

OIL & GAS



 **INTERGRAPH®**

SmartVoice

Intergraph® Process, Power & Marine
Customer Success Stories

VOLUME 2

The Intergraph logo features the word "INTERGRAPH" in a bold, blue, sans-serif font. A thin, curved line arches over the letters "I" and "N". A registered trademark symbol (®) is positioned to the upper right of the word.

INTERGRAPH®



INTRODUCTION

Advances and innovations in engineering technology during the last three decades have changed the way people approach their work, the methods and tools they use, the collaborative partnerships they develop, and the solutions they employ to ensure the success of their businesses.

With more than 40 years' history, Intergraph has been helping customers around the world to improve safety, quality, and productivity in their process, power, marine, and offshore facilities. Today, our advanced technology is helping customers change the way they do business by offering solutions that enable them to capture and reuse their intellectual capital across the entire enterprise, enhancing their global competitiveness.

In SmartVoice, you will learn how our customers of all sizes and in all industries are transforming their businesses with Intergraph solutions. Intergraph empowers you to make better, faster operational decisions, leverage best practices from around the world, and explore how other customers are generating more value with Intergraph products and services.



GLOBAL LEADER

Intergraph's Process, Power & Marine division creates solutions that enable the design, construction, and operation of process and power plants, offshore platforms, and ships, and provide the information management capabilities to build and operate those facilities.

Intergraph has been ranked the No. 1 overall worldwide provider of engineering design solutions for industry, according to the ARC Advisory Group. Our leadership position is backed by a proven track record of high-quality product development, a global customer base of industry leaders, and a worldwide sales and support network. Intergraph Process, Power & Marine's business is based on a strong financial foundation and steady growth.

Our customers use Intergraph software and services to design, build, and operate many of the world's largest and most elaborate industrial facilities.

“ More than two-thirds of the plants built worldwide are designed using Intergraph software. ”

HISTORY OF EXCELLENCE

Since offering its first solution for plant design in 1978, Intergraph has focused on developing industry-leading plant and marine design solutions, enabling our customers to use integrated applications to execute projects for increased efficiency and effectiveness. Today, Intergraph is the leading global provider of enterprise engineering software to the process, power, and marine industries. We offer a full suite of solutions that enable proven productivity gains for engineering, procurement, and construction (EPC) firms and owner operators, improving engineering efficiency by up to 30 percent.

1987	Offered our first piping application for plant design.
1984	Launched the leading 3D plant design system.
Late 1990s	Created first data and document management system specifically for the plant design industry.
2000s	Presented suite of integrated, intelligent 2D solutions. Offered leading material management and procurement system specifically for the plant design industry.
Today	Providing the only next-generation 3D solutions for process, power, and marine industries.

INTERGRAPH ENTERPRISE ENGINEERING COMPONENTS

3D MODELING & VISUALIZATION

Save project time and increase production efficiency

For manufacturing and power industries, meeting higher production goals and stricter regulatory requirements begins with building a better plant. Intergraph provides an integrated design environment for plant construction that defines and manages the 3D plant model. The intelligent, rule-based 3D environment enables faster, silo-free plant design and engineering, better collaboration, and reduced time to market. Innovative plant modeling software from Intergraph provides consistent 2D/3D integration between process engineering and detailed engineering disciplines, and true workflow-managed integration across the project enterprise.

INFORMATION MANAGEMENT

Ensure consistency and accuracy of your engineering data

Plant designers and plant owners need plant management software with enhanced decision support capabilities to facilitate global design, production, and life cycle optimization of the plant. Intergraph's information management software maximizes efficiency for industrial and manufacturing plant maintenance and provides plant operation solutions. From concept and design through plant maintenance, operations, and decommissioning, Intergraph enables electronic management of all of the plant's engineering information, integrating information on the physical asset, processes, and regulatory and safety imperatives.

ENGINEERING & SCHEMATICS

Increase data quality and consistency across tasks

To keep a plant operating smoothly over its 30- to 40-year life requires efficient and intelligent plant engineering from the beginning. Intergraph's comprehensive plant engineering solution has been developed for today's 24/7 global engineering workshare environment. All engineering disciplines are intelligent and fully integrated — an engineering change in one area automatically triggers change in all associated objects, no matter where the change occurs. Designed to drive plant optimization, the rule-driven environment prevents engineering errors, thus avoiding shutdowns and lost production.

PROCUREMENT, FABRICATION & CONSTRUCTION

Reduce material surpluses and shortages

With Intergraph's efficient and accurate plant control system for procurement, fabrication, and construction, plant designers and owners save valuable production time during plant construction. The solution spans the complete project management life cycle — from materials specification and change management through procurement and tracking to inventories, forecast, and material issuing. Intergraph lowers labor costs throughout engineering, procurement, and plant construction. Designed to drive efficiency, our solutions for plant project management can help avoid costly material surpluses and shortages, and reduce overall project risk.

ANALYSIS

Streamline your plant design validation processes

For plant owners and designers, the need to integrate plant design and engineering analysis is vital. One without the other could result in delays and unexpected costs. But with the two working together, you have the ability to validate your plant's design as you go, saving you costly time and resources.

With Intergraph's acquisition of COADE, we now provide plant analysis solutions that set the standard for the industry. Leading plant engineering companies and owner operators worldwide count on our software to deliver accurate, reliable results. Intergraph has transformed primarily manual, time-consuming, and error-prone tasks into seamless and accurate processes. From pipe stress analysis to automated full vessel and oil tank analysis, our software helps you improve safety and reliability while tightening the entire design process to save time and money.





OIL & GAS

Design, construction, operation, and data management of oil and gas process plants

Intergraph supports the design, building, handover, commissioning, operating, and maintaining of large plants involved in producing or processing oil and gas natural resources, including offshore platform structure construction. Oil and gas refinery owners can eliminate unplanned plant shutdown to avoid the tremendous costs of labor and lost production, as well as comply with federal regulations in order to keep their plants operating. Both designers and owners can enjoy better decision support capabilities to facilitate global design, life-cycle optimization, and refinery production.

