

Owner Operators

A Special Focus of **Insight**

Suncor

Nynas

PTTEP

Vietsovpetro

Neste Oil

SCG Chemical Group

ARC Advisory Group

Trinity Technologies



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Intergraph® Offers Real Value for Owner Operators

Owner operators (O/Os) currently face unprecedented demands to:

- Deliver multiple new plants and major expansions of existing facilities more rapidly while utilizing finite resources
- Maintain adequate safety levels
- Deliver projects on schedule and within rigid budget constraints
- Manage time to market and deliver a high-quality product in a competitive environment
- Create facilities flexible enough to meet market demands in production and product offerings
- Avoid adversely impacting the functionality and production of the existing plant while undertaking complex plant modifications
- Maintain safe, predictable production levels from existing plants, at the lowest sustainable cost
- Demonstrate to regulatory authorities the integrity of plant-maintained information
- Provide assurance that the owner operator's "virtual plant," in-plant documentation, and IT systems are consistent with the current physical state of the plant in operation
- Demonstrate that a controlled management of change (MOC) process with auditable traceability is enforced within plant operations
- Retain plant knowledge and experience in the face of increasing rates of workforce retirement

To face these challenges, more O/Os are partnering with Intergraph for success. In this special focus issue of *Insight*, read how a variety of O/Os have used Intergraph solutions to speed time to market and reduce costs.

Throughout the years, many leading O/Os have chosen Intergraph's industry-leading Smart-Plant® Enterprise integrated suite of tools to manage their dynamic engineering design basis. O/Os around the world rely on our software to increase productivity and provide for safe and clean operations.



SmartPlant® Enterprise for Owner Operators Optimizes Life Cycle Work

Make your engineering design basis work for you

■ By **Adrian Park**

This article is a portion of a complete SmartPlant Enterprise for Owner Operators white paper available at www.intergraph.com/spo.

Intergraph, the leading provider of engineering design solutions for the process, power and marine industries, understands the challenge that owner operators face in enabling better interoperability throughout their plant life cycle.

The ARC Advisory Group, a leading manufacturing and supply chain industry analyst firm, recognizes Intergraph's SmartPlant Enterprise for Owner Operators (SPO) as a proven solution that addresses core engineering design, procurement, operations and maintenance needs, in addition to providing a means to reap the benefits of increased interoperability.

SAP® and Meridium are special early SPO partners, and more partners will be added over time.

SPO is built upon SmartPlant Enterprise, a proven set of best-in-class applications that may be de-

ployed individually or as a flexible, integrated enterprise solution. SmartPlant Enterprise is already well respected as a powerful environment for efficient collaboration across design groups, contractors and project supply chains to maximize profitability throughout the plant life cycle.

Now, the solutions portfolio has been customized to meet the needs of owner operators to help them increase interoperability throughout every phase of the plant life cycle, resulting in improved profit margins. The importance of enhanced interoperability – and the cost of poor documentation to owner operators – is described in the accompanying article by Dr. Sid Snitkin from the ARC Advisory Group in this issue.

Enabling interoperability and profitability

While Intergraph recognizes that its primary role lies in creating and managing engineering content, the company understands the central role the engineering design basis has during both project execution and plant operations.

Intergraph has developed SPO to enable asset owners to exploit the engineering design basis in

managing asset performance for profitability by helping them ensure efficient project execution and proper maintenance of information integrity across the operations and maintenance phases. SPO intends to accomplish this by providing out-of-the-box integrations between the SmartPlant Enterprise engineering design basis and other owner operator applications including:

- Distributed control systems (DCS), e.g., Honeywell, Emerson, Yokogawa, ABB
- Enterprise asset management (EAM) systems, e.g., SAP, Maximo, Ventyx
- Enterprise content management (ECM) systems, e.g., Documentum, Microsoft
- Enterprise resource planning (ERP) systems, e.g., SAP, Oracle
- Reliability systems, e.g., Meridium.

Integrations will use the capabilities of service-oriented architecture (SOA) technologies to synchronize data between systems and provide a secure, universal, role-based Web portal. The Web portal will seamlessly present data to the user from the underlying applications in the

context of the work processes and according to the roles allocated to them. This will reduce user time in locating data and provide a basis for better decision making throughout the plant life cycle. The intuitive nature of the Web portal will reduce the training needs of end users.

SPO will deliver these capabilities to plant operators through preconfigured, best practice work processes that cover three key areas:

- SPO Core Solution
- SPO Operating Plant Solution
- SPO Project Execution Solution.

Many of the business packages included in these solutions have already been proven in customer project implementations and are now being generalized and brought together as part of a total solution for owner operators.

SPO solutions will be released in phases. The first phase comprised the initial version of the SPO Core Solution and SPO Operating Plant Solution. The latter solution provides a Web-based portal and integration with SAP using SAP NetWeaver®. Intergraph has already gained SAP "Powered by NetWeaver®" certification for this solution. The SPO Project Execution Solution was next released along with additional business packages in the SPO Core and SPO Operating Plant solutions. It is envisioned that support for other SOAs will be available in future releases.

SPO Core Solution

The SPO Core Solution helps manage the engineering design basis in operating plants. This set of Intergraph SmartPlant Enterprise applications is out-of-the-box preconfigured to support owner operator work processes that are applicable across the plant life cycle, including:

- Maintenance of engineering data for modifications and smaller "in-house" projects during operations
- Conceptual engineering using SmartPlant Layout and integration with project estimation tools during project evaluation phases
- Basic work processes such as plant breakdown structure management, document management, tag management, vendor data capture and data loading during all life cycle phases
- Maintenance of isometrics during operations
- Viewing and navigation of current and past engineering data.

SPO Operating Plant Solution

The SPO Operating Plant Solution builds on top of the SPO Core Solution to help manage the engineering design basis in operating plants. An extensive range of business packages addresses work processes that are critical to supporting operating plants in maximizing their profitability through improved maintenance to lower costs and improve uptime. The first release includes the following features:

- Bi-directional synchronization of data between SmartPlant Foundation and plant maintenance systems ensures consistency between the engineering design basis and maintenance data.
- A secure, role-based, common Web portal for plant management, operations, maintenance and engineering personnel seamlessly presents data from across engineering and maintenance systems. In subsequent releases, this will be extended to cover other major plant operations systems, including process safety, reliability, DCS and enterprise content management systems.
- Workflow processing of change requests in SmartPlant Foundation enables automatic notification of approved requests in the maintenance system.

SPO Project Execution Solution

The SPO Project Execution Solution also builds on top of the SPO Core Solution and provides business packages addressing work processes that are critical to coordinating activities during capital projects and managing the evolving engineering design basis for an effective, efficient handover process, shorter project times and reduced CAPEX.

The processes to be addressed in this solution include the management of:

- Change in projects
- Non-conformities and waivers
- Technical queries
- Interfaces between contractors
- Risk and opportunities.

Common to all of these processes is the need for consistency in handling, a complete and auditable workflow trail, management reporting to show the status of these critical processes and operations reporting to identify due items and bottlenecks to enable the timely initiation of remedial actions. The out-of-the-box preconfigured work processes provided may be rapidly adjusted to meet specific customer needs, such as reflecting corporate ap-

proval routines and authorization matrices.

The Project Execution Solution leverages the value of the engineering design basis. For example, for a change under review, the solution shows what other planned or ongoing changes affect the same tags, documents or part of the plant breakdown structure. Similarly, linking non-conformity requests to the plant design basis enables operations after project handover to answer why parts of the plant have not been built in accordance with regulations, corporate best practices or project specifications by listing the waivers agreed in the area and providing full details of the non-conformity requests, the auditable review and approval process and the documentation used as a basis to agreeing to all waivers.

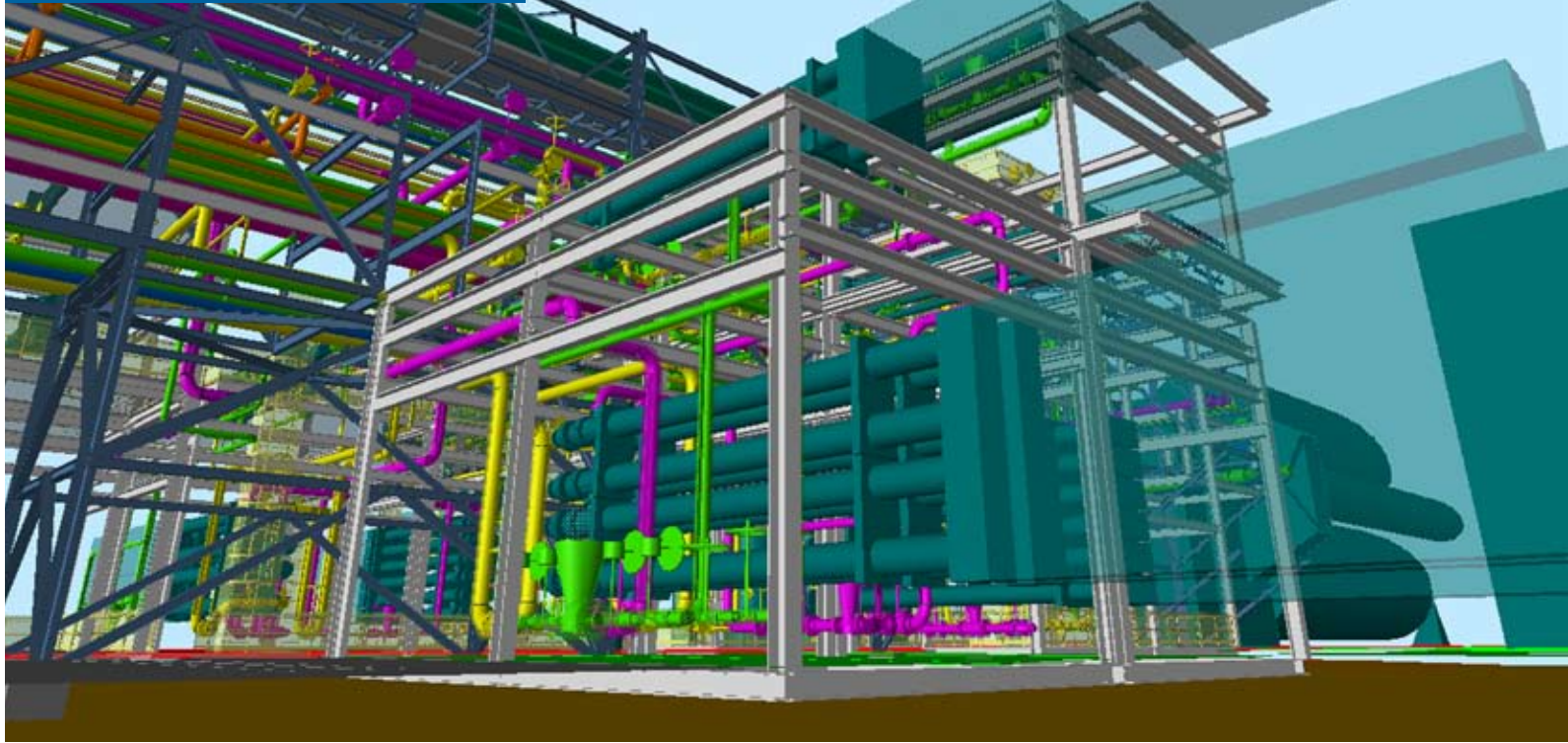
SPO deployment planning

Intergraph recognizes that implementation of enterprisewide solutions such as SPO impacts a customer's personnel, processes and technology. So Intergraph offers a fast-track methodology for the evaluation of the impact of implementing SPO with key customer stakeholders. This will be undertaken by a team of Intergraph domain experts and business transformation consultants. The results will include:

- Organizational mandate for change
- Analysis of the gap between current and "as-desired" work processes
- Transformation roadmap to achieve the "as-desired" state
- Cost-benefit analysis
- Risk mitigation strategy.

This approach will reduce risk and increase the probability of achieving the greatest gains from SPO implementation.

Adrian Park serves as global technical director of owner operator solutions for Intergraph Process, Power & Marine and is based in Stavanger, Norway.



Suncor Meets Tight Schedule with Intergraph SmartPlant 3D

Worksharing and data handover boost Firebag project

■ By **Paul Crowley**

This article originally appeared in *Insight* Issue 20, 2007.

For more than 40 years, Suncor has been known as both an innovator and a leader – from our pioneering work in developing the Oil Sands of northern Alberta, to our introduction of more environmentally responsible fuel.

