provides unprecedented connectivity through all levels of process and business operations to optimize work processes, improve routine maintenance efficiencies, enhance safety management, and release personnel from manual processes. Safety Manager delivers the following benefits:

- **Safe and Secure** – Every Safety Manager includes a safety firewall to protect the critical Safety Instrumented System (SIS) layer of protection from cyber attacks and disruption of service.

- **High Availability Architecture** – Honeywell’s field proven QMR 2oo4D architecture provides the highest availability with a fail-to-safe architecture. Applying the proven-in-use QMR technology allows uninterrupted process operation in the event of any system degradation.

- **Easy, Intuitive, Error-Free Engineering and Modifications** – Safety Builder, an intuitive and comprehensive configuration tool, provides plant-wide management of safety-critical databases and application programming with safety built inside. Designing safety networks has never been easier. TUV-approved, menu-driven online modifications prevent errors while maintaining the systems.

- **Operational Integration** – Experion Safety Manager delivers best-in-class integration developed with over a decade of experience in providing integrated safety systems.

- **Defense-in-Depth** – SafeNet™ and remote distributed Safety Manager provide the ability to design unparalleled defense-in-depth safety strategies that maximize safety and security while minimizing risk and scope-of-loss concerns that come with traditional remote I/O technologies.

**PLANTWIDE HISTORIAN**

Honeywell’s Uniformance® Process History Database (PHD) collects, stores and replays historical and continuous plant process data, which makes timely data visible at the production level and enterprise-wide. PHD’s timely data empowers plant staff to better align, plan, execute and improve business performance.

The Uniformance PHD infrastructure supports integrating existing control systems and applications across multiple plants and sites. Its seamless data interfaces, data collection fail-over and automatic history recovery ensure maintenance of vast amounts of data in long-term history to enable user access and application integration.

In addition to collecting and consolidating potentially massive amounts of process data, PHD provides the rich historian features needed to transform data into knowledge. PHD’s calculated tags allow users to apply engineering and business knowledge to current and historical data, while built-in engineering unit conversions help users view...
data in a format that makes sense to them. Process data may be combined with business data to provide a view of the entire operation.

Uniforce PHD release 210 integrates with Honeywell’s Experion® Process Knowledge System (PKS) R300 to create a solution that requires less administration and greater data integrity than is possible with any other plant historian. Experion integration features include:

- Tag synchronization ensures the right data is being collected, without the need for costly, error-prone manual configuration.
- Integrated PHD/Experion links ensure that operator history data and advanced history data is consistent, while creating minimal data collection load.
- A new PHD system can be installed, have its tags automatically built and be collecting data all in the same day.

Benefits of Uniforce PHD include:

- **Scalable**: PHD’s distributed architecture ensures that data may be collected from disparate data sources into a single consistent database. A PHD database may start out small and be expanded to handle hundreds of users and hundreds of thousands of tags.
- **Secure**: PHD provides support for commonly required firewall configurations and protects historical records from unauthorized access.
- **Robust**: PHD provides data collection and history recovery features to ensure availability of complete data records, even after data collection interruptions.
- **Open**: PHD has interfaces to collect data from numerous Honeywell and third-party data providers.

Meeting the external regulatory demands placed upon process industries can be costly and time-consuming. Uniforce PHD helps meet regulatory expectations by allowing the uninterrupted collection of all critical data and securing data from unauthorized tampering.

**PROCESS PERFORMANCE APPLICATIONS**

Optimization means more than running in your comfort zone. More than simply pushing your facility to its current limit, Experion addresses your entire manufacturing process, and identifies ways to safely enhance production results through facility wide process optimization. More than likely, there are hidden opportunities in your system. Honeywell can help take advantage of them, achieving optimal process control and profitability. Achieving peak performance safely is the overall goal. As a result of actively managing
and raising process performance through Experion, you’ll improve efficiencies, maximize production, and optimize the return on your investment.

To improve plant process performance you must first achieve consistent product quality and then drive for improvement. If economics demand increased production, advanced process control and optimization applications can work to remove bottlenecks in the reactors, feed purification towers, cracking furnaces. At other times, advanced controls can improve the production yields without affecting furnace run-lengths, through tighter control of furnace conditions. In addition to increasing production and reducing operating costs, advanced process control strategies also control the purity of products and by-products.

**Advanced Process Control and Optimization**

Honeywell’s Advanced Process Control (APC) and Optimization solution (Profit Suite) employs a unique layered approach to advanced control and optimization—an approach that effectively matches your plant needs with the appropriate, scaleable optimization solution.