Chiyoda Establishes Industry-standard Materials Management System for Mega-projects

Intergraph SmartPlant Materials delivers an optimized, integrated materials management system for successful project completion



PROFILE

Company: Chiyoda Corporation

Website: www.chiyoda-corp.com

Description: Since its founding in 1948, Chiyoda Corporation has successfully built several plants and executed many projects in over 40 countries around the world in very diverse fields, including energy, petroleum and natural gas, chemical and petrochemical, pharmaceuticals, environmental conservation, and general industries. Chiyoda is a front-runner in energy-related technology, and its purpose is to contribute to the society through engineering for sustainable progress by promoting balance and harmony between industrial progress and the global environment.

Revenue: US\$2.97 billion

Industry: Energy

Country: Japan

PRODUCTS USED

- SmartPlant Materials
- SmartPlant Instrumentation
- SmartPlant P&ID
- SmartPlant 3D
- PDS®

KEY BENEFITS

- Optimized, integrated materials management system
- Automated deliverables such as custom reports for ease of sharing
- Project monitoring for improved efficiency and enhanced risk management
- Successful project execution for concurrent projects

IDENTIFYING GOALS

Chiyoda Corporation (Chiyoda), headquartered in Yokohama, Japan, is a world-leading engineering company with wide-ranging business interests in such fields as energy, chemicals and petrochemicals, pharmaceuticals, environmental technology, social infrastructure, and industrial facilities. Since its founding in 1948, Chiyoda has built several plants and executed numerous projects in over 40 countries around the world.

Chiyoda had developed its own in-house materials management system but in 1998, it decided to replace the system. After an intensive evaluation of all the solution providers in the market, the company chose Intergraph and decided to replace its in-house materials management system with SmartPlant Materials as the global, enterprise-wide standard.

In 2005, Chiyoda took on three large LNG (3LLNG) projects in Qatar, with each project requiring the construction of two trains with a capacity of 7,800,000 t/year each, which is the world's largest capacity record to-date. It was highly critical that the company could execute the challenging EPC work for these three mega-projects, using Intergraph technology.

OVERCOMING CHALLENGES

- Establish an automated, transparent materials management system across all EPC processes, especially for mega-projects
- Ensure a seamless interface between the materials management system and multiple 3D CAD systems
- Optimize project workflows to execute multiple projects concurrently

REALIZING RESULTS

Chiyoda is an experienced SmartPlant Materials user, and the Intergraph solution played a significant role in the 3LLNG Qatar mega-projects.

"SmartPlant Materials is recognized as the industry standard, and its fundamental data structure is an excellent fit with our desire for an automated materials management system," said Ichiro Ota, general manager of the engineering services and project IT department at Chiyoda. "With SmartPlant Materials

implemented, we were able to meet the requirements of the 3LLNG Qatar mega-projects."

SmartPlant Materials is the only solution available on the market that fully supports the unique materials management processes needed in the process, power, and marine industries. It offers Chiyoda a total materials management and subcontract management solution for its plants and projects. SmartPlant Materials is proven technology and has been adopted by industry-leading EPC companies around the world – users of SmartPlant Materials report improved procurement efficiency with lower risks and costs through accurate and effective materials management.

Intergraph worked closely with Chiyoda to implement SmartPlant Materials to its specific requirements, establishing project workflows, preparing material codes, and customizing reports. Chiyoda also introduced custom functionality, such as reducing the importing spool BOM data volume as the company had requested subcontractors to send BOM data for all spools, and automatic execution of custom reports each night to share the generated intermediate file, which reduces report generation time for each user. In addition, Intergraph tuned several native programs in SmartPlant Materials to meet the data volume of the mega-projects, which was critical for project execution.

Chiyoda also implemented other Intergraph solutions, such as SmartPlant Instrumentation and SmartPlant P&ID, which were integrated with SmartPlant Materials for the sharing of instrumentation and line list data. It was also important that SmartPlant Materials was integrated with Chiyoda's other systems, including SmartPlant 3D and its in-house ELE/INS MTO systems. Chiyoda established a seamless interface, enabling the company to manage all EPC data in a single database for a fully integrated materials management process. The company could monitor the project status regularly and manage any risks accordingly. At the peak of the 3LLNG projects, more than 300 users would be accessing the SmartPlant Materials system.

"SmartPlant Materials helped tremendously in optimizing the entire materials management process, ensuring that the correct quantity of the required materials was delivered at the right time to the construction site," said Ota. "SmartPlant Materials contributed significantly to project execution – without the

Intergraph solution, we would not have been able to complete the 3LLNG Qatar mega-projects successfully."

MOVING FORWARD

As a leading EPC contractor, Chiyoda continues to enhance its materials management system with SmartPlant Materials. Ota said, "SmartPlant Materials is one of the best software solutions for EPC contractors, and it can handle even the most complex and challenging projects. We used it successfully for our mega-projects, and we highly recommend the solution for effective materials management."

Chiyoda is a longtime Intergraph customer and has been using SmartPlant Enterprise solutions, including SmartPlant Materials, SmartPlant Instrumentation, SmartPlant P&ID, and SmartPlant 3D. The company is currently exploring other solutions from the SmartPlant Enterprise suite, such as SmartPlant Foundation, SmartPlant Process Safety, and SmartPlant Electrical, which can be used in an integrated environment to enable Chiyoda to further enhance safety, quality, and productivity of its projects.