Suncor pioneered the world's first commercially successful oil sands operation in 1967 and reached a new milestone in 2006 with the production of our billionth barrel of oil. In 2006, production at the Athabasca Oil Sands facility averaged 260,000 barrels per day. Construction is now underway for the next phase of oil sands growth, which is expected to deliver production capacity of 350,000 barrels per day in 2008, growing in stages to a goal of up to 550,000 barrels per day in 2010 to 2012.

One of our latest developments is our Firebag In-Situ operation, located 40 km northeast of our original oil sands plant. In-situ technology

opens up the potential to recover large reserves that can't be reached economically by traditional mining methods. An independent evaluation of our in-situ leases estimates recoverable resources with a potential to produce about nine billion barrels of crude oil.

Our in-situ operations use recycled water in a closed system for steam generation. No additional surface or groundwater is required and no tailings ponds are created. In-situ development disturbs only about 10 percent of the surface land in the development area.

Worksharing

With our current Firebag expansion work, we need to mobilize very large engineering forces to be able to complete the project on time and within the expected first oil recovery dates.

There's a huge amount of ongoing engineering work – not only in Calgary, but worldwide. Our

engineering providers, such as Jacobs Engineering and Colt WorleyParsons, have severe constraints in regard to the skilled work force that they can draw upon.

To access a skilled resource base, we needed to expand the market beyond a single engineering provider into a multiple engineering environment across the world. In this manner, we're able to benefit from the best expertise from around the world rather than having to live with the constraints of a very small marketplace. That's why we chose Intergraph SmartPlant 3D.

Worksharing was one of the primary drivers for our selection of SmartPlant 3D. During our first year of using SmartPlant 3D, the top benefit has definitely been workshare. We enjoy a real-time worksharing environment with our engineering providers in Mumbai, Charleston, Edmonton and Calgary, each working eight-hour shifts.

Data are a valuable asset

Our secondary driving force in choosing SmartPlant 3D was the ability to own the asset data at the end of the project. We believe that the data represent an important asset to our actual operations. We need to control how those data are deployed and managed within our organization, so that when we're operating this plant, we can create an effective information workflow. We are looking forward to the expected project completion in 2011 when the database turnover will certainly be a major milestone.

The other major benefit will be to our procurement system. We are looking at how we manipulate model attributes to our procurement management. The attributes describe the actual billing materials, takeoffs and implementation across to the various fabricators and manufacturing equipment. Also in the future, we plan to provide our operators with the data so that they can manage their plant in the most effective way possible.

Productivity tools

SmartPlant 3D has promoted our engineering, procurement and construction contractors' (EPCs') visualization. SmartPlant 3D represents a significant advancement toward achieving increased productivity. Any piping designer would rather work in a fully rendered visualization than a stick-model type design.

We have also implemented real-time piping clash mechanisms. When an individual places a component within the model, any clashing is immediately evident, rather than waiting to run a report later in the project. Sometimes our EPC will turn off the automatic clashing systems to speed processing because the models can get quite large. But the functionality does enable them to perform one-time placement of objects without a lot of rework.

Dedication to success

Intergraph has implemented many of our recommendations in the latest version of SmartPlant 3D. Intergraph has been very proactive in working with us to make the tool more effective through customization. One of the key things about SmartPlant 3D, as with any 3D model, is that the large amount of data and moving data around the world with limited Internet highway pipelines

can become a significant issue. Intergraph has been very supportive in streamlining the design of SmartPlant 3D to eliminate data movements that we didn't need.

Intergraph has also helped us with customizing Work Breakdown Structure (WBS) diagrams to pull spools or isometrics out of the model. For example, we need to be able to identify a series of pipe rack modules from, in our case, a heavily modular plant. We needed to break up those pipe rack modules into specific groups of piping isometrics. Intergraph has been very helpful in building the macros that created the dicing of the models to be able to produce that WBS so that we could actually create the isometrics we desire.

Suncor has a series of standard pipe supports that we use for all of our piping design. In fact, it's integrated with our procurement strategies and our fabrication strategies. We use many commercially available custom pipe supports, but we commissioned Intergraph to create some specific parameterized pipe supports for us, and these are now incorporated within our database. Now when we place a pipe support, we get a Suncor pipe support with our engineering rules and intelligence built-in automatically.

Intergraph has been very supportive in helping us work through the issues that we've had. This has been the biggest advantage of our relationship with Intergraph.

I give kudos to the Intergraph team for their commitment to making us a success. We had some "teething problems" along the way, and I think Intergraph recognized we've taken a pretty big step out with the product by starting the project in such a big way. Intergraph employees, from the very highest executive levels, have been very supportive in assisting us, in committing to support us and in making sure that we're a success with this tool.

Building on SmartPlant Enterprise

When looking for a solution, we wanted software that would be reasonably familiar to engineering providers, either through their training on other software tools or through actual experience with the product. We were already comfortable with using PDS®. Because of the similarity between PDS and SmartPlant 3D, that made it a good fit. Of course, SmartPlant 3D

has its own special characteristics.

Our future plan for SmartPlant 3D is to integrate SmartPlant P&ID and SmartPlant Instrumentation through SmartPlant Foundation. SmartPlant Foundation will enable us to manage data back to the operators. This way, not only will we be able to create the project because of workshare, but we will also be able to share those data with our operators to make them more effective in what they do.

Changing the work process

I encourage other users to plan their SmartPlant 3D implementation, and plan it well. Recognize that there is a learning curve. Sometimes engineers are excited about getting a new product, but then it turns out that they don't want to put the work into it. Remember that if you put the work into it, you're going to get good things out of it.

You must also accept the fact that SmartPlant 3D represents a different work process. Convincing your engineering providers to change their work processes to match the input method of SmartPlant 3D takes a little effort and a little time, but it's worth it in the end.

While traveling along the learning curve, it's really all about implementing new processes and new ways to do things. We're excited to see where this great adventure leads us.

Paul Crowley serves as director of engineering with Suncor Energy's Major Projects division, and is based in Calgary, Canada.

www.suncor.com



Nynas Chooses SmartPlant Enterprise for Refinery Productivity Gains

Moving from 2D to 3D increases data quality and improves workflows

■ By Thomas Stutterheim

Sweden-based Nynas AB, a world-leading producer of specialty oil products, seeks to expand its refinery base and double its production capacity by 2020. In addition to meeting increasing market demands for environmentally friendly naphthenic oil, Nynas also wants to maximize its US\$650 million refinery expansion investment by ensuring plant data are captured and used over the full life cycle of its existing and planned refineries.

Currently Nynas operates one refinery in Nynäshamn with approximately 250 employees. To meet its goal of doubling production capacity, the firm is planning to build eight new plants over the next 12 years.

A long-time producer of naphthenic specialty oils and one of the largest European suppliers of bitumen, Nynas refines naphthenic oil, a more environmentally conscious alternative to the highly aromatic oils used in the production of tires. Nynas will increase the production of naphthenic oil from 400,000 tons per year to 1 million tons per year. The expansion project

will allow Nynas to serve the growing bitumen market as well.

Increasing data value

For the first project phase, Nynas is investing in a new flare and a new hydrogen generation unit (HG4). Nynas is working with Neste Jacobs in Finland and KTI in Italy. These suppliers are performing the engineering design using Intergraph SmartPlant Enterprise.

Nynas chose SmartPlant Enterprise since it offers a complete solution from start to finish. “We wanted to be able to work with a system that will work in the future,” said Gunnar Bengtsson, CAD manager at Nynas, who is also project manager for the SmartPlant Enterprise implementation. “We knew that Intergraph would enable us to upgrade as time passes and provide high-quality, professional drawings.”

The largest existing hydrogen unit, HG3, has 20 P&IDs. The new hydrogen plant will have approximately 40 P&IDs.

“We will receive the plant information and models in a way that makes it possible for us

to review, update and maintain the data and documents created,” said Bengtsson.

Nynas is now looking at taking advantage of the assets created during engineering. In a structured manner, the company will receive accurate and complete plant information in terms of data and documents from the suppliers. This will be accomplished by implementing an integrated information management system.

Phased implementation

Nynas is taking a phased approach to software implementation as well. The company has chosen to explore several Intergraph solutions piece-by-piece.

“The first phase’s two new plants will validate if the Intergraph system fits in our business,” said Bengtsson. “If the evaluation period is successful, the system will be implemented across the entire plant, meaning an increased number of solutions and users.”

For Phase 1, a limited number of users will receive and check data and documents produced by the suppliers. Nynas will continue to

internally roll out the system toward operation and maintenance to determine if the solution is easy and practical to use in daily workflows and offers the stability to support operations throughout the plant's life, which is normally 10-20 years.

"For Nynas, it is important that we at an early stage make sure that the product fulfills our requirements regarding production reliability in a safe workplace for everyone," said Bengtsson.

The design tools SmartPlant P&ID and SmartPlant Instrumentation will be used to receive data from the suppliers until SmartPlant Foundation is rolled out. Nynas intends to integrate SmartPlant P&ID with SmartPlant Instrumentation in a later phase.

"We have chosen to use Intergraph capacity in our project NHN 2020 for building a new hydrogen generator and a new flare," said Helene Eng, responsible for document management at Nynas.

"In this coming design process, we will have time to make sure that the designed facilities fulfill Nynas requirements. If the outcome of this project is successful we will, of course, consider increasing our use of Intergraph products in the future."

SmartPlant Enterprise in action

Nynas intends to use Intergraph's SmartPlant Enterprise tools for a variety of workflows:

Creation and modification of engineering data and documents

- SmartSketch®
- SmartPlant P&ID
- SmartPlant Instrumentation

Review and control of live project data

- SmartPlant Explorer
- SmartPlant Review

Review and management of project assets

- SmartPlant Foundation
- SmartPlant Markup

Efficient handover

Turnover of an investment project to the operations department has long been a top priority for Nynas. Well-defined turnover procedures are always included in contracts with suppliers. Detailed planning for turnover begins immediately after detailed design is finished.

At Nynas, this task is normally handled by the sub-project Preparation for Operation. In addition to handling turnover, this organization is also responsible for training operators and maintenance personnel, planning the commissioning and initial startup phases and organizing the documentation and quality control of the as-built status.

Over the years, Nynas has invested in enhanced tools to handle these activities with all of their checklists, certificates, documents and data. Nynas now expects to gain high performance and efficiency using their new model, document and data platform.

Single source of truth

Nynas and its suppliers are moving away from traditional 2D drawings. Bengtsson said, "We see a trend that more engineering consultants and larger EPCs are using 3D models and data-centric solutions for engineering."

With SmartPlant Enterprise, Nynas expects to benefit from an easy interface for searching and finding plant items and reviewing associated data and locations. Since Nynas has limited engineering resources, it is possible to give assignments to contractors and consultants who will also work in the system.

"Our expectation is that the Intergraph solutions will help us in keeping our plant information readily available and accessible for all personnel in a single source of truth, improve our information management and handover as well as manage revisions more effectively," said Bengtsson.

"Now is the time for us to take the step toward the new technology and working procedures that Intergraph provides. With SmartPlant Enterprise, we are ready to face the future."

Thomas Stutterheim is a process industry consultant for Intergraph Process, Power & Marine and is based in Karlskoga, Sweden.

About Nynas AB

Nynas AB is the parent company of an international group specializing in producing and marketing non-commodity heavy crude oil, which is upgraded to produce bitumen and naphthenic specialty oils.

With more than 1,000 employees, Nynas has four owned refineries, two in Sweden and two in the U.K., one of which is a joint venture. Through alliances with other specialty oil producers, Nynas also controls supply points in Belgium, Switzerland, Finland, the U.S. and Curaçao.

The origins of Nynas can be traced back to the 1920s. Charles Almqvist returned to Sweden from the U.S. with the objective to build the country's first oil refinery. He began working with consultant Axel Axelsson Johnsson, and in 1928 the first shipment of crude oil was delivered to the newly built refinery in Nynäshamn. Even the bitumen played a central role in the business concept.

As time passed, the company grew and expanded. Investments were made in hydrogenation technology to modernize and increase the production of naphthenic specialty oils. Further investments in the production plant took place beginning in the late 1990s and continue today.

www.nynas.com





PTTEP Creates Enterprise Engineering Hub

SmartPlant Enterprise investment for greenfield project offers safety benefits and significant ROI

■ By **Jana Miller**

Petroleum producer PTT Exploration and Production Public Company Ltd. (PTTEP) is a dynamic Thailand-based exploration company. It has invested in exploration and production activities in a variety of countries, including Thailand, Malaysia, Indonesia, Cambodia, Vietnam, Oman, Egypt, Algeria and New Zealand.