**Advanced Regulatory controls**

Profit Loop is a single input/single output (SISO) model predictive control application specifically designed with the operating simplicity of a standard PID controller. This technology, which is tightly integrated into Experion PKS, is a Smith Predictor, gap controller, and optimizer all in one that is used to control discrete analyzers, tank levels, long process delays, and more. Profit Loop can reduce valve travel and wear, give you better control, and reduce the possibility of controller windup. Because Profit Loop is tightly integrated with Experion, olefins and polyolefins users can incorporate Profit Loop into complex and custom control strategies, driving better control of their processes. With such versatility you may never build another PID controller again.

**Model –based predictive control (MPC)**

Model based predictive controllers such as Profit Controller. Based upon Honeywell’s patented Robust Multivariable Predictive Control Technology (RMPCT), Profit Controller is ideal for controlling the cracking in the furnaces or the quality and production leaving the purification section.

**Dynamic optimization**

Profit Optimizer can link the MPC level applications to cover a broader process area(s). Combined with a first principles plant model, the optimization level can identify the different effects of increased cracking depth or increased throughput on conversion across multiple furnaces and as the plant
pushes up against capacity limits such as furnace firing limits, light ends purification column limits, etc.

Honeywell’s Advanced Control Solution for Olefins combines some or all the control layers listed above into a complete integrated package designed to maximize a plant’s profitability.

APC applications for an ethylene plant include those for the cracking furnaces, the primary fractionator and cracked gas compressor, the De-methanizer and cold box, the De-ethanizer, the Acetylene converter and the C2/C3 product purification section.

An example of how Honeywell’s Profit Suite applications achieve improved process performance is shown below.

In the cracking furnaces Profit Controller:

- Controls the overall feed rate to the multiple furnaces in operation.
- Controls the steam to hydrocarbon ratio in each furnace.
- Controls ethylene production by controlling to a target severity whilst honoring constraints such as maximum tube metal temperatures.
- Controls excess O2 in furnace flue gas to minimize furnace fuel consumption.

On top of the APC provided by Profit Controller, Profit Optimizer provides closed loop dynamic optimization to the overall olefins plant. The optimization strategy incorporates a rigorous kinetic model, SPYRO from Technip, which provides predictions of severity and product yields in each of the furnaces.

To achieve optimization benefits, Profit Optimizer:

- Maximizes production up against the plant’s physical constraints. This may be in the furnace, the cold box or in the back-end separation section.
- Optimizes product yield by maximizing the yield of the most valuable products while maintaining furnace run length.
- Optimizes energy consumption by trading off energy costs against product recoveries and capacity.
Procedural Operations

Procedural Operations integrates best practices for batch turnarounds, system startup, and shutdowns to improve operator performance and reduce cycle times. Designed with members of the Abnormal Situation Management (ASM®) Consortium, Procedural Operations software and services prevent downtime by capturing knowledge gained by operators over years of performing cyclic procedures – knowledge that would otherwise be lost as the workforce transitions. Preserving this knowledge is critical: An ASM Study concluded that 14 percent of all incidents were partly attributed to improper execution of operating procedures as a contributing factor; one site even reported a $12 million loss during four years.

Procedure Analysis

Honeywell’s Procedure Analyst provides reporting and analysis for Procedural Operations. It is focused on providing key process operations benefits:

- Comprehensive procedure execution reporting for quality and tracking
- Continuous process improvement through identification of procedure execution issues
- Early identification of quality problems or deviations from golden procedures for consistent execution and operational effectiveness
- Timely comparison and analysis across procedure executions for improved process performance, optimization and adherence to operational best practices

Procedure Analyst uses events generated by the phases within transition procedures to track progress. In addition, process history can be related to these events to provide a comprehensive view of operating conditions as the procedure was executed.

These tools allow the plant to define a “golden” execution that serves as a baseline for performance that other similar executions can be measured against. Reports can also be generated to show differences between batches or key batch steps.

BUSINESS AGILITY APPLICATIONS

When you put accurate information to work, you get better results. What good is productivity information that arrives too late to act on? Or what good is a business decision if it takes too long to effectively implement? When opportunity knocks, you want to respond quickly. Experion helps make your facility a true business engine that’s tuned to - proactively react. Forget about having monthly or quarterly reporting periods as your only insight. With our set of business agility applications, you have access to comprehensive performance data in real-time. Which means you can assess and capitalize on opportunities faster and more intelligently. Our applications also tightly interface with business software, to deliver robust business analysis and execution.
We'll help you manage the manufacturing process from planning and scheduling to the entire supply chain.