Images courtesy of Qatargas Operating Company Limited



www.chiyoda-corp.com

DOD Uses SmartPlant Materials to Improve Procurement Efficiency

Industry-leading Intergraph technology enables Chinese design institute to establish effective materials management system



PROFILE

Company: Daqing Oilfield Construction Design and Research Institute

Website: www.cnpc.com.cn/dq

Description: DOD is an international engineering company and a technology enterprise, and is a leading design institute in China's petroleum industry. It specializes in engineering consultation, engineering design and survey, turnkey projects, engineering development and research, development of technical products, and other services. DOD has maintained a prominent position among China's top 100 survey and design corporations since 1992.

Employees: Over 1,700

Industry: Oil & Gas

Country: China

PRODUCTS USED

- SmartPlant Materials
- SmartPlant Reference Data
- SmartPlant Instrumentation
- SmartPlant 3D
- PDS

KEY BENEFITS

- Intelligent materials management system for increased procurement efficiency via optimized project workflows
- Integration with other engineering applications for consistent, accurate, and high-quality data
- Reduced costs and accelerated project schedules

IDENTIFYING GOALS

Daqing Oilfield Construction Design and Research Institute (DOD) is the design institute of Daqing Oilfield Limited Company, which is a subsidiary of China National Petroleum Corporation (CNPC). The Daqing oilfield is the largest in China, and also one of the rare giant sandstone oilfields in the world. CNPC is China's largest oil and gas producer and supplier, as well as one of the world's major oilfield service providers and a globally reputable contractor in engineering construction.

DOD is a leading design institute in China's petroleum industry, providing EPC services. It took on two projects in China: a natural gas treatment plant and a natural gas processing plant. The Chinese design institute wanted to improve its current materials management process and reduce the associated risks with procurement.



OVERCOMING CHALLENGES

- Establish integrated materials management system across all EPC processes
- Improve procurement efficiency and reduce project risks and costs

REALIZING RESULTS

DOD determined that Intergraph SmartPlant Materials was the most intelligent materials management solution available in the market, offering full materials control and optimized project workflows. SmartPlant Materials is part of Intergraph's integrated suite of SmartPlant Enterprise engineering solutions, enabling DOD to manage the materials required across all engineering disciplines, such as piping, structure, equipment, electrical, instrumentation, and others. This greatly improves overall procurement efficiency and project productivity.

SmartPlant Materials is the only solution available on the market that fully supports the unique materials management processes needed in the process, power, and marine industries. It offers DOD a total material management and subcontract management solution for its projects. SmartPlant Materials is proven technology and has been adopted by industry-leading engineering firms around the world – users of SmartPlant Materials report improved procurement efficiency with lower risks and costs through accurate and effective materials management.

DOD implemented SmartPlant Materials as its centralized materials management system, establishing the relevant material codes for its projects in the SmartPlant Reference Data database. This database can then be applied in other SmartPlant Enterprise tools, such as SmartPlant 3D, SmartPlant Instrumentation, PDS, and other solutions. Intergraph provided DOD with dedicated support and technical guidance throughout the implementation process.

With clearly defined commodity and material codes, along with the associated rules, DOD has access to consistent, accurate, and high-quality data, helping to improve procurement efficiency for reduced risks and lower project costs. Using SmartPlant Materials, the Chinese design institute is able to establish an effective materials management system, ensuring the company delivers its projects on time and within budget.

MOVING FORWARD

DOD will continue to use SmartPlant Materials and further enhance its materials management system. The company will also integrate SmartPlant Materials with other SmartPlant Enterprise solutions for a single interface across the project life cycle. This will help to facilitate the overall construction phase of its projects and enable DOD to execute projects successfully.



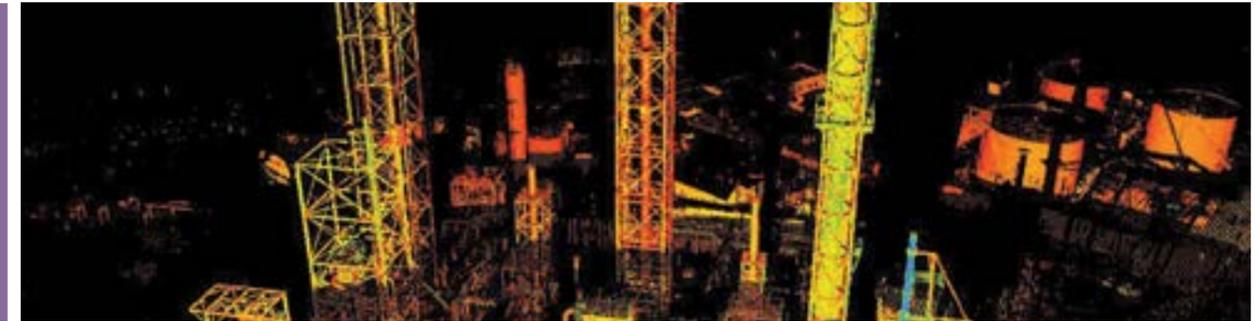
www.cnpc.com.cn/dq



Innovative Laser Scanning Workflows

Creating synergy between design and as-built modeling with CADWorx, CloudWorx™ and HDS

Ryan J. Fuselier, P.E., P.L.S.



Fenstermaker began as a small, regional surveying company in 1950. It has since become one of the largest surveying and mapping companies in the southern United States, known for its commitment to finding solutions to the most complex mapping and surveying challenges.

A large part of our success has been our willingness to adopt and adapt technological advancements. This willingness led to the formation of our Advanced Technologies Division in 2008.

The Advanced Technologies Division offers specialized field services including Underwater Acoustic Imaging (UAI), high-definition surveying (HDS) to provide topside and underwater as-built mapping services to the oil and gas industry. In the office, we incorporate powerful 3D CAD modeling and point cloud software to provide comprehensive as-built surveys, intelligent 3D CAD models and detailed 2D isometric spool drawings.

The combination and synergistic working relationship of all these tools gives us the opportunity to deliver high-resolution 3D visualization, accuracy and detail on projects that are not possible using traditional survey methods.