PTTEP recently implemented an enterprise engineering hub powered by SmartPlant Foundation. The platform serves as a single point of reference for information on the Arthit asset and will result in cost savings in terms of time and resources no longer wasted searching for information in numerous databases.

“Maintaining accurate information that can be used effectively until the end of an asset’s life is a real challenge,” said Suchart Srivaranon, integrated planning engineer and data handover team lead of the Arthit Project at PTTEP.

The Arthit Project represents the company’s first exploration project as operator. Covering more than 4,000 sq km in the Gulf of Thailand, the Arthit petroleum fields are located approximately 230 km off the coast of Songkhla province. The area includes natural gas and condensate.

Safety first

“For an exploration and production business like us, the safety of field staff on projects like Arthit is of paramount importance,” said Srivaranon. “As a result, information used by engineers and field staff must be accurately prepared using an efficient ‘housekeeping’ system.”

To do this, the company has invested in engineering data warehousing – a global platform that can house data, integrate numerous applications and enable multiple users across the enterprise to access information.

By ensuring that data are accurate and consistent, staff members can reduce errors and improve personnel safety on-site.

Data flow

During the design and construction phases of the Arthit Project, the housekeeping system previously used to manage and maintain the extensive information generated was limiting. Ongoing use of the system was deemed a “mission impossible” by engineers.

The project team needed a system that could house a vast amount of complex data within a global, process-based framework, ensuring the

efficient and seamless delivery of contextual and role-based information to all necessary parties.

“Communication of approval and changes of ‘as-built’ drawings and general engineering business processes between engineers can take weeks – or even months,” said Srivaranon.

“To revolutionize the process, engineers need to be able to make changes, send the changes directly to drafting via an intelligent system and manage approvals using an automated workflow process integrated with the e-mail system.”

A sound investment

In theory, powerful data warehousing would allow a large volume of information to be managed. But the project team realized that integrating their chosen data warehousing solution with a range of applications would be challenging.

The benefits of such integration would ensure less time spent on change control processes. That would maximize profits returned, as proven by global research group IDC (Steven Graham, *A Study of the Financial Impacts of Data Warehousing*, special IDC report).

Typically, field staff and engineers spend almost

“SmartPlant Enterprise is used by the majority of leading companies within the energy and petroleum industry and was widely recommended.”

Suchart Srivaranon

Integrated Planning Engineer and Data Handover Team Lead of the Arthit Project, PTTEP

30 to 40 percent of their working time finding, verifying, re-formatting, changing or trying to understand the information gathered about an asset. An IDC survey found that 90 percent of companies investing in an engineering data warehouse solution had a three-year return on investment of more than 40 percent.

Comprehensive solution

PTTEP's search for a data warehousing solution led it to Intergraph's SmartPlant Enterprise solutions. SmartPlant Enterprise offers a powerful portfolio of best-in-class applications to ensure an open, independent data storage system that improves project execution, handover and plant operational efficiency.

“SmartPlant Enterprise is used by the majority of leading companies within the energy and petroleum industry and was widely recommended,” said Srivaranon.

Within the suite, SmartPlant Foundation is the key to centralizing, incorporating and managing well-organized orders for data. It also enriches intelligent cross-referencing between various types of engineering information without boundaries. To maximize the efficiency of the enterprise engineering hub, PTTEP will integrate SmartPlant Foundation with SmartPlant P&ID, SmartPlant Instrumentation and SmartPlant Electrical.

Birth of the hub

By using SmartPlant Foundation as the platform for its hub, PTTEP expects to benefit from:

- A single engineering portfolio with seamless data accessibility
- Greater accuracy and consistency, faster processing of engineering information and more efficient change management
- Standardization in engineering documentation
- 10 to 15 percent OPEX reduction

- 80 percent reduction of volume and cost of equipment documentation for operation.

SmartPlant Foundation will also send an e-mail alert to parties involved to follow up on the work required for the designed workflow. This shortens normal processing time to days or a few weeks. The goal is to have all applications working together from the enterprise engineering hub – the information gateway through which users can connect to all of the information they require.

As well as being used as an engineering handover tool and an application integration tool, the hub will also be used as an engineering companion to asset tracking software Maximo. Maximo serves as a supplier gateway for technical information and as a client and regulatory review portal.

Next steps

Expanding the hub to cope with surface and sub-surface engineering applications and related information will be the next big challenge for PTTEP. Like other leading owner operators and exploration and production businesses, PTTEP views the hub as a way to effectively maintain and collate information for the duration of the Arthit Project's life cycle.

“Arthit is a greenfield project and we have a good opportunity to shorten implementation processes by using data conversion and manipulation techniques,” Srivaranon said. “Once information is integrated using the same application platform, we could possibly initiate information standards to be used among various engineering disciplines. That really would be a big return on investment for us.”

Jana Miller is editorial director of Insight.

Enterprise engineering hub

To build its enterprise engineering hub, PTTEP chose the following Intergraph SmartPlant Enterprise solutions:

- SmartPlant P&ID
- SmartPlant Instrumentation
- SmartPlant Electrical
- SmartPlant Foundation

About PTTEP

PTTEP was established in 1985 in response to the government of Thailand's desire to strengthen the nation's energy stability and minimize costly petroleum imports. The Petroleum Authority of Thailand (PTT) established PTT Exploration and Production (PTTEP) to explore, develop and produce petroleum reserves to maximize the country's highest possible benefit from energy resources.

As PTTEP's business operations expanded dramatically, both domestically and internationally, the company decided to reduce the government's administrative and financial responsibilities. So PTTEP registered as a publicly traded company in 1992, becoming PTT Exploration and Production Public Company Ltd., and currently has a registered capital of US\$105 million.

Besides its core business of petroleum exploration and production, PTTEP has extended its investments into strategic downstream projects and, in proactive response to the government's liberalization policy toward natural gas producers, PTTEP has also entered the power generation sector to enhance and sustain its core business.

www.pttep.com





Improving the Functional and Financial Performance of Your Plant

Better plant asset information management delivers large, compelling benefits

■ By **Sid Snitkin, Ph.D., Vice President and General Manager, Enterprise Advisory Services, ARC Advisory Group**

This article is a portion of a complete ARC Advisory Group white paper available at www.intergraph.com/spo.

Organizations build and acquire complex plant assets with the full expectation of receiving a reasonable return on their investments. But meeting these expectations remains a challenge for even the best of organizations. Silo behavior within the many groups involved in designing, building, operating and maintaining such facilities wastes time and money, jeopardizes plant safety and limits the owner operator's ability to optimize plant performance.

The incredible costs to owner operators of poor asset life cycle management have been documented in numerous research studies. This justifies immediate action. Better coordination and teamwork, throughout the complex maze of partners, suppliers and internal departments involved in asset life cycle management, can significantly improve plant performance in both functional and financial terms. Interoperability enables teamwork, and plant asset information management is a necessary foundation for interoperability.

While the solution to poor asset performance is conceptually clear, few companies currently have a plant asset information management strategy in place that is adequate to support the required interoperability initiatives.

Improving performance

Metrics like return on assets (ROA) may be top management's key performance indicators (KPIs) for plant performance, but rarely, if ever, will you find groups involved in the plant life cycle sharing this perspective. Their scope of activities and the extent of their control is simply too limited to accept accountability for all of the inputs involved in such measures.

Instead, we find groups responsible for designing, sourcing, building and commissioning of plants focused on minimizing capital expenditures (CAPEX) and project schedules. Those responsible for operation and maintenance are focused on maximizing output to drive higher revenues and minimizing operating costs (OPEX) to further drive profitability.

Some people believe that limiting a group's focus to the "things they can control" is the best way to manage plant assets. It breaks a

big problem into manageable chunks, drives each group to individual excellence and wins the plant performance war one battle at a time (*Diagram 1*).

But, there is a basic flaw in this thinking – it assumes that group contributions are independent and additive. And, this is clearly not the case for complex processes like plant asset life cycle management. Stories of how parochial, short-sightedness in one group makes a disaster for another are commonplace and highlight the need for groups to embrace broader, shared goals.

Plant life cycle groups are highly interdependent, i.e., the actions of one can affect many others, and this can be a serious problem when it is not properly managed. Leading companies recognize this and have tried to manage it through use of more-inclusive practices like total cost of ownership (TCO) and formal review/approval workflows. While this helps, these efforts only address the tip of the iceberg, i.e., those decisions that create clear, highly visible problems. They do not address pervasive problems, like information interdependency, that lie below the surface and continue to frustrate everyone's performance.

Information interdependency

Poor management of information is one of the most pervasive, challenging, interdependency issues. Groups throughout the plant life cycle take care to manage the information they need to do their own work, but give little or no consideration to the information needs of others.

Often, this results in the owner operator having a collection of asset information that is inconsistent, inaccurate and incomplete. And, everyone who uses it wastes time and money reconciling confusing, conflicting information and reworking related mistakes. This issue underlies many of the problems, like delayed startup and higher OPEX, and is still being neglected by most organizations.

While some owner operators are beginning to address these information management problems, too many are focused solely on improving the transfer of engineering information from EPCs during plant "handover." They see the issue as a one-shot "glitch" related to data form and completeness.

But, the real challenge is much larger, more dynamic and pervasive. Resolving the information interdependency issue to the point of driving optimal efficiency and effectiveness throughout the asset life cycle requires a complete, proper plant asset information management strategy.

Handover information represents only a small portion of what owner operators need to operate and maintain the facility. Using this as a base, they create additional information, like procedures and MRO material lists, to populate their many systems and support users who neither understand engineering drawings nor are interested in engineering details that go beyond their specific needs.

Poor handover significantly increases the time and cost to create this additional information. Improving handover is clearly important and deserves attention. But it is equally important to recognize that this is still "closing the gate after the cows have left." Better management of information throughout the design/build activities, and making handover a non-event, is the only correct solution.

Regardless of the type, missing and inaccurate asset information significantly impacts the owner operator's ability to extract full functional and financial performance from its investments:

- It is often the root cause of delayed plant startups, which lengthen time-to-market, postpone revenue realization and miss critical market windows
- It can cause difficulties during operations in explaining deviations from regulations, corporate

best practices, etc. during plant audits or after plant incidents where details of non-conformities and waivers were not transferred as part of asset information

- It regularly lengthens the time to complete maintenance jobs on operating assets, reducing revenues and driving up maintenance costs which result in reduced profits.

Owner operators also need to recognize that plant asset information is dynamic and will change during the operation and maintenance stages. Benefits of better upfront information management will be quickly lost if data integrity is not preserved through effective change management processes that cover the engineering design basis and all of the derived information.

Experience shows that the time and cost of plant modifications are significantly impacted when organizations have to rely upon physical plant audits to verify their plant asset information. Some people have estimated this cost to be as much as 30 percent of the total cost for modifications.

Information created during the operation and maintenance activities is another area that deserves attention in a proper plant asset information management strategy. Operating, maintenance, inspection and purchasing histories are important records of how the asset was used, how

Diagram 1:
Many groups contribute to ROA

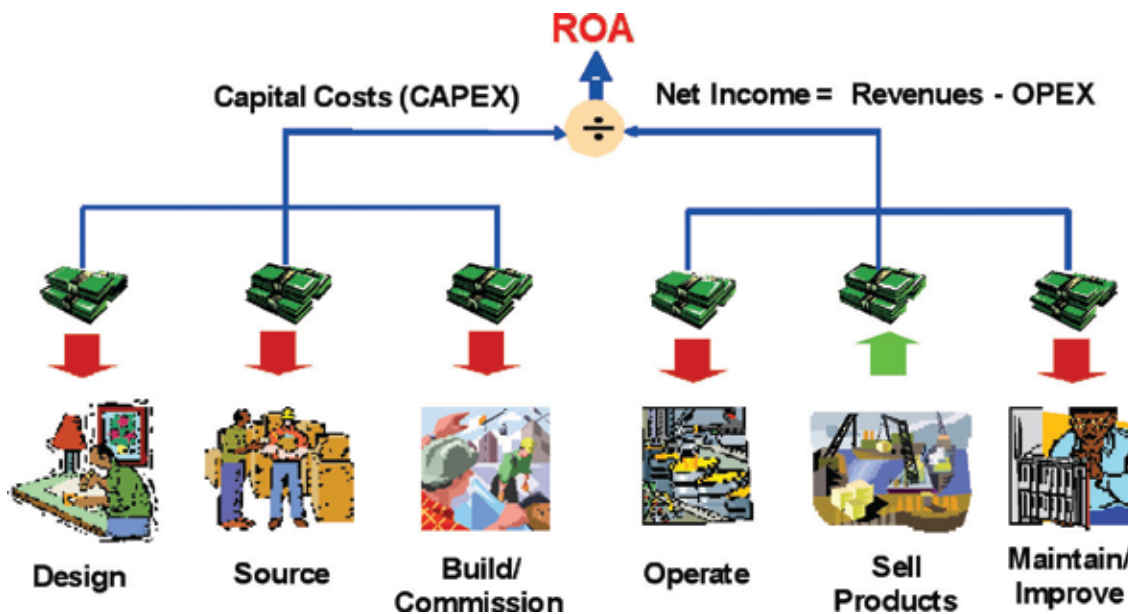


Diagram 2:

How much does poor interoperability with major project engineering cost your plant each year?