**Supply Chain Solutions**

This solution enables the customer to visualize inventory through the supply chain and make both tactical and strategic decisions to improve the performance of the supply chain and business.

The Picaso solution, comprised of a series of modules, enables visibility and improved decision making across the enterprise. The main components of the solution are described below.

The **Demand Management** module generates and manages sales forecasts that are seamlessly integrated into the Supply Chain Simulator. Powerful statistical techniques create projections of future sales that can be reviewed and updated by sales, marketing, and planning personnel based on market knowledge and product availability. Forecast additions and overrides are recorded so that you can track the accuracy of each participant in the planning process. Forecasts can be distributed to remote sales force users via a variety of systems infrastructures, including the Internet. Through the Internet, the system can reach your customers—and their customers—to gather the data needed for the most accurate forecast possible.

The **Production Scheduling** module combines industry-specific models of a wide range of production processes with a powerful memory-resident simulator to provide a rich environment for developing, reviewing, and communicating production plans and schedules. Production schedule changes are instantly propagated throughout the supply chain so that effects on feedstock availability, distribution plans, and order fulfillment can be quickly identified and evaluated. Planners can develop schedules that best balance customer service requirements, inventory targets, and plant operational constraints.

The **Raw Material Planning (MRP)** module dynamically monitors raw material and feedstock needs as planners develop production plans and schedules. It highlights expected raw material shortages and creates purchasing plans based on actual production schedules or based on expected needs driven by finished product forecasts.

The **Supply Chain Event Monitor** performs an inventory simulation of the company’s extended supply chain including plants, company supply locations, customer demands and supplier procurement options. The Event Monitor makes use of customer orders, stock transfers, planned purchases, inventory levels, production schedules, forecasts and supply chain constraints to predict future
inventory positions over a user-selected horizon. The model is used to predict pending stock-outs, late shipments and inventory levels that violate minimum and maximum target levels. This tool is used by planners, customer service representatives, sales representatives, product managers and plant schedulers to monitor all pending supply chain events and identify variations to plan that require attention.

The Distribution Replenishment Planning (DRP) module gives planners the vision to analyze planned material movements, future inventory levels, and potential distribution bottlenecks. This module predicts material needs at all plants and supply points and determines if planned replenishments meet projected needs. Integrated into the Supply Chain Event Monitor, DRP uses standard formulations for each final product and replenishment algorithms compute and recommend just-in-time replenishment orders for raw materials to meet unsatisfied demand. These replenishments consider the lead-time and typical lot size from each provider. Raw materials inventories and replenishment orders are automatically linked to the supply chain simulator. Therefore, inventory projections for raw materials are handled in the same way as with final products. If a change in the production schedule turns infeasible the raw materials plan, then the algorithms re-plan the orders for optimal replenishment.

The Inventory Targeting module is used to strike the right balance of safety stocks and inventory target levels with customer service levels at distribution locations based on forecast accuracy. This is typically used to determine the right strategic balance of these key parameters.

For cycle-based production environments, Cycle Optimization determines optimal production plans and most profitable cycle characteristics, such as cycle length and frequency. The optimizer considers product-to-product transitions and off-grade production costs and balances these costs with those of carrying safety stock and cycle inventories to meet customer service goals. It clearly demonstrates the cost sensitivities of varying production cycles.

The Advanced Planning module provides the capability to support Sales and Operations Planning (S&OP) activities and analyses. The tool provides a highly visual way to optimize supply chain performance. It can be used to find the optimal production and sourcing policies that reduce costs and maximize profitability. The tool provides a means of rapidly determining not only what portion of the forecast is feasible to produce, but what product mix is most profitable to produce. In situations where capacity exceeds demand, the tool identifies opportunities to increase profits by recommending expanded production and sales of key products. Like all of the Picaso modules, the Planning and Optimization suite presents its results in an easy-to-understand user interface. The user can explore the solution interactively, and can modify the solution to
include additional constraints as necessary. The Advanced Planning module blends the best of a shrink-wrap software product with the flexibility of programming language. Since it was built for the chemical and polymer industries, the solution is ready to optimize complex, multi-site chemical supply chain problems with minimal configuration. And when unique problems arrive, it uses the power of Picaso’s model formulation language combined with the ILOG Optimization Engine to build quick solutions.