EARLY DAYS OF SCANNING

Fenstermaker began laser scanning in 2006, prior to establishing the Advanced Technologies Division, with the help of Joe Lafranca from Leica Geosystems. Due to the onslaught of levee and infrastructure projects following Hurricane Katrina, the company's primary client base was with the U.S. Army Corps of Engineers (USACE). The first laser scan for the USACE was a pump station and six-mile topographic survey traversing Lake Shore Drive in New Orleans. At the time, Fenstermaker relied on Leica Cyclone 3D Point Cloud Processing Software, Leica CloudWorx™ for AutoCAD® for 3D model extraction from point cloud and other modeling systems.

From this project, we understood that the scanning capabilities would be of value to the oil and gas industry. In 2007, we completed a laser scan of a Georgia Gulf Corp. chemical facility, and implemented the first seat of Intergraph CADWorx plant design suite operating on top of AutoCAD to model and generate 2D spool isometrics for fabrication. As our first chemical facility, we had to address several field and office challenges. While in the field we experimented with several vibration dampening techniques that enabled us to survey while a unit was running yet yield millimeter closures. In the

office, we streamlined our workflow between Leica Cyclone, Leica CloudWorx and Intergraph CADWorx. Cyclone generated steel, CloudWorx extracted pipe centerlines and CADWorx added the intelligence.

Not long after, Fenstermaker surveyors were regularly combining traditional survey methods with resection scanning techniques to conduct surveys that far surpassed traditional accuracies.

AS-BUILT MODELING

After the Georgia Gulf project, we began testing the use of laser scanning with traditional total stations in dimensional control projects that required high tolerances, such as the large-scale fabrication of steel structures or modules, and even jumper and hub alignments. We've taken all these tools – the scanners, Cyclone, CloudWorx, CADWorx and total stations – and created our own synergistic workflow that is more efficient than conventional methods and enables us to develop high accuracy, intelligent design models for our clients.

In one recent project, a large oil and gas company tasked with making upgrades to its existing infrastructure solicited our group to develop an as-built model for an offshore platform located 50 miles off the Gulf Coast.

Our scope was to map the existing structure on the topside and second sub-level of the platform, with particular attention to pre-identified tie points and general information along potential pipe routes and proposed equipment locations. The data needed to be delivered to within 1/8-inch accuracy for tie points and to an as-built model classification Fenstermaker defines as Class A – Level 1. Class A – Level 1 means tie point and fabrication-grade accuracy with specification-driven intelligence added to every modeled component.

The timeline was very tight. The client directed that all field data collection on the platform needed to be completed in two days, including mobilization.

Traditional methods simply wouldn't have worked. Conventional techniques such as prisms and total stations would have yielded accurate, but limited results, while costing the client more time and greater safety risk.

Instead, we put in place our entire scanning and modeling workflow – from HDS scanner to Cyclone, CADWorx and CloudWorx software – to make this project a success.

ADVANCED WORKFLOW

Once we had the schedule coordinated with the client, we sent a two-man survey crew on a helicopter with a Leica Geosystems HDS6000 laser scanner to map the 45-foot by 45-foot portion of the upper and sub-level deck of the platform. On the first day, the crew completed the upper deck in nine scans and set control for the lower deck. The next day, the crew completed seven scans on the lower deck and mobilized back to headquarters.

Once back at the office, the survey team post-processed and registered the scan data within Cyclone software. Main structural and pipe supporting steel were modeled and used to set the project coordinate system.

TruViews were published. TruViews enable anyone to easily view and measure laser point cloud data without extensive knowledge of point cloud software. While navigating a TruView, participants can:

- Collaborate about project needs
- Generate markups
- Manage assets
- Acquire 3D coordinate data and measurements
- Modeling synergy

The model was exported using the Cyclone Object Exchange (COE) format to AutoCAD. Our designers launched CloudWorx within AutoCAD to model the piping elements, flanges and equipment along with specification-driven intelligence.

Intergraph CADWorx and Leica CloudWorx complement each other well. Both are menu-driven programs within the native AutoCAD environment. The synergy between these two programs is evident in terms of functionality and our overall workflow efficiency. Used together, we can develop an intelligent asset model of existing conditions from which designers can build the most effective and efficient retrofit and upgrade to the facility. This ensures zero rework upon installation.

Because the data from the scanner was so accurate and comprehensive, underlying structural deformation was uncovered. During the model process, we could see the main

deck structural steel deformation and notify the client. We were able to report this vertical deformation in a color relief map of the entire upper section of the platform. With this visual and analytical data, smart decisions could be made by the client concerning corrective measures for reinforcing or replacing the structural components in the area to handle the proposed skid load. These unforeseen deformations could have presented serious installation delays, but were able to be addressed prior to equipment mobilization.

As a final deliverable, the client wanted Fenstermaker's SurvDMS (Data Management System) product with a specific interest in an intelligent as-built 3D model. SurvDMS is a portal for serving all project-related deliverables to include TruViews, monument data sheets, 3D models and engineering/construction drawings.

LOOKING AHEAD

Fenstermaker plans to continue to capitalize on its success and work experience to build cutting-edge solutions in the oil and gas service sector. So many companies and facilities are only scratching the surface in bridging the gap between data and management.

We are in a unique position, having extensive knowledge of how a synergistic network exists between the as-built and design world. One day in the near future, our clients will enter a feature-rich ecosystem with bi-directional communication between project management, design, construction, asset management and training, all powered by the point cloud engine.