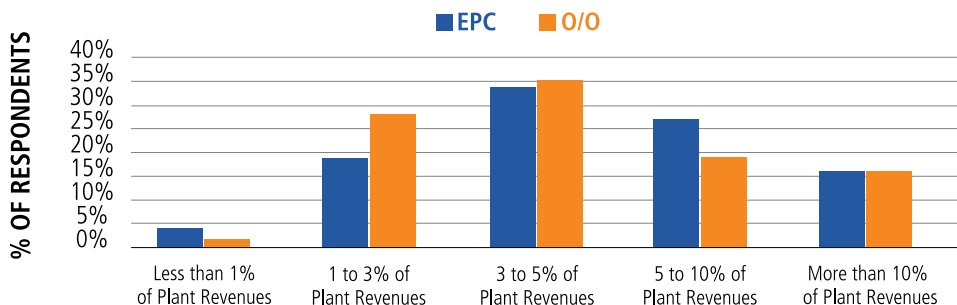
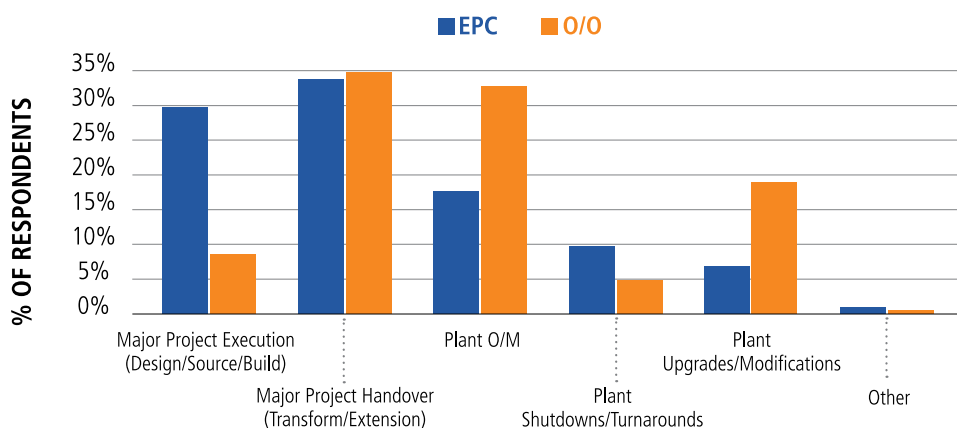


Diagram 3:

Which of the following life cycle stages/activities offers the highest ROI opportunity for interoperability?



well it performed and how it was changed to improve performance.

This is invaluable for analyzing problems, improving asset availability and designing plant improvements. For many, care of this information is critical for reporting to outside agencies. Relating this information to the engineering design basis is essential for all of these activities.

Costs of poor information management

Poor management of plant asset information is not a new problem and the impact of this on the owner operator’s financial performance has been the focus of various reports. Probably the most well-known is the NIST report, which examined the cost of inadequate interoperability in the

U.S. capital facilities industry. Its definition of interoperability, as “the ability to manage and communicate electronic product and project data between collaborating firms’ and within individual companies’ design, construction, maintenance, and business process systems,” is comparable to what we previously discussed, but this study was restricted to a range of greenfield projects executed in North America, albeit in a variety of industries.

NIST estimated the cost of poor interoperability across the complete design, build and operate supply chain to be US\$15.8 billion per year in increased CAPEX and OPEX. Its sample covered projects that represented a capital spend of

US\$374 billion. Combined, the CAPEX and OPEX costs represented a loss of 4.2 percent of this installed cost.

NIST added that, “Of these costs, two-thirds are borne by owners and operators, which incur most of these costs during ongoing facility operation and maintenance (O&M). In addition to the costs quantified, respondents indicated that there are additional significant inefficiency and lost opportunity costs associated with interoperability problems that were beyond the scope of our analysis. Thus, the \$15.8 billion cost estimate developed in this study is likely to be conservative.”

Assuming installed cost as the basis for evaluating financial performance, one could relate this owner operator loss directly to asset performance as a continual, ongoing penalty in ROA of 2.8 percent.

While less rigorous, a survey conducted at the Intergraph 2007 International Users Conference showed similar results (Diagram 2). Participants in this survey felt that poor interoperability (with a similar meaning as the NIST report) between groups representing the design/build and operate/maintain stages averaged three percent of plant revenues (three percent of revenues for a 100,000 bpd refinery is approximately US\$60 million per year). And opinions in this survey were relatively consistent whether one was an owner operator or EPC. While no analysis was done as to the source of these losses (CAPEX or OPEX), the potential savings are obviously large and compelling.

As a follow-up question, survey participants were asked about the plant life cycle stages/activities where they would expect to see the largest benefits from efforts to improve interoperability (Diagram 3). Handover was viewed by everyone as a high priority activity, including both the information exchange and the extension of engineering information into other owner operator systems. Not surprisingly, EPCs and owner operators differ in the importance they place upon addressing interoperability during major project execution, operate/maintain and plant upgrades/modifications.

DOMinO – Design, Operate and Maintain interoperability for owner operators

To address the many challenges of interdependency, owner operators need to start with a more appropriate model of asset life cycle management; one that explicitly recognizes interdependency as

something to be managed for short- and long-term performance benefits.

Design, Operate and Maintain (DOM) is a new perspective on asset life cycle management that meets these requirements. It is owner operator-centric and replaces traditional, sequential, hand-over-based concepts with a more appropriate “systems view” of the underlying processes and their interactions.

DOM views asset life cycle activities as supporting one of three continuous, complementary processes that impact asset performance (functional and financial) which we refer to as design, operate and maintain:

Design – Providing the “right” capabilities to meet market needs (note: this includes procurement and construction life cycle stage activities)

Operate – Using these capabilities in the most “profitable” way

Maintain – Maximizing the “availability” of capabilities for use.

While each of these processes has its own specific responsibility and goals, their interdependency is explicitly recognized and the additional coordination to manage this is identified as an owner operator responsibility.

DOM also encourages all parties to focus on overall plant performance (functional and financial). It includes a model of performance that shows how overall performance is a product of performance in each of the three main processes and that poor performance in any of the processes will both reduce overall asset performance and limit/reduce benefits of superior performance in other processes. In DOM, asset performance is maximized only when each of the processes is optimized in the context of the overall goal.

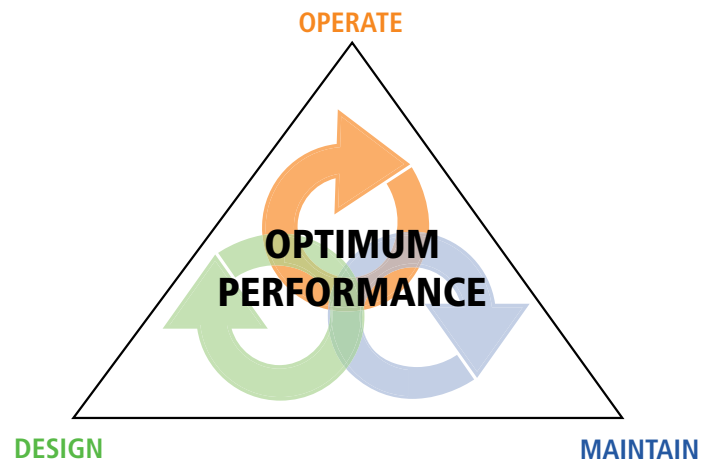
The symbol created for DOM (*Diagram 4*) captures the concepts of three continuous, interdependent processes focused on one common goal and also highlights the relative roles that each process plays in overall asset performance. Operate is placed at the top of a triangle reflecting the fact that value is only created through asset use, but Design and Maintain provide the foundation for performance.

Interoperability enables effective DOM teamwork

DOM shows why collaboration and teamwork are the best strategy for managing interdepen-

Diagram 4:

ARC’s DOM Model for asset life cycle management



ency and encourages owner operators to strive for a state where groups involved in the plant life cycle bind together and “interoperate” as if they were a single, virtual organization. Individuals in this “interoperability nirvana” are as effective and efficient in their interactions with people in other groups as they are with those in their own, close-knit team.

To achieve this level of teamwork, groups have to be made interoperable in several different ways for the areas where their work intersects in their view of information, approach to analysis, way of working and work priorities.

Depending upon the activities, this will require some or all of the following:

- **Common data models** that facilitate efficient, yet accurate and precise knowledge exchange. No one should have to translate (and possibly distort) information, wasting time and money, just to understand.
- **Complementary tools** that allow groups to efficiently share their analysis of problems and proposed solutions. No one should have to replicate the work of others and risk using different assumptions or reaching different conclusions, e.g., selecting a pump that limits plant capacity because losses were calculated incorrectly or differently.
- **Compatible processes** that allow groups to synchronize actions and effectively support each other’s efforts. No one should be delayed waiting for information from others when their need is truly pressing, or create unnecessary disruptions for others when it is not, e.g., scheduling MRO

parts recommendations early enough in the plant design to allow parts to be purchased at the best cost, yet still on-site during commissioning.

- **Shared goals** that enable everyone to have a common understanding of priorities and the appropriate plan of action. Priorities should always be clear to everyone, as should everyone’s responsibilities.

Achieving this ideal world is not easy, but it is also not optional. Managing interdependencies is vital to eliminating roadblocks that prevent better asset performance. Creating effective teams is the only real solution.

Addressing interoperability in all of the ways noted will likely involve new asset management policies, training and technology investments. But your first priority should be to establish a proper plant asset information management strategy. Information is the foundation for interoperability and without it, teams and assets cannot deliver superior productivity and profitability. Given this, a proper strategy to identify the right investments to achieve interoperability is critical.

References:

Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry, National Institute of Standards and Technology, NIST GCR-04-867.

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www.arcweb.com



Vietsovpetro Stays on Top of Offshore Design

Upgrade from PDS to SmartPlant 3D improves productivity

■ By **Dang Dinh Nguyen**

Vietsovpetro (VSP) is a Vietnamese-Russian joint venture focused on the production of oil and gas from offshore sources; exploration and survey work for the oil and gas industry; well drilling; and the design, assembly and repair of offshore facilities. Responsible for approximately 80 percent of the nation's oil and gas output, VSP helps Vietnam rank third in oil production and export in Southeast Asia.

VSP has produced more than US\$33 billion of oil and gas and continues to grow fields through new discoveries and the enlargement of existing fields. The company contributes about 25 percent of Vietnam's national revenue, making it the largest contributor to the state's economy.

Advanced technology

When it comes to maintaining and managing our assets, we face a number of challenges. It is important that we invest in and embrace good technology to address these needs.

With Intergraph technology, we are able to quickly visualize, question and analyze situations so that we don't make costly mistakes.

We have been a longtime user of Intergraph

applications, beginning with PDS. We chose Intergraph because it offers a complete solutions portfolio to satisfy project execution needs.

When we first learned about the advanced concepts that SmartPlant 3D offered such as relationships, associations and rule-based engineering, we knew without a doubt that SmartPlant 3D is the future of engineering. We began to migrate our PDS seats to SmartPlant 3D seats soon afterward.

Data integrity

At VSP, we perform a large number of designs and modifications for new and existing offshore platforms. It is a challenge to keep track of the changes and the related documentation updates when we use a traditional CAD-based approach.

With Intergraph SmartPlant Enterprise solutions, design and documentation activities are synchronized. This means we can ensure the data integrity of the design or model.

Keeping track of existing, new and future data is also important when we work on proposals.

When a change occurs, we want to make sure that there are no clashes or operability or maintainability issues.

Because of the number of changes we make on our facilities, we chose the SmartPlant Enterprise platform. Specifically, SmartPlant 3D was our top priority.