The **Customer Service Available-to-Promise (ATP)** Console brings all of the integrated information needed to the CSR to improve customer service and satisfaction. Based on the updated inventory projections provided by the Supply Chain Event Monitor, ATP is a powerful tool for supporting day-to-day activities of the Customer Service personnel. It provides accurate estimations on the future availability of a particular product. The available-to-promise analysis uses updated inventory, current production schedule, orders and forecasts to compute availability at any moment in the future. It also gives alternate sources, like the availability in other locations.

### Operating Instructions

With a framework established of advanced controls and automating common procedures, it is important to be able to consistently align all of the operating conditions that go with each grade with the schedule being produced.

Production Orders represent the schedule within the plant and allows everyone within the plant to see what will be produced, when. A production order is used to define what product should be made, the amount of production and when production should begin. The application maintains a list of production orders and transitions in accordance with the schedule determined by the business. In addition, operating instructions are associated with the production order that define the operating conditions and limits for the plant while the product is being made.

Transition parameters are maintained within Operating Instructions to support the Transition Management solution. These transition parameters are associated with a production order which defines the required transition between products. This allows key transition parameters to be maintained, verified and updated in advance based on anticipated operating conditions. This greatly simplifies the process of updating these as part of a continuous improvement process.

Operating Instructions also coordinate with the Alarm Management solution to define the operating envelope and corresponding alarm limits.
Operations Monitoring

Operations Monitoring provides the tools for an operations department to establish the engineering limits and constraints, to monitor performance against those limits, and to follow-up on performance problems.

Operations Monitoring allows the organization to see how well the plant is performing and categorize deviations that have occurred in order to support a continuous improvement process.

Operator Log Book

Operator Logbook provides an electronic logbook to gather relevant operating data – performance, current operating limits, deviations from operating limits and LIMS data. In addition the logbook allows operations to record observations, track a daily to do list and provide information for shift handover.

The log is historized to provide a convenient way to look at performance over several shifts and understand issues that have arisen.

KPI Manager

KPI Manager is Honeywell’s solution for managing an integrated KPI System. KPI Manager automates the collection of both target and actual values from a wide-variety of production and business systems; then calculates and reports the actual performance throughout the business – via intranet. KPI results can be calculated and reported on an ongoing basis – even before the official measurement period is complete.

Production Explorer

Production Explorer provides the tools for an operations department to capture, review and analyze batch information. The tools are intended to help process engineers understand the correlation between product properties and raw material properties and process conditions during production. In addition, it allows a broad community of users (including operations personnel, process
engineers, development groups, and customer service representatives) a convenient way to review all information associated with a production batch.

This application automatically collects the required data, including LIMS data, and provides a convenient set of tools for selecting and analyzing the desired batches.

**Business Hiway**

Business Hiway integrates ERP systems with Honeywell Unified Manufacturing Solutions. Using Business Hiway, automation of the customer’s business processes can effectively be extended from the ERP & Supply Chain Management environment down to plant production management and operations, and vice versa.

Business Hiway offers comprehensive support for integration with SAP R/3 – included certified interfaces, as well as providing a generic XML interface for integration with other ERP and Supply Chain Management systems.

**PEOPLE EFFECTIVENESS APPLICATIONS**

When you connect better, you work better. Your people are the best source of knowledge for improving business performance. And capturing and sharing it is what adds up to real results. Often however, significant legacy and anecdotal data resides locked-up in your individuals’ experiences. And in the absence of a facility-wide system, people are prone to focus knowledge exclusively on the area most familiar to them. Worse still, studies show 25% of plant incidents are caused or made worse by operators who simply didn’t have access to the data they needed to succeed.

Experion helps everybody have the information they need to be most effective. It is the only automation system that embeds advanced application technologies based on research by the Abnormal Situation Management (ASM®) consortium. Our open, collaborative decision support tools help to prevent abnormal situations and minimize disruptions by allowing operators to reliably and systematically make sense of alerts, detect faults and probable causes, and implement corrective measures early on—long before alarms are triggered. Plus, by using our UniSim™ simulation solutions, operators can put their skills to the test in a variety of difficult situations.