Ryan J. Fuselier, P.E., P.L.S., serves as director of the Advanced Technologies Division at Fenstermaker Inc. He is based in Lafayette, Louisiana, U.S.

www.fenstermaker.com



Bringing Norwegian Gas to Europe in an Efficient, Safe, and Reliable Manner

Intergraph tools manage change and ensure plant asset data integrity at gas transport company Gassco



PROFILE

Company: Gassco

Website: www.gassco.no

Description: Gassco is responsible for transporting gas from the Norwegian continental shelf to other European countries. It is a state-owned company, managing 7,975 km of large-diameter, high-pressure pipelines, delivering to Europe 94.2 billion cubic meters in 2011, via receiving terminals in Germany, the United Kingdom, Belgium and France.

Employees: 325

Industry: Oil & Gas, Gas Transport

Country: Norway

PRODUCTS USED

- SmartPlant Foundation
- SmartPlant Instrumentation
- SmartPlant P&ID
- SmartPlant for Owner Operators

KEY BENEFITS

- Technical information management
- Concurrent engineering handling
- Revision control
- Easy access and navigation for end users
- Database engineering tools
- Standardization of systems across Gassco
- Data quality management

IDENTIFYING GOALS

Norway is the world's second-largest gas exporter, supplying about 18% of Europe's needs. Gassco, a state-owned company, exports 94.2 billion cubic meters to Europe in 2011. This amount is the highest since the company was created in December 2000 and it will possibly increase in the future. Gassco's goal is to provide a well-run transport system 50 years from now to the benefit of owners, users and customers in an increasing challenging environment.

The company has receiving terminals in four European countries (the United Kingdom, Germany, Belgium, and France), first operated by Technical Service Providers (TSP) until 2007, when Gassco took over daily operations.

The company's goal was to increase the quality of technical data, to enhance efficiency, and to improve work processes by creating a single place to access all Technical Information (LCI) and as-built information for all plants.

OVERCOMING CHALLENGES

Information is very important for Gassco operations, as the company has to allocate the capacity available at any given time in the pipelines and transport-related facilities, while being very responsive to changes in both gas provider's capacity and customers' demand.

When Gassco chose SmartPlant Enterprise and decided to deploy SmartPlant Foundation as its technical information management system, it had to deal with complex and varied data legacy in different formats/systems and different data quality.

The company had some important objectives when it embarked on the changes:

- Easy access and easy way to navigate through all levels of technical information
- To ensure concurrent engineering management and revision control
- To change from "document-based" information to more "intelligent" information by the use of engineering tools

- To provide contractors with correct as-built information for projects and modifications in a format that allows users to make changes in an easy and more efficient way
- To enhance integration across different systems
- To standardize the use of systems and the management of technical information and engineering data



REALIZING RESULTS

Standard processes for data management were put into place, including import/export functionalities. The efforts focused on ensuring that all as-built information was transferred to SmartPlant Foundation from the old systems. These engineering tools, which include SmartPlant Instrumentation and SmartPlant P&ID, provide all users (contractors included) different levels of access to relevant information.

SmartPlant Foundation has been set up to support modifications and project processes in Gassco. With updated as-built information, operations and maintenance, as well as engineering, are faster and more efficient every time new projects or modifications are undertaken.

Experience shows that it is very important to have management commitment and to focus on work processes during the implementation of new technical information management systems. Experience also shows that the deployment of a new system takes time, as it does having everyone up to

speed. Therefore, sharing information and good coordination are essential to maintain the company's normal operations.

After the establishment of the SAP interface to SmartPlant Foundation and some code customization, all plants are now using the same technical information management system. This allows Gassco to operate its plants and terminals in a systematic, reliable and competitive manner.

MOVING FORWARD

Gassco is currently upgrading from SmartPlant Foundation to SmartPlant Enterprise for Owner Operations (SPO). The main drivers include:

- Support of Windows 7, Oracle 11, Office 2007
- New features to support plant operation and maintenance
- Common portal for SAP and SmartPlant Foundation (SAP Netweaver)
- Less customization – code is preconfigured to Owner Operators needs
- Centralized tag management – SmartPlant Foundation as Tag master
- Less risk during upgrades

In the near future, SPO will be more spread in the industry than today's "Nordic template" solution, enabling Gassco to work and interact faster and more efficiently with contractors, customers, and other sector players.

www.gassco.no



HEC Establishes SmartPlant 3D and SmartPlant Reference Data Interface for New Piping Components

Longtime Intergraph customer adds to comprehensive piping library to further enhance design automation



PROFILE

Company: Hyundai Engineering Company Limited

Website: www.hec.co.kr

Description: Hyundai Engineering has successfully continued to perform over 5,000 projects in domestic and overseas markets since its foundation in 1974. It has established itself in the field of processing plants, including oil and gas, LNG facilities, oil refinery and offshore facilities, as well as next-generation industry power and energy, environment, SOC, and new transportation systems. Hyundai Engineering is also recognized as a global leader with FEED/PMC competencies, contributing towards a higher value-added business.

Industry: Process Plant, Power & Energy, Industrial Plant, Infrastructure & Environmental

Country: Korea

PRODUCTS USED

- SmartPlant 3D
- SmartPlant Foundation
- SmartPlant Review
- SmartPlant Instrumentation
- SmartPlant Materials
- SmartPlant Reference Data
- SmartPlant Electrical
- SmartPlant P&ID

KEY BENEFITS

- Easy customization to meet project requirements
- Enhanced design automation
- Integrated enterprise engineering environment

IDENTIFYING GOALS

Hyundai Engineering Company Limited (HEC) is a world-class engineering company headquartered in South Korea. Founded in 1974, the company has demonstrated its status as a 'Global Premier Engineering Partner'. HEC continues to set global standards in the engineering industry with superior skills, outstanding talents, ingenious thinking, and challenging spirit. This has been crucial in HEC beating the competition for orders amid the economic downturn.

HEC has been a longtime Intergraph customer and has been using SmartPlant Enterprise solutions for many years. It first implemented SmartPlant 3D for a power plant pilot project back in 2008, and has since executed several real-world projects using Intergraph's next-generation 3D engineering design solution. As HEC continues to expand the use of SmartPlant 3D for its projects, the engineering company determined the need to add new piping components to its existing SmartPlant Reference Data library.