With SmartPlant 3D, we can easily manage data in both the 3D model and in outputs such as drawings. Once our model for a platform is built, it serves as an as-built model of the facility. This enables us to query, report and extract any type of deliverable depending on the request. We also intend to use the model as an initial data set when we engage contractors for major modification projects.

VSP's Science Research and Design Institute (NIPI) division is focused on design and engineering. NIPI uses SmartPlant 3D for the design and update of our offshore platforms. Since there are very few changes to the structural members on these facilities, the majority of the work is related to mechanical and piping.

NIPI uses SmartPlant 3D for tasks such as design and installation of new pipelines and equipment items, extraction of general arrangement drawings, piping isometric drawings, equipment layouts, pipe support drawings and various types of reports.

As-built model

SmartPlant 3D manages the as-built 3D model of our RP2 offshore platform. We use SmartPlant 3D to model the existing process system and main structure of the platform. With Intergraph's advanced solution, we designed and modeled the new process system, including equipment, piping, auxiliary structure and pipe support.

SmartPlant 3D helped us perform design check and review. We were able to generate deliveries to meet VSP's standard formats for 2D drawings as well as equipment and piping plans, piping isometric drawings and MTOs.

Services

Having experienced and knowledgeable local partners gives us confidence in upgrading our Intergraph technology. We chose Intergraph because of the high level of support we receive from Intergraph and its local partner in Vietnam, Credent Technology.

The Intergraph consultants are experienced and very knowledgeable. Most of them have experience in working for large EPC companies. They bring to the table not only software experience but also project execution knowledge, which is very important to us.

Our PDS users took a SmartPlant 3D training course. Intergraph and Credent training staff were available in the office to offer assistance afterward for approximately four weeks. This was perfect for the users to get used to the new system.

We have received excellent service from Credent for both training and customization. We customized catalogs, specifications, symbols, drawing templates and more.

We wanted to start from scratch with SmartPlant 3D, so no data migrations were performed. All of the catalog and specification items were created by referring to the softcopy documentation and manufacturer catalogs.

Constant support from Intergraph and Credent was very helpful in guiding us along our initial path. We started our first SmartPlant 3D project

within just two months. We definitely see productivity benefits in using SmartPlant 3D.

SmartPlant Enterprise

VSP uses a variety of Intergraph SmartPlant Enterprise solutions:

- SmartPlant 3D
- PDS
- SmartPlant Foundation
- SmartPlant Instrumentation
- SmartPlant P&ID
- SmartPlant Review
- SmartPlant Spoolgen®.

In the future, we plan to expand our use of SmartPlant 3D in conjunction with our other SmartPlant Enterprise solutions to ensure that other relevant information such as P&ID and instrumentation data is maintained in an as-built status.

We recognize that having access to new technology is vital. One of our most important tasks is to help our employees enhance their professional knowledge, apply technology and gain project execution knowledge. This is the biggest value we add to our organization – by building up our greatest asset, our employees.

Dang Dinh Nguyen is manager of the process, piping and offshore design department for the Science Research and Design Institute at Vietsovpetro Joint Venture. He is based in Vung Tau City, Vietnam.

www.vietsov.com.vn



About Vietsovpetro

During its 28 years of experience, Vietsovpetro has accomplished a number of noteworthy achievements. The company has built a synchronized and advanced technical system onshore and offshore to supply oil and gas production.

VSP was the first to discover and efficiently exploit Vietnam's unique basement oil reservoirs, such as White Tiger, Dragon, Big Bear and Eagle. The company has developed technical solutions for optimal exploitation of subsoil resources. These techniques have attracted the attention of foreign investors to petroleum exploration and production on Vietnam's southern continental shelf, and the attention of worldwide scientists as well.

The joint venture has become the main force of Vietnam's petroleum industry and economy. VSP has produced nearly 161 million tons of crude oil from its White Tiger, Dragon and Big Bear oilfields, with total crude oil turnover at approximately US\$33 billion.

VSP has boosted Vietnam's economy across a broad spectrum of industries. The supply of gas from the White Tiger field has brought the development of energy, fertilizer-chemicals and fuel gas industries in addition to improving shipping repair, port and warehouse services, petroleum products distribution and even tourism.

The company plays an important role in the development of local economy and culture. VSP has contributed millions of dollars from both its corporate fund as well as employee voluntary contributions for building infrastructure, historical-cultural care, schools, hospitals, and supporting victims of poverty and both domestic and foreign natural disasters.

The president of Vietnam has twice given VSP the nation's highest award, the Hero of Labor Golden Star of Vietnam, along with many other honors. Such great achievements are the results of tireless efforts of the company's 6,500 employees.





Streamlining Data Validation, Transformation and Loading

New solution reduces costs and time for data handover and migration of legacy data

■ By **Adrian Park**

Managing the handover of data and documentation from CAPEX projects to operations is a formidable and labor-intensive task. The volumes of data handed over are enormous, with a typical \$1 billion CAPEX plant having 200,000 tags, 100,000 documents and up to 20 million characteristics and relationships. Data are submitted from multiple sources (contractors, suppliers, authorities, etc.) and are often delivered incomplete and with errors.

The challenge of validating and correcting errors can be compounded if data are delivered very late in the project life cycle, with staff demobilized, budgets exhausted and management focused on how to finish the project as quickly as possible. The handover from a \$1 billion CAPEX plant can typically cost \$10-15 million and take up to one year to successfully validate and load operations systems.

Performing a high-quality data handover is critical to ensure the safe, reliable and effective operation of a process plant. If the quality of information handed over to operations is questionable, there is a constant need to physically verify the true physical state of the plant. This can drive up the cost of plant modifications by 30 percent.

A best-practice approach to ensure a smooth handover of data from project to operations includes the following prerequisites:

- A well-defined information handover specification incorporated into all contracts
- An organization responsible for follow-up of handover requirements
- A process of continual incremental handover of data
- A mechanism to receive and verify data received and loaded into target systems.

Intergraph has extensive experience in assisting our customers with data handover by providing information specifications, assistance in quality control and loading of data. Our new tool, Validation, Transformation and Loading (VTL), a SmartPlant Enterprise for Owner Operators solution, combines our many years of experience in data quality control and loading with requirements identified by key customers.

Handover from CAPEX projects

VTL is a comprehensive solution that manages VTL data acquisition from multiple sources. Data are held in a staging area, subject to rigorous quality control before being extracted for loading into

target systems, including Intergraph's SmartPlant Enterprise suite and third-party applications.

The solution enables owner operators and project management contractors to verify the quality of incoming data prior to loading into target project or operations systems. It empowers EPCs to check the quality of information deliverables before sending them to customers. The extensive tracking process of all data submissions, checks performed and results will offer complete auditable traceability of the handover process.

Data validation during maintenance and operations and legacy data migration

VTL can play a key role in efforts to improve and maintain data quality during the operations phase of a plant. Data may be extracted from operations and maintenance systems into VTL to validate data quality and perform corrections as part of a data quality improvement exercise before reloading back into operations systems.

Data from turnaround projects and OPEX modifications can be very extensive. Systems can be validated in VTL to ensure correctness and completion prior to approval for loading into operations systems.

VTL can also play a key role in data migration from legacy systems. Data can be loaded from existing applications for verification before loading into new target systems.

Data import

Incoming data submissions from one or more sources are imported into the VTL staging area. The customer provides mapping and transformation tools. Any mapping tool capable of generating XSLT, such as MapForce from Altova, can map incoming data or export data to be loaded into target systems.

The import module reads incoming files and transforms these using the XSLT generated from a mapping tool. The incoming file format may be provided in accordance with the supplier's standard, the owner's handover specification or an international standard such as ISO 15926. The import module's advanced features prompt users for input or can calculate values based on incoming data if needed. Users can check incoming .CSV files for compliance with ISO-8859-P15 and RFC 4180 standards to validate characters used and file structure.

Staging area

Based on Intergraph's industry-leading information management repository, SmartPlant Foundation, the staging area provides a highly robust and flexible repository to meet the needs of target systems. The staging area is also used to create and maintain rules and rule sets, and hold the details of all tests and test results.

The staging area validates loaded data. VTL supports a wide range of rule types and you can define your own rules, executing rule sets on data submitted to the staging area.

The types of rules you can define include:

- Syntax rules
- Uniqueness validation
- Relationship cardinality
- Date/time validation
- Integer/float validation
- String and pick list validation
- PL/SQL and DLL rule definitions – for more complex rules
- Unit of measure validation
- Mandatory fields validation
- Cascading errors – errors on one object can create errors on associated objects.

You can apply the PL/SQL rule type to more complex rules, such as comparing two characteristics for an object. For example, users can check data sheets to ensure that maximum operating temperature for an equipment item does not exceed maximum design temperature. You can also apply this rule type to compare data in the staging area with data already loaded into a target system.

The cascading rule type propagates an error on one object to all related items. For example, a customer can create a rule specifying that if one tag within an instrument loop is in error, then all other items in the loop must also be set in error.

Data export to target systems

The SmartPlant VTL export module enables the filtration and export of data that again can be transformed by XSLT from a mapping tool and initiate loading programs to load data into Intergraph SmartPlant Enterprise tools or third-party applications.

Added value

VTL significantly reduces the time and costs associated with validation of data handover from brownfield/greenfield projects and turnarounds to operations. It also improves the range, quality, consistency and traceability of validation performed.

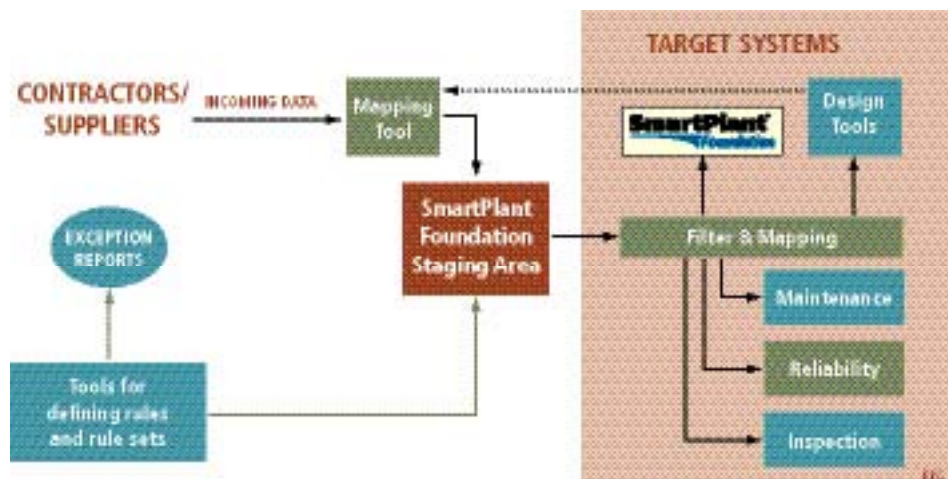
A very extensive range of user-definable rule types can be easily created with forms prompting the VTL administrator for input. You can restrict rules to a single plant or extend them to multiple plants. Once rules and rule sets are created, they can be rapidly executed against incoming data submissions. Established rules and rule sets ensure efficiency and consistency in testing. The staging area captures all results from testing, providing full auditable traceability of what testing has been performed, by whom and when, as well as the results of the testing.

VTL is based on well proven, SmartPlant Foundation technology that provides a highly configurable, robust staging area. Data submitted from multiple sources can be managed within the staging area. SmartPlant Foundation users can easily adapt to VTL. Comprehensive user access control in SmartPlant Foundation can allow control of who can:

- Create rules and rule sets
- Execute validation
- See results of validation.

In addition, VTL provides a highly flexible export mechanism that can initiate external loading programs to target SmartPlant Foundation systems, SmartPlant design tools or third-party applications.

Adrian Park serves as global technical director of owner operator solutions for Intergraph Process, Power & Marine and is based in Stavanger, Norway.



More information

More information about SPO, including a brochure and solution sheets, is available at www.intergraph.com/ppm/spo.aspx. Register to download SPO white papers at www.intergraph.com/spo.



Neste Oil Takes Steps for a Cleaner Future

World's largest renewable diesel facilities designed with SmartPlant Enterprise

■ By **Tuuli Kousa**

Neste Oil is a refining and marketing company focusing on advanced, cleaner traffic fuels. The company's strategy is based on growing both its oil refining and premium-quality renewable diesel businesses. Neste Oil's refineries in Porvoo and Naantali, Finland have a combined crude oil refining capacity of approximately 260,000 barrels a day.