**Operator Training Simulation**

Whether you are operating an existing plant with an aging workforce about to retire or starting up a brand new facility and looking to hire new operators, making sure that you have a skilled workforce with the right qualifications and domain knowledge is critical to improving and sustaining plant profitability.
Honeywell’s UniSim Operations Suite provides a dynamic simulation solution that can help you to:

- Identify and correct weaknesses in the automation system design before commissioning and operation
- Begin startup of a new or modernized unit sooner, and complete it faster
- Train and develop operators on procedures and systems that are safe, optimized, and environmentally friendly
- Enjoy improved operating rate and product quality for your process on an ongoing basis
- Avoid or minimize incidents, and recover faster from abnormal situations
- Satisfy government regulations for operator certification and environmental operations
- Provide simulation applications for improving realtime operation and control
- Continue the return on your investment through sustained simulator use by other personnel who contribute to the operation of your business.

The Unisim Plant Simulator provides a dynamic simulation of your plant and supports a variety DCS interfaces for training and checkout. Learning Management systems assess an individual operator’s readiness by testing against tailored exercises representing real process upsets. In this way an operator can practice responses to abnormal situations such as a furnace shutdown or a chlorine breakthrough in the chlorination unit. Such assessment will give your team the confidence that your procedures have been validated against the dynamic behavior of your process and controls.

Once your plant is commissioned, Honeywell’s UniSim ProcessSync can also initialize the dynamic simulator to assess historical incidents that have been captured by the plant or mill information system. Training programs can then be extended with remedial exercises to address chronic incidents and to avoid subsequent occurrences. In this manner, peers can learn from the mistakes of others.

Advanced control strategies such as Profit controller applications can be tested against the process simulator before commissioning on the live process.
Unisim Process Monitor can be used to dynamically assess the performance of a piece of equipment. Using a Unified Real-Time (URT) bridge, real-time data can be “played” through the dynamic simulator and alert the operator to a discrepancy that may indicate potential process problem.

**Boundary Management**

Boundary Management can help you to maintain all of your plant limits. Store and track alarm limits, safety limits, equipment constraints, application limits, operational targets, corrosion limits, and other limits for each mode of operation or product in your plant.

**Alarm Configuration Management**

Honeywell offers a solution to maintain and enforce alarm limits. This application works with the control system to ensure that the correct alarm limits are enforced for the current production order. It also works with the Operations Monitoring solution to ensure that alarm limits are consistent with the operating envelope that has been defined and is being monitored for the current production order.

**Advanced Alarming and Alerting**

Honeywell’s alarm management solution features integrated products and services to deliver the following benefits:

- Protect plant uptime and safety by reducing losses caused by ineffective alarming.
- Increase operator effectiveness by reducing the number of alarms that require operator intervention.
- Reduce time and effort to develop, deploy and maintain an alarm system that is consistent with Abnormal Situation Management® (ASM®) Consortium best practices.
Experion PKS, at the base level has a sophisticated and rich alarm and alerting system, capable of handling alarms and alerts for your process. In addition to Experion’s rich base capabilities, tools like User Alert add help to off-load your alarm system in order to make sure that your operators are taking appropriate actions, especially during abnormal situations.

User Alert, which integrates with Experion Station to provide lower-priority alerts as opposed to alarms, is capable of providing a complex set of alerts for informational purposes. Each operator may have his own alerts, if desired, and these alerts can be time based, multiple condition based, and, with Boundary manager installed, based on approach to a critical boundary.

**Event Analysis**

Events happen, and the Experion PKS system has a feature rich set of integrated tools to allow operators, engineers, and plant supervision to view and analyze events. With the release of Experion R300, a plant engineer could look at recent history and process data, view associated events, alarms, and other activities, and store, and configure trends for future event analysis. One could view process data and events for a given reactor or furnace, look at trends and events and analyze the the variability within a given time frame.

**ASSET EFFECTIVENESS APPLICATIONS**

Proactively manage your assets in real time. If you can count on the assets in your system to perform, you can focus on optimizing the performance of your entire facility. Experion breaks down barriers and proactively manages the health of all your assets. Not only does it monitor your equipment in real time, it also helps you discover the areas most likely to negatively impact performance, and in greatest need of repair. As well, it goes further to help you understand how well a device is performing in the context of a control loop or a process unit. This process-centric approach to asset management helps make Experion truly unique. Proactively identifying and preventing potential failure is key to consistent performance.

**Asset Management**

Asset Manager provides a best-in-class infrastructure that allows plant personnel to make key decisions that increase uptime and improve production quality. Functioning as a significant productivity tool for releasing hidden plant profitability, Asset Manager improves business performance and profitability,
decreases incidents, and increases plant availability. As a comprehensive decision support component of the Experion unified architecture, Asset Manager connects the right people across the supply chain with the right knowledge when it is needed, improving operational effectiveness and reducing maintenance costs.