OVERCOMING CHALLENGES

- Add new piping components required for project to library
- Ensure seamless integration with modeling application for new piping component to be reflected in the 3D model

REALIZING RESULTS

SmartPlant Reference Data provides materials libraries at the corporate and project levels, enabling better standardization and change management. It is the software tool for maintaining catalog and pipe specifications for SmartPlant 3D, SmartPlant Materials, and other SmartPlant Enterprise solutions. SmartPlant Reference Data includes a comprehensive library of piping components but it also enables users to easily add to the library with new components as required.

For example, HEC needed to add a long welding neck flange into the library, which is connected to the pipe as a branch item. The Korean engineering company could do this easily by establishing a workflow process where a new item code would be added in SmartPlant Reference Data if the component was not already in the library. This item would then be mapped for the appropriate SmartPlant 3D specifications and catalog value. A new 3D symbol would be created accordingly, enabling users to model with the new piping component directly in SmartPlant 3D. The 2D isometric symbol would also be created to generate the isometric drawing accurately, reflecting the new piping component.

This customization helps to further enhance SmartPlant 3D's design automation capabilities. The solution features powerful out-of-the-box functionality, but is also easy to configure to meet specific project needs. The seamless integration between SmartPlant 3D and SmartPlant Reference Data ensured that HEC could easily update the piping library to include new piping components as required for its project.

SmartPlant 3D is the world's first and only next-generation 3D plant design solution, employing a breakthrough engineering approach that is focused on rules, relationships, and automation. It provides all the capabilities needed to design a plant, and then keep it as-built throughout its life cycle. This innovative Intergraph solution captures new and existing engineering

knowledge so that it can be saved and reused in the future, which is the key to success in today's competitive global economy. SmartPlant 3D is the most advanced and productive 3D plant design solution that effectively enables optimized design for increased safety, quality, and productivity, while shortening project schedules. Companies using SmartPlant 3D, including HEC, typically report a 30 percent improvement in overall engineering design productivity.

MOVING FORWARD

HEC plans to continue using SmartPlant 3D and other SmartPlant Enterprise solutions for its engineering projects. It has recently implemented SmartPlant 3D for a chemical plant project that has over 10,000 pipelines. HEC will expand its use of SmartPlant Enterprise and also adopt laser scanning solutions to execute projects.





Intelligent Laser Technology for Smart Design

MAJA Consulting Group cuts 70 percent of survey time

Headquartered in Veracruz, Mexico, MAJA Consulting Group S.A. de C.V. (MAJA) provides innovative design and engineering solutions to clients. A major client is Petroleos Mexicanos (PEMEX), one of the few oil companies in the world that covers upstream, downstream and final product commercialization. PEMEX is the largest enterprise in Mexico and the highest fiscal contributor to Mexico. PEMEX refinery subsidiary's facility in the Madero-Cadereyta corridor is one of the most important in northern Mexico. To support a proposed renovation, PEMEX asked MAJA to model these six stations, including mechanical systems, pipelines, instruments, auxiliary services, civil engineering and processes.

The US\$10 million PEMEX project required models of all processes, including 20 turbines, more than 70 pumps, electric motors, seven 200,000-barrel oil storage tanks, 24 filtering systems, six sets of instrument air systems and 52,000 meters

of pipes ranging from a half-inch to 35 inches in diameter. With the numerous interconnected systems, a high level of detail was required. In addition, the models for this eight-month project needed to be completed in a short period of time because an early 28-day window was set aside for surveying the eight acres of industrial facilities.

LINKING LASER SCANNING WITH INTELLIGENT 3D MODELS

MAJA introduced intelligent 3D modeling to PEMEX, demonstrating that it would greatly benefit the project, particularly within such a tight timeframe. Convinced of the advantages of 3D models, the project's lead engineers, Ana Maria Macías Juárez and Gustavo Juárez Solís, and engineer Emmanuel Vega and his team of specialists from MAJA, broke paradigms within PEMEX and established intelligent 3D modeling of its industrial facilities for the very first time.

The objective was to develop intelligent 3D models to help PEMEX support the proposed renovation and new technological developments regarding facilities and surface processes. Using a Leica Laser Scanner HDS 600, the project team captured civil work, pipe supports, pipelines, machines and equipment in just one scan with a high degree of accuracy. CADWorx fieldPipe™ for Leica fieldPro was used to model the piping in real-time during the surveying. With CADWorx, representative data was captured to develop the entire 3D model, including pipelines, instrumentation, equipment, supports and other components, interacting easily with Leica CloudWorx data. This required just three survey people in the field, using the scanner to capture point cloud data, and five specialists to build the models.

SURVEY TIME REDUCED BY 70 PERCENT

The decision to use the Intergraph CADWorx platform for the intelligent 3D models paid off tremendously. This first project for PEMEX using the CADWorx platform delivered great results, with the surveying time reduced by 70 percent, a record for the company. The project team also reduced project resources and production costs, completing the 3D models in four months. In addition, users saw improved visual results in the finished model, and they reported ease of developing modeling skills with greater versatility in editing components.

"We greatly improved our corporate image among clients using 3D modeling technologies," explained Vega. "We also eliminated the high costs of having dedicated servers for handling the software, and removed the specialization of disciplines, with two users working across disciplines at the same time."

These intelligent CADWorx 3D models will help PEMEX optimize operating procedures and the scheduling of maintenance activities. With real information on the state of equipment, decisions are easier regarding risks, preventing any costly errors, as well as the feasibility of upgrades, replacements and extensions of proposed improvements. With this new perspective of its facilities and projects, PEMEX can enjoy increased data quality and reduced costs while enhancing plant safety.



www.majaconsultinggroup.com

Mott MacDonald Uses CAESAR II with Success on Pipeline in Papua New Guinea

With over 14,000 employees, Mott MacDonald is a major provider of engineering and design, management and technical consulting, and project and construction management services to oil, gas, and petrochemicals businesses worldwide.