Growing energy demands

As world energy demands continue to grow, new energy solutions are urgently needed. At the same time, Neste Oil believes that combating climate change calls for immediate action. Minimizing environmental effects and ensuring sustainability are the company's main business drivers in renewable fuel production.

To help face these challenges, Neste Oil has developed NExBTL technology. NExBTL renewable

diesel is the cleanest diesel in the world made from renewable raw materials. NExBTL technology is several years ahead of any competitors in the renewable fuels market. It can be produced in large volumes on an industrial scale. NExBTL can be used in all diesel engines and it significantly reduces both tailpipe and greenhouse gas emissions.

Renewable fuels

Renewable fuels are Neste Oil's fastest-growing business. Neste Oil produces and sells premium-quality NExBTL renewable diesel based on the company's proprietary technology. A number of new NExBTL plants are currently under construction and the company is continuing an active program of research and development on biofuels and raw materials suitable for biofuel usage.

The demand for biofuels is growing rapidly. Neste

Oil has set an objective to become the world's leading producer of renewable diesel.

Growing production capacity

Worldwide demand for diesel fuels is expected to reach 750 million tons a year by 2015. Traffic biofuels currently account for approximately one percent of total global fuel production according to the International Energy Agency. Production capacity of conventional bio-diesel and higher-quality renewable diesel in Europe totaled around 16 million tons in 2008. Consumption is projected to reach 13 million tons per year in Europe by 2010.

Neste Oil has responded to this demand challenge by launching a major expansion of its own capacity. A plant commissioned at the Porvoo refinery in 2007 already produces approximately 170,000 t/a of NExBTL renewable

NExBTL renewable diesel capacity outlook			
LOCATION	CAPACITY	INVESTMENT	YEAR COMPLETE
Porvoo, Finland	170,000 tons	US\$135 million	2007
Porvoo, Finland	170,000 tons	> US\$135 million	2009
Singapore	800,000 tons	US\$735 million	2010
Rotterdam, The Netherlands	800,000 tons	US\$900 million	2011

diesel, and a second plant of equal size is due to be completed in 2009.

Neste Oil made a decision to build a 800,000 t/a NExBTL plant in Singapore in 2007. In 2008, Neste further expanded with a similar-sized plant in Rotterdam. Both plants are currently under construction and are due to come online in 2010 and 2011 respectively. These will be the world's largest renewable diesel facilities.

Engineering

Technip Italy is performing the EPC work for the Singapore and Rotterdam plants. The information and communications technology specification for the project included a requirement that Intergraph applications would be the main engineering tools used for the project.

This requirement was put in place because Neste Oil wants to maintain its plant data in the native data format after commissioning. Neste Oil also made this decision because the majority of global engineering contractors use Intergraph applications.

Intergraph's global presence and support give engineering companies the ability to make plant modification and document updates to maintain plant information over the plant life cycle.

Document management

In 2008, Neste Renewable Fuels was looking for a document management system for its NExBTL renewable diesel plants. Intergraph SmartPlant Foundation was chosen in 2009.

The main reason for Neste Oil's selection of SmartPlant Foundation is that the product is part of the Intergraph SmartPlant Enterprise and is specifically designed for efficient plant document management. Plus, the system offers the potential to expand to manage plant data and 3D models.

SmartPlant Foundation will be linked to Neste Oil's maintenance management system. Implementation began in February 2009. After the first phase, the system is now ready for document handover from Technip Italy's document management system.

Technological pioneer

Neste Oil's NExBTL diesel is a major innovation that has been extensively tested and in commercial production since 2007. NExBTL renewable diesel offers a major reduction in both greenhouse gas and other harmful emissions. Measured over the product's entire life cycle, its greenhouse gas emissions are between 40 to 60 percent lower than those of fossil diesel, depending on the raw

material used. Blended with conventional diesel, NExBTL reduces overall emission levels in line with the proportion blended.

NExBTL diesel fuels have been studied extensively with cars, trucks and buses, and the results have all been very positive. In addition to lower greenhouse gas emissions, the fuel offers significantly lower particulate emissions than conventional diesel, as well as lower NOx emissions than conventional biodiesel. A clear reduction in tailpipe aldehyde emissions confirms that NExBTL renewable diesel burns cleanly.

Using NExBTL renewable diesel has a significant positive impact on emissions, as the fuel generates substantially less particulate and NO₂ emissions than conventional diesel fuel. Test results show that NOx emissions are cut by around 10 percent and particulate emissions by around 30 percent compared to fossil diesel.

Research and development

The energy supply of tomorrow will be based on multiple technologies and feedstock. Very large volumes of renewable fuels will be called for in the next few years, and no one raw material or technology can meet this challenge alone. All current approaches will be needed, together with a number of new ones as well – which is why Neste Oil is working hard on finding and introducing new raw materials and new solutions.

The company is committed to using only sustainably produced raw materials in the production of its renewable diesel. Significant new feedstock for transport fuels includes vegetable oils, tallow, wood residues, side products, and waste.

Neste Oil is working with more than 20 research institutions on six research initiatives aimed at identifying new raw material suitable for use as biofuel inputs. The research initiatives include jatropha, algae and microbes. A pilot project to demonstrate the use of wood residues is under construction in Finland.

Tuuli Kousa is a communications manager at Neste Oil and is based in Helsinki, Finland.

www.nesteoil.com



Differences between NExBTL and conventional biodiesel	
NEXBTL RENEWABLE DIESEL	CONVENTIONAL BIODIESEL
<ul style="list-style-type: none"> Can be blended up to 100 percent content 	<ul style="list-style-type: none"> Can only be used up to five to seven percent content (maximum allowed under the European diesel standard)
<ul style="list-style-type: none"> Complies with the strictest quality standards 	<ul style="list-style-type: none"> Biofuel usage requirement cannot be met without compromising fuel quality specifications
<ul style="list-style-type: none"> Reduces tailpipe emissions 	<ul style="list-style-type: none"> Increases NOx emissions
<ul style="list-style-type: none"> Offers excellent storability 	<ul style="list-style-type: none"> Must be used by a "best before" date
<ul style="list-style-type: none"> Does not require any engine modifications 	<ul style="list-style-type: none"> Can cause engine problems



Executing Capital Projects More Effectively

SmartPlant Enterprise for Owner Operators Project Execution solution reduces CAPEX and project schedules

■ By **Adrian Park**

Owner operators today are faced with the challenge of implementing larger portfolios of capital projects than ever before, with limited resources and pressures to ensure projects are delivered on schedule, to specification and within budget. This is not easy to achieve.

Average CAPEX overruns of 20 to 30 percent and delays in production start of several months are common in many areas of the process, power and marine industries today. Examples of projects that have fared much worse are not difficult to find and gain considerable adverse publicity for the companies involved.

One trend that is clear is that there is a positive correlation between the size and complexity of projects and the relative magnitude of cost overruns and delays. It appears that as projects grow larger and more complex, the number of things that can potentially go wrong increases, as do

the consequences and complexities in project execution. This is worrying in an industry where what was once considered a mega-project at US\$1 billion is now becoming more the norm, and multi-billion dollar projects involving many different contractors working globally are being more frequently encountered.

Project Management Contractors (PMCs) face similar issues to owner operators in managing complex projects effectively, often against challenging fixed-price or incentive-based contracts. Many of the benefits described in this article can apply also to the PMC.

SPO Project Execution

CAPEX projects require effective, user-friendly tools for project execution that can be rapidly deployed. To meet this demand, we are launching the SmartPlant Enterprise for Owner Operators (SPO) Project Execution solution.

This is the third SPO solution suite and is now available. The other two solutions, SPO Core and SPO Operating Plant, were released late last year.

As further explained in my other article (pages 28-30), the work processes in the SPO Project Execution solution can make a major impact in greenfield and brownfield CAPEX projects, saving between two to six percent of CAPEX. This is achieved through implementation of improved project execution processes supported by our SPO Project Execution solution, resulting in a combination of reduced CAPEX overruns and risk of project delays, improved quality and bringing plants online more quickly.

SPO Project Execution provides preconfigured, out-of-the-box work processes for managing several critical project management procedures

for very rapid, low-risk implementation. The processes that are being initially prioritized are:

- Management of change
- Non-conformity management
- Technical queries/site queries
- Interface control.

The first three are included in the initial release and interface control is planned for inclusion in a follow-up release. These key business processes overlap and are integrated with the plant design basis managed in the SPO Core solution. A key success factor for these processes is the ability to easily cross-reference project changes, non-conformities, technical queries and more to the affected documentation, tags and plant breakdown structure elements (areas, systems, units, etc.). SPO Project Execution work processes can also be linked to each other, as shown by the green arrow in Figure 1. For example, a technical query arising from a site can result in a temporary or permanent non-conformity or project change. The ability to link these project execution work processes facilitates the complete auditable traceability of issues and their resolution.

SPO Project Execution will include the capability of bi-directional exchange of information with contractors and suppliers and the seamless hand-off of processes via Web services. This mechanism is available as an alternative to either bulk-loading through Microsoft Excel spreadsheets or manual data entry.

For example, an EPC contractor may raise a variation order request and send details and attached documentation to the owner operator via Web services. The request will then be placed into a predefined owner operator change workflow, and after review and approval or rejection, the response is made available to the EPC via Web services.

This process eliminates costly traditional correspondence and reduces the amount of manual intervention in transferring work processes between organizations. SPO Project Execution can dramatically speed the process of handling key project execution functions such as project change, non-conformity, technical queries, interfaces, etc.

In SPO, both the plant design basis and project execution data are managed in Intergraph's SmartPlant Foundation information management tool. This provides a high degree of flexibility and enables rapid adjustment of the out-of-the-box work business processes if required to meet any customer-specific requirements.

The SPO Project Execution solution can exchange information with cost control and contracts administration systems to provide essential input, such as the correct cost of changes to be incorporated into revised project baselines and budgets.

Management of change

Change to the approved project design basis is the single greatest influence on project costs and schedule. It is therefore essential that changes are subject to an appropriate level of scrutiny before being approved or rejected.

On a major CAPEX project, there will be thousands of changes, and hundreds may be under consideration at any one time. Changes can arise from the owner operator project team, the owner operator corporate organization, contractors or suppliers.

The process of evaluating changes is complex, involving many technical and administrative stakeholders in the project. This complexity is compounded by overlapping scopes between changes.

The management of change process in many CAPEX projects is still largely based on simple hardcopy, electronic paper-type solutions or

spreadsheets and costly correspondence. For the owner operator or PMC, these do not provide adequate control of the change process through the project value chain, nor do they provide management the necessary visibility of the change process to effectively manage it proactively.

The lack of a good change management process results in a major drain on project executive resources. It can also jeopardize the achievement of project schedule, budget, quality and safety targets.

The SPO Management of Change process for projects provides:

- Increased visibility through management reporting
- A method for implementing increased discipline and rigor in the change process, including the critical distinction between change within existing scope (commercial and design development) and additions to existing scope (commercial and design change) as shown in the standard report from the SPO Management of Change process.

The SPO Management of Change process provides auditable traceability to demonstrate adherence with the owner operator project authorization matrices. Savings of one to three percent of CAPEX investment are possible from enabling a tighter change discipline and increased scrutiny of changes across the value chain.