ENGINEERING FOR A MAJOR PNG LNG ONSHORE PIPELINE PROJECT

SpieCapag Pty Ltd. selected Mott MacDonald to provide engineering for 445 km of onshore pipelines for gas production and processing facilities in Papua New Guinea operated by Esso Highlands Limited, a subsidiary of Exxon Mobil Corporation. The pipelines transfer gas to the facility outside the capital city of Port Moresby for liquefaction and export to major LNG customers in Asia. Following Australian standards, the project encompassed all equipment and infrastructure for collecting and conveying the gas and condensate. Mott MacDonald's OGP Andheri office in India was the project lead.

RESOLVING DIVERSE STRESS CONDITIONS AND GEOGRAPHIC CHALLENGES

The pipelines range from DN20 to DN850 and involve pressures of 12500kPag to 56100 kPag and temperatures of -46 deg C to 80 deg C. These pipelines cross rugged terrain with geo-hazards such as surface fault crossings and seismic activity. Engineers had to address stress from the effects of wind, earthquake, soil properties and diverse operating conditions.

ADDRESSING MULTIPLE CHANGES WHILE REDUCING THE NUMBER OF MODELS

The project required multiple revisions in stress models and fast turnaround on rework, and Mott MacDonald benefited from the proven flexibility of CAESAR II and ability to address these types of challenges. It analyzed the effect of pipelines according to ASME B31.4 and associated piping according to ASME B31.3 in same model, reducing the number of models and saving time and associated costs.

ANALYZING DYNAMIC AND STATIC EQUIVALENT CONDITIONS WITH EFFICIENCY

CAESAR II allowed Mott MacDonald to create a site-specific earthquake spectrum and perform dynamic analysis to develop optimum loading conditions and analyze the possible vibration modes. With the project's diverse soil conditions, it used CAESAR II to simulate the above ground and buried pipe behavior and stresses for the location of virtual anchors. This saved in material, cost, and time for the EPC contractor.

LEVERAGING ISOGEN FOR GREATER ACCURACY

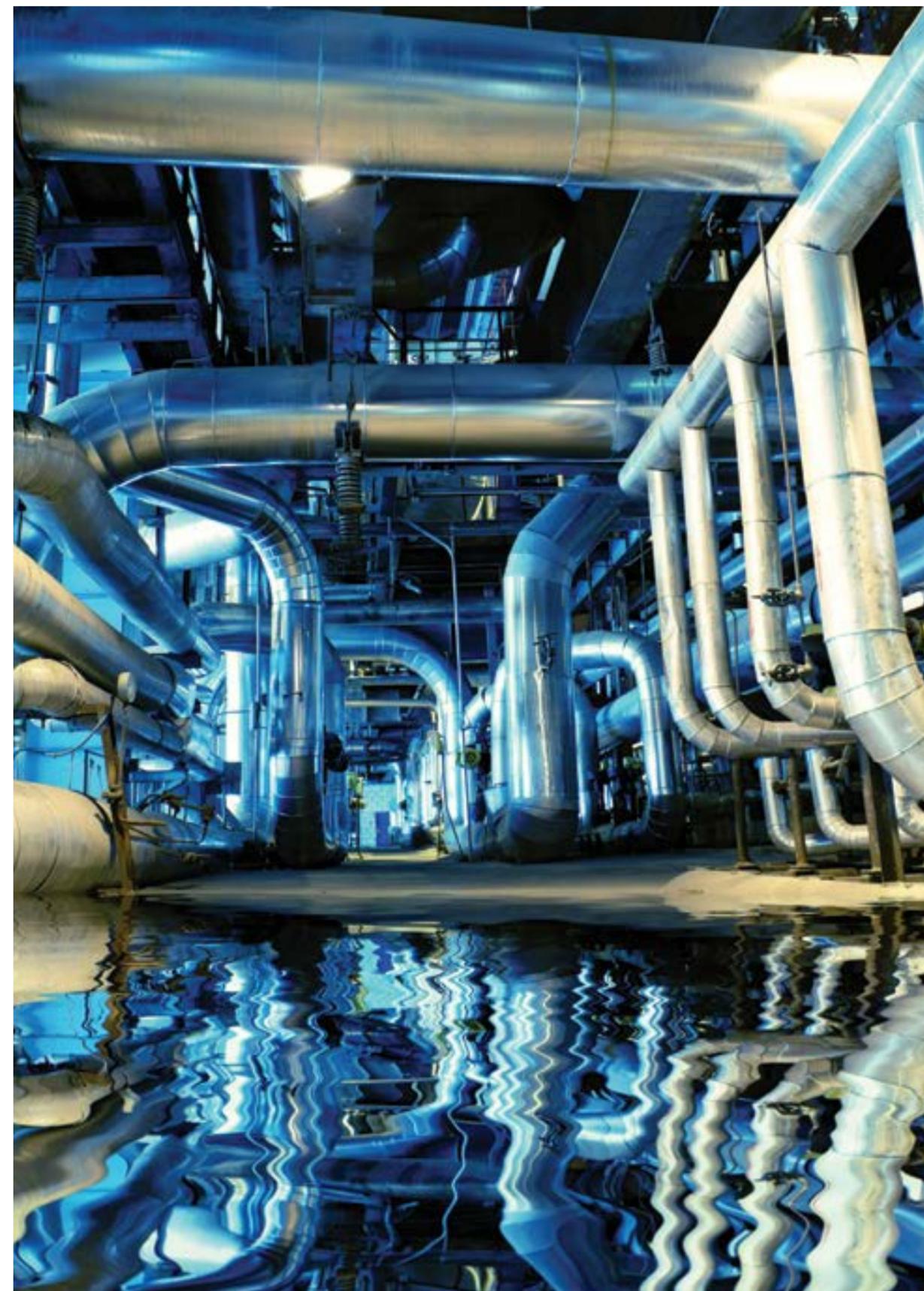
It used CAESAR II's ISOGEN® module to generate isometric drawings internally for design inputs such as types of supports and piping layout changes. This provided greater accuracy, reducing errors, man-hours, and costs.