In addition, administration costs and cycle times are reduced through:

Figure 1:

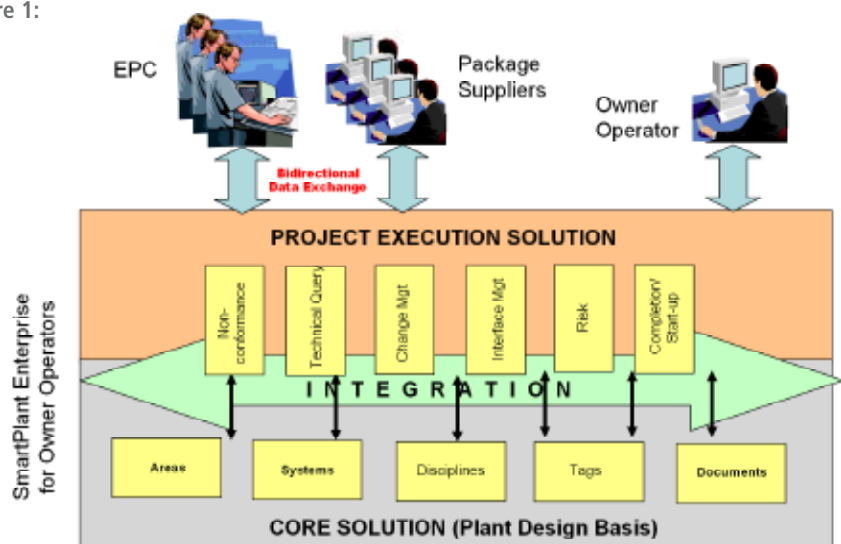


Figure 2:

CHANGE SUMMARY REPORT
 Plant/Installation : Main West
 Project : Explore
 Date/Time : 02.05.08

	Total Number	Total Value (1000 \$)	Changes being handled						Changes completed							
			Status: Registered			Status: Ongoing			Status: Rejected		Status: approved		VOR		VO	
			No.	Value	VOR No.	VOR Value	Number	Value	Number	Value	NO	Value	Value	Value		
Project Changes	299	1364000	65	273000	98	148000			117	587000						
Site Changes	417	1750000	69	245000	115	485000	274		172	680000	320	780000	786000			
Design/Commercial Changes outside existing scope/budget																
Project Changes	446	352200 (9%)	125	110000	150	114000			45	54200	96	74000				
Site Changes	533	588600 (14%)	172	144500	192	155000	302	155000	87	82500	102	206800	171	206800	206800	
Total Change	1095	4055000	451	772500	585	802000			172	826700	487	1553800				
Budget ref.		5200000														

- Automated hand-off of the change process between the owner operator and EPCs
- Implementation of workflows to push the change through the pre-defined work process
- Reporting providing both overviews and identification of bottlenecks in the management of change process.

The close integration of the management of change process in SPO with the plant design basis facilitates the evaluation of change requests. Users can easily identify what other changes involve the same plant items and documentation and determine any potential conflicts or synergies.

Non-conformities

Non-conformities and deviations to relevant laws, regulations, corporate governing documents and project specifications all need to be closely managed on projects. The process is tightly linked and integrated with the other project execution processes such as the management of change process and is required to demonstrate compliance with regulatory requirements. Non-conformity requests may need to involve the owner operator corporate organization experts in evaluation of potential technical, HES impacts, etc. and regulatory authorities.

The management of non-conformities and waivers in many organizations is performed by traditional paper-based or electronic archive systems. Such systems often suffer from non-conformities and the associated history of review and approvals not being easily visible,

especially during operations. When an incident does occur in a plant with such a system, it can take a long time to gather the necessary information together for the investigatory team and to receive permission from regulatory authorities to resume production.

The non-conformity process in SPO manages non-conformities from all parties (corporate, project/site team and contractors/suppliers) and the granting of temporary and permanent waivers. During project execution, the exchange of non-conformity-related information between the owner operator and contractors may be facilitated by Web services. This process is undertaken during project execution and the resulting non-conformity data are handed over seamlessly to operations (Figure 2).

The transfer of non-conformity information to operations, including the plant items and areas that are affected, helps to prevent the occurrence of incidents by making non-conformities highly visible for operations so that preventative steps can be taken, such as increased inspection. When incidents do occur, the process reduces the downtime impact of the plant and quicker restart of production by enabling all documentation and information related to the waiver process to be made available without delay. This includes complete, auditable traceability of the process leading to the waiver.

The benefits of this process are estimated at an average of three to five days per year in avoided production loss (OPEX) and reduced

time and administrative effort needed to accumulate information from incidents. But these benefits pale in comparison to the potential avoidance of loss of reputation to an owner operator that can be achieved by increased visibility of non-conformities and proactively preventing an incident that causes environmental damage, an injury or loss of life.

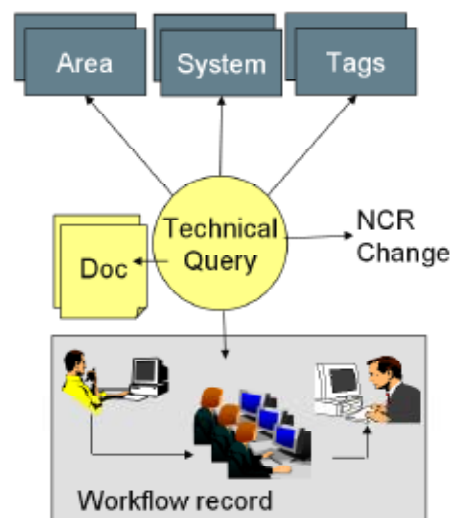
Technical queries

Technical queries (also known as site queries) occur across the value chain on CAPEX projects. A technical query usually involves a request for an engineering or construction clarification. Generally, project procedures require a fast (typically 72-hour response) to a query. Not meeting this deadline can give rise to variation order claims from contractors and suppliers. On any large CAPEX project, thousands of these queries arise, and some of these result in non-conformities or change requests.

Technical queries are a fact of life, and projects today often suffer from a lack of overview of the technical query situation. This makes it difficult to identify bottlenecks and ensure proactive steps are taken to avoid late response to technical queries with the potential consequence of project delays and variation order claims increasing.

The SPO technical query process (Figure 3) provides for effective monitoring of query handling, plus it enables automated workflow and management reporting. This can reduce project schedules by one to three percent by empowering project management to take proactive

Figure 3:



“CAPEX projects require effective, user-friendly tools for project execution that can be rapidly deployed. To meet this demand, we are launching the SPO Project Execution Solution.”



action to resolve bottlenecks in processing technical queries and resulting project delays. It can also produce savings of \$6-16 million on a \$1 billion CAPEX plant from reduced project costs by being able to start production and generate revenue earlier. Plus, potential variation order claims and administrative effort for all parties will be reduced.

Interface control

Interface control is a key project execution area for the control of all formalized internal and external interfaces:

- Between the main contractors, suppliers and owner operator
- Within the owner operator project team and the corporate organization.

The interfaces include technical items that need to be agreed upon and delivered between two or more parties in the project organization. This includes both contractors and the owner operator. There are often interfaces within the owner operator itself that need to be managed. For example, on an offshore oil and gas development there could be interfaces between the reservoir engineering, subsea development, drilling and topsides development subprojects as well as the corporate organization. All of these interfaces are broken down into hundreds of interface items that need to be executed according to formalized contracts or agreements between the interfacing parties.

In many projects, interface control is performed by each interface coordinator, individually documenting the interface through multiple spreadsheets. This makes consolidated reporting and gaining an overview impossible.

The SPO interface control process offers a uniform means of reporting the status and exceptions for all interfaces across a project and provides the necessary visibility for project executive management to proactively manage conflicts between contractors and avoid schedule impact or variation order claims arising. Typical benefits for the owner operator include reduced variation order claims and reduced administrative effort in compiling reports and administrative effort in handling interfaces, resulting in CAPEX savings of one to two percent.

Future work processes

The processes described so far are those that are being prioritized. There are several other work processes that are planned for future releases, such as:

- Risk-reducing measures – Plant risks and the measures to be taken to reduce these risks “as low as reasonably possible”
- Supervision, the identification of management reviews and follow-up of findings
- Risk and opportunity management will identify risks and opportunities related to project

execution. Measures taken will reduce the probability of risks and increase the chances of gaining from opportunities

- Technical issues administration with interfaces to administrative systems
- Site surveillance findings for deviations discovered by the owner operator construction/field teams
- Plant handover to operations – Streamlining the handover of the plant to operations by commissioning sub-system/area.

Adrian Park serves as global technical director of owner operator solutions for Intergraph Process, Power & Marine and is based in Stavanger, Norway.

More information

More information about SPO, including a brochure and solution sheets, is available at www.intergraph.com/ppm/speoo.aspx. Register to download SPO white papers at www.intergraph.com/spo.



Discovering the Value of Intelligent Data

SCG Chemical Group puts data handover standards into action with SmartPlant Enterprise

■ By **Surachate Chalothorn**

The Siam Cement Group (SCG) has been a leader in the Asia-Pacific region since its founding under the Royal Decree of His Majesty King Rama VI in 1913. It was Thailand's first cement producer, and has played a key role for nearly a century in the growth and modernization of the country and the region.

Today, SCG has diversified into a number of industries, becoming the largest and most advanced industrial conglomerate in Thailand, with five strategic business units: Petrochemicals, Paper and Packaging, Cement, Building Products and Distribution.

SCG entered into the petrochemical business 15 years ago when its first petrochemical industrial plant was developed. Since then, SCG

Chemical Group has grown about tenfold to become a fully integrated, leading petrochemical producer in the Southeast Asian region.

Data handover problem

SCG Chemical Group's first world-scale ethylene complex, built by Toyo Engineering Corp., began operating in 1999 with an annual production capacity of 600,000 tonnes of ethylene and 300,000 tonnes of propylene. Due to a rapid growth in demand for the products, we retrofitted the plant in 2001 to increase capacity to 800,000 tonnes of ethylene and 400,000 tonnes of propylene per year.

For the plant retrofit project, the engineering contractors had extensively made use of intelligent IT solutions to collate and manage the

engineering data. However, the information was not handed over in an intelligent format that could then be re-used for operation and maintenance throughout the life cycle of the plant. The data was instead provided mostly in scanned image format. This meant we had to direct a large amount of resources toward incorporating the scanned images into our operation and maintenance systems.

Intelligent data

To help bridge this data gap, the SCG Chemical Group turned to Intergraph's SmartPlant Enterprise solutions to create intelligent plant engineering information.

We first chose INtools®, now known as SmartPlant Instrumentation. SmartPlant Instrumentation



helps us design, manage and maintain our instruments throughout the life cycle.

We next implemented SmartPlant P&ID, which creates intelligent piping and instrumentation diagrams and builds a comprehensive data model.

We were able to handle the conversion to SmartPlant solutions with our internal resources. Staff members only needed a month for training and preparation. Our team of six drafters and one junior engineer converted more than 300 P&IDs in just seven months – a remarkable achievement!

Managing information

After SmartPlant Instrumentation and SmartPlant P&ID went live, our group adopted SmartPlant Foundation as an engineering document management system. SmartPlant Foundation also enables a tight integration with SmartPlant Instrumentation and SmartPlant P&ID. The system streamlines data entry, identifies and resolves inconsistencies and presents data in the format that best meets the need of a specific task. SmartPlant Foundation helps us plan for maintenance, expansions and modifications, as well as any shutdowns.

In addition, SmartPlant Foundation helps us prove compliance with governmental regulations. International protocols, national laws, insurance requirements and local authorities

all require increasing detailed technical documentation. Non-compliance could result in significant costs or, in the worst case scenario, a shutdown.

Setting the standard

Thanks to our implementation, we now realize the value of using intelligent engineering software systems for plant operation and maintenance and the ability to interchange data among plant applications.

We are currently planning a second ethylene complex. The project consists of a world-scale naphtha cracker and downstream polymer units. There will be multiple contractors from different locations involved in the project.

Because of our experience, we are now defining the approach for handover of documents and data for this project. EPC contractors, subcontractors and vendors must provide data in formats that can be populated and loaded into our existing SmartPlant Foundation system.

By using SmartPlant Enterprise, the tremendous amount of data prepared during the EPC phase becomes very useful for operation and maintenance throughout the life cycle of the plant. Data can be accessed efficiently, minimizing the effort to re-input the data after the plant is handed over to the operations team. Also, if this data is available in an intelligent format,

it can easily be re-used for plant modifications and de-bottlenecking.

The road ahead

Our company prides itself on being a pace-setter in the introduction of new technology and new skills to Thailand. It's no surprise, then, that we are continuing to work with Intergraph to develop and implement additional tools, particularly in the area of operations and maintenance.

Intergraph has helped us develop our "road map" with a step-by-step approach to achieving full benefit from the invested asset. By fully taking advantage of SmartPlant Enterprise intelligent software solutions, we can continuously improve our plant's productivity and performance. We will follow this road map on our path toward operational excellence.

Surachate Chalothorn serves as olefins research and technology manager for the SCG Chemical Group in Thailand.

www.siamcement.com



SmartPlant Enterprise for Owner Operators Offers Significant Value Proposition

Gain benefits throughout the plant life cycle

■ By Adrian Park

In the article on page 4, we explained that SmartPlant Enterprise for Owner Operators (SPO) is comprised of three discrete solutions, each offering pre-packaged work processes:

■ **SPO Core Solution** — Addresses work processes that are common throughout the plant life cycle such as managing the plant breakdown structure, tag management, document management, data loading, etc. and integrated with Intergraph's suite of design tools

■ **SPO Operating Plant Solution** — Focuses on work processes for plant operations and maintenance including managing plant modifications and synchronizing the engineering design basis with the maintenance system

■ **SPO Project Execution Solution** — Provides work processes for the owner operator to effectively manage greenfield and brownfield CAPEX projects including management of project

change, interface control, management of non-conformities, technical query management, etc.

Example plant

In this article, we will briefly explain how some key work processes provide improved productivity and other benefits to the owner operator. The figures quoted here are based on estimations for a typical US\$1 billion CAPEX refinery producing 150,000 barrels per day and \$5 per barrel margin. Labor hour rates have been based on \$80 per hour.

The SPO implementation process includes a gap analysis and deployment planning exercise conducted by Intergraph and the customer. The value proposition and productivity benefits are estimated for a specific customer implementation. The figures used in this article are for a typical plant and actual cost benefits will be dependent on each customer's specific circumstances and business environment.

SPO Core Solution — Manage the engineering basis across the life cycle

The SPO Core Solution centrally allocates tag and document numbers in accordance with the plant engineering numbering system. This ensures consistency of allocation, reduced errors and corrective actions and the distribution of these numbers to design tools. The document management transmittal workflows ensure effective, consistent distribution of electronic documentation.

The improved consistency of plant configuration between tools, reduced frequency in errors and improvements in document distribution are estimated to yield benefits of \$340,000 saved annually.

The integrated Intergraph design tool set available for SPO Core Solution yields benefits in ensuring the consistency of data across the engineering design basis and from the individual tools. For example, after implementation

of SmartPlant Instrumentation, O/Os have reported improvements in the consistency and accuracy of data. These improvements result in reduced downtime from unplanned shutdowns arising from incorrect data, amounting to one day of extra production per year. For the example plant, this would lead to an increase in annual production by \$750,000.

Other benefits offered by the rule-based integrated tools include accuracy of data and consistency between tools. Data are required to be entered only once. The tools automate generation of many key documents as reports from the design tools, such as loop drawings, termination drawings, etc. During the OPEX phase of a plant life cycle, these benefits can typically amount to \$2.2 million per year in reduced costs and productivity gains in the example plant.

Another benefit of the integrated design tools is through SmartPlant Isometrics, powered by ISOGEN®. Formerly known as I-Sketch™, this tool enables non-CAD specialists to easily maintain isometrics. With automatic import from 3D CAD, the process is less prone to error and automatically produces output for fabrication purposes. Typical benefits for the example plant amount to \$136,000 annually.

SPO Operating Plant Solution — Manage change and provide data access through Web portals

The SPO Operating Plant Solution includes two key business packages:

- Management of operations changes, including maintenance of the engineering design basis with the maintenance system
- Providing a Web portal to access data.

The management of operations change processes is an important feature. It ensures consistent compliance with the company approval process so that changes are effectively maintained and correctly routed through the operator organization. In addition, auditable traceability for authority review improves historical tracking. The SPO Operating Plant Solution ensures accuracy and consistency between tools, reducing the need for plant walk-downs to verify the as-built status of data.

Another benefit is the automatic creation of notifications in the maintenance system for the

execution of minor modifications on the approval of changes. This is typically estimated to generate \$2.6 million in savings for the example plant.

Consider what would happen in the absence of updating information to the maintenance system of a plant with changes to the plant engineering design basis from modifications. This could result in incorrect maintenance plans being followed with an increased risk of breakdown or accident. The incorrect procurement of replacement equipment and parts also might require equipment and parts to be replaced a second time, causing delays and marginalizing plant production or shutting it down altogether.

SPO Operating Plant Solution includes the automated creation and update of functional locations in SAP EAM on changes to the dynamic engineering design basis. The savings achieved by automatically creating and updating functional locations in the maintenance system and the savings from avoiding erroneous procurement of replacement of equipment and parts alone amount to \$680,000 per year for the example plant.

The SPO SAP NetWeaver® Web portal provides simple access to data in SPO and SAP EAM. This avoids the tendency of plant staff to keep its own unofficial archive of documents and the potential

danger of working with outdated versions. The portal will reduce training needs; enable ad hoc queries to be answered more quickly and with less effort; ensure the latest version of data and documents are accessible; enable faster and more informed decision making; and reduce the time needed to prepare maintenance packages. These benefits amount to \$1.5 million annually in OPEX cost reductions and productivity gains.

Future releases of SPO are planned to extend the range of operations systems covered and provide alternate Web portal technologies such as Microsoft® SharePoint®.

SPO Project Execution Solution — Reduce project schedules and CAPEX costs

The SPO Project Execution solution will include coverage of key processes for managing the execution of greenfield and brownfield CAPEX projects. These processes will include: management of project change; interface control; management of non-conformities and management of technical queries.

Change management in many CAPEX projects is still largely based on simple hardcopy or electronic paper-type solutions. These do not provide





adequate control of the change process through the project value chain nor do they often provide management the necessary visibility of the change process to properly manage changes.

The SPO management of change process for projects increases visibility via management reporting. This vehicle creates improved discipline and rigor in the change process, including the critical distinction between design development and design change. Management reporting ensures auditable traceability to demonstrate SOX compliance and adherence with project authorization matrices.

Savings are estimated at typically two to three percent of CAPEX investment. These savings derive from enabling a tighter change discipline and increased scrutiny of changes across the value chain, amounting to \$20-30 million for the example plant. In addition, some \$600,000 in reduced administration costs will typically be experienced in a 48-month project execution cycle.

The management of non-conformities and waivers is still characterized in many organizations by traditional paper-based or electronic archive systems. Such systems often suffer from non-conformities not being easily visible, especially during operations. When an incident does occur with such a system, it can take a long time to gather the necessary information for the investigative team and to gain permission to resume plant production.

The non-conformity process in SPO helps prevent the occurrence of incidents. Non-conformities are made highly visible for operations, for example, in the 3D plant model. Where incidents do occur, the process reduces the downtime impact of the plant and a quicker restart of production. SPO enables all documentation and information relating to the waiver process to be presented without delay, including a complete, auditable traceability of the process leading to the waiver.

The benefits of this process are estimated at \$2-3 million annually in avoided production loss (OPEX) and \$100,000-200,000 annually in efforts needed to accumulate information from incidents. But these benefits pale in significance compared to the potential avoidance of loss of reputation to an O/O that can be achieved thanks to the increased visibility of non-conformities and proactive prevention of an incident that causes environmental damage, an injury or loss of life.

In many projects, interface control is performed:

- Between the O/O project team and the EPCs
- Between the EPCs.

This is individually done by each interface coordinator, documenting the interface through spreadsheets. This makes consolidated reporting and gaining an overview difficult.

The SPO Interface Control process offers a uniform means of reporting the status and exceptions for all interfaces across a project. Intergraph's solution

gives project executive management the necessary visibility to proactively manage conflicts between contractors and avoid schedule impact or variation order (VO) situations arising. Typical benefits for the O/O include reduced VO claims of \$5-10 million in CAPEX savings and reduced administrative effort of \$400,000 in compiling reports and administrative effort in handling interfaces.

Technical queries arise across the value chain on CAPEX projects and generally there are procedures requiring a fast response to a query, usually within 72 hours. Not meeting this deadline can give rise to VOs from contractors and suppliers.

Projects today often suffer from a lack of overview of the technical query situation, making it difficult to identify bottlenecks and ensure proactive steps are taken. By taking these steps, companies can avoid late response to technical queries with the potential consequence of project delays and VO claims arising.

The SPO Technical Query work process enables effective monitoring of the design development and construction progress and avoids delays. This can reduce project schedule by one to three percent by enabling project management to take proactive action to avoid delays in handling technical queries. Typical savings that can be achieved for the example plant would be:

- \$1-3 million project costs
- \$4-12 million production gain by being able to start production earlier
- \$0.5-1 million reduced VO claims
- \$400,000 reduced administrative effort.

Adrian Park serves as global technical director of owner operator solutions for Intergraph Process, Power & Marine and is based in Stavanger, Norway.

More information

More information about SPO, including a brochure and solution sheets for SPO Operating Plant Solution and SPO Core Solution, is available at www.intergraph.com/ppm/speoo.aspx. Register to download SPO white papers at www.intergraph.com/spo.

Are Owners Seeing in 3D?

Adding a new dimension to planning and execution

■ By **Joe Morray**

The use of 3D models by owners has always been a matter of some debate. Primary among the challenges has been the large expense associated with capturing existing facilities in 3D, though this has been somewhat mitigated through the significant advances in laser and point cloud capture. The other issue is how can owners use 3D models in their typical business processes, centered on operations and maintenance activities?

Foremost in his advocacy of 3D for owners is my Trinity Technologies colleague Ed Anderson, formerly of Air Products. Through his seminars, he discusses a wide array of business processes which are uniquely addressed through the use of 3D models.

"I constantly hear people say, 'It is just too expensive to keep the 3D model up-to-date,'" said Anderson. It is obvious to me these people do not understand the new work practices that 3D enables, and therefore cannot "do the math" to actually determine if keeping the model up-to-date is expensive or actually reduces the cost of operations.

"Countless case studies tell us that it is much more expensive to keep multiple drawings produced by multiple organizations up-to-date and synchronized than to keep one 3D model up-to-date," said Anderson. Among the business processes he cites are:

Owner overseeing construction process

Delivery of a 3D model through viewing software has been shown to greatly improve the planning process at all stages. The high-level milestone plan must be created several months before construction is scheduled to mobilize onsite and the 3D model (actually 4D with time mapped in) is provided to all key stakeholders.

The plan must be formed with all craft supervisors through a coordination process referred to as a "sticky note process." The objective is

for the teams performing the work to create a plan that meets – and preferably exceeds – the high-level plan created earlier. The 3D model makes the entire construction plan visible to all project stakeholders, including management, so that issues can be identified quickly and then resolved.

Plant commissioning

By using the 3D view/redline tool we discovered that we were able to create inspection circuit "drawings" from the model. In one particular example, as a result of reusing the model, the maintenance department was able to:

- Reduce its inspection expense budget by more than US\$293,000 for the baseline study
- Reduce the number of man-hours required to create the inspection circuit drawings by 3,100 hours
- Reduce the plant commissioning schedule by several weeks, allowing the plant to come online sooner – this was the most significant benefit. Note that the plant was actually started up before all baseline inspections were completed and documented.

Use of 3D images to guide the startup crews

Anderson frequently reminds his clients that "no one has to be taught how to read pictures." His best practices for systems startup include cutting from the model a variety of prints of the systems' equipment and piping, with the tag numbers printed on the images. "The startup crew knows exactly what they have to work on, since there is a literal picture of the layout and components," he said. "It's easy to figure out where everything is."

Plant maintenance

"I received a phone call one day from Don, a maintenance planner, whom I had trained some weeks earlier in how to use the 3D view/redline tool, since his new plant had been designed in

3D," said Anderson. "He had discovered a steam leak. 'Discovered' is probably not the operative word, since the air was full of steam and noise. As usually happens with steam leaks, it was not easy to tell exactly where the leak was located, because steam tends to blow out at all insulation joints in the vicinity of the leak.

"As he was trying to assess how to get started, not knowing exactly where the leak was, it dawned on him that he might be able to tell more about the situation if he was to see what the pipe under the insulation looked like, and if he could 'eliminate the steam cloud.' He went directly to his computer and pulled up the 3D model.

"Because he could turn off the insulation and since there was no steam cloud on his monitor, he studied the piping and finally deduced that the leak was probably at one of the small take-offs on the mud-leg. His reasoning was based upon these two areas being the weakest points, and the fact that the entire system was less than five months old. Problem analyzed and solved."

Opportunities

There are literally hundreds of these kinds of examples. There is a great opportunity for owners to add a new dimension to their planning and execution activities. We can see clearly in 3D!



Joe Morray is president of Trinity Technologies Corp., a process and power industries consulting firm that helps owner/operators and EPC firms succeed in the use of information systems. The company specializes in driving companies to align work processes, technology, and organizational change requirements for the plant environment.

www.trinitytechnologies.com



Change is the
only constant

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Promote turnaround planning with accurate plant data. Reduce the risk from loss of critical asset intelligence due to a retiring workforce. Keep your maintenance data updated for auditability and ensure correct procurement of replacement parts.

Improve productivity

Increase "wrench-time" for operations and maintenance personnel by eliminating unproductive information searches. And reduce downtime from plant walkdowns and data validation.

Enhance plant safety

Improve facility safety with better configuration management and ensured data consistency.

Learn how your data asset can keep up with your dynamic pace of business. Register to download a special ARC Advisory Group productivity white paper at www.intergraph.com/spo.



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