EXPEDITING EQUIPMENT MODELING TO SAVE TIME

As equipment, Pig traps are typically outside the purview of the pipe stress engineer. While the civil team was designing the foundation of the pig traps, the engineers analyzed the composition of the foundation design loads and modeled the pig traps as pipe elements. This expedited foundation design, saving additional time.

DEALING SUCCESSFULLY WITH CHANGES IN DESIGN CODES

With the flexibility of CAESAR II's modeling and analysis capabilities, Mott MacDonald was able to sail through this challenging project while addressing these continuous changes. It was also able to achieve milestone incentives, generating additional revenue for the organization.



Taking the Next Step

Integration with SmartPlant Enterprise enhances workflows

China Petrochemical Corporation (Sinopec Group) is Asia's largest oil refining and petrochemical enterprise and the world's seventh biggest company in terms of revenue. One of Sinopec Group's ventures is Sinopec Engineering Inc. (SEI). SEI is a leading engineering firm performing PMC and EPC projects and offering professional project management services. The company has more than 2,200 employees, posting total assets valued at US\$2.47 billion in 2011.

LAYING THE GROUNDWORK

SEI recently used SmartPlant 3D to lay out the structure, equipment and piping models, including more than 1,000 pipelines, for the Maoming 300,000-ton polyethylene project.

Next for the Central Plains 60,000-ton OCC propylene project, SEI began a pilot project of the SmartPlant Enterprise software suite. SEI chose SmartPlant 3D to build the entire factory



model. It generated 700 to 800 one-pipe isometric maps. The integrated applications included SmartPlant 3D, SmartPlant Foundation, SmartPlant P&ID and SmartPlant Instrumentation.

In both projects, SEI also used SmartPlant P&ID to draw a flow chart and map the SmartPlant P&ID drawings. This helped SEI to complete about 200 flowcharts in the OCC project.

INTEGRATION PILOT

Sinopec Shanghai Research Institute of Petrochemical Technology (SRIPT) and SEI worked in cooperation to develop the Zhongyuan OCC project, featuring a C4 olefins catalytic cracker to produce 60,000 tons of propylene. There were more than 50 equipment units, including compressors, and more than 400 pipelines. The project included process, piping, almost all engineering structures, containers, pumps, instrumentation, electrical and waterways. This made the project very suitable for a software integration pilot program.

FLEXIBLE P&IDS

SEI enjoyed the flexibility that SmartPlant P&ID offers to develop the P&IDs. The process department used SmartPlant P&ID to draw 18 intelligent P&IDs in the integration pilot project. SEI customized some special symbols, reports and properties. It inputted the equipment, pipelines, instrumentation and other attribute data into the P&IDs. From SmartPlant P&ID, the team could output the P&ID drawings, equipment data sheets, pipeline table, instrument index table and other finished products, to ensure that the data was accurate when sharing the finished products.

INTELLIGENT SMARTPLANT 3D

Piping professionals used many SmartPlant 3D features to meet project needs, but thanks to the depth of the integrated software, they could go a step further. The OCC project used SmartPlant 3D for smooth piping database creation and maintenance. The software handled equipment, piping, instruments and structures plus cable tray layout design.

Users reported that SmartPlant 3D is more intelligent and easier to use than older systems introduced in the 1970s and 1980s.

SEI can establish a more complete 3D plant intelligence model to generate nozzle platform diagrams, single-line diagrams,



piping layout, equipment layout and other items required for a variety of conditions and the finished model. Users can also perform collision checking and create an output materials report.

DESIGN INTEGRATION

In addition to further deepening the development and use of design software, SEI found that design integration was one of the most important benefits of SmartPlant Enterprise. The test strategy for an integrated environment included phased implementation of the integration capabilities to the standard software to develop a customized solution, supplemented by gradual improvements.

The default out-of-the-box environment opens up the integration between the various solutions. The process data from SmartPlant P&ID passes through SmartPlant Foundation and then goes to SmartPlant Instrumentation for instrumentation design. The instrument geometry data from SmartPlant Instrumentation goes to SmartPlant Foundation and is then passed to SmartPlant 3D to create the instrument components model. The process data from SmartPlant P&ID can also pass through SmartPlant Foundation and then to SmartPlant 3D. Users can click on the P&ID to see the pipeline data for the effective design of piping, valves and other components. They can also click on the P&ID to see the SmartPlant 3D materials database.

The customized systems integration environment helped the team successfully perform pipe grading, insulation/heat tracing levels, fluid codes and the expansion of user attributes, such as pipeline levels. With the P&ID, the team benefitted from version updates, 2D and 3D calibration and data updating that were convenient, efficient and accurate.

OPTIMIZING WORKFLOWS

Concurrent testing of integrated applications enhanced the depth of understanding of the workflow design software for the professional collaboration and the integration of some deep-seated features. In taking a look at the existing division of labor, the team could further adjust and optimize the division of professional labor and collaboration.

Integrated applications can significantly improve design efficiency, especially in design revisions. When versions are

updated, the system automatically checks to ensure that the design is complete, efficient and accurate.

SEI now uses a number of Intergraph products, including:

- SmartPlant 3D
- SmartPlant Foundation
- SmartPlant Instrumentation
- SmartPlant Materials
- SmartPlant P&ID
- SmartPlant Reference Data
- SmartPlant Review
- PDS

As the project progresses, the team will further test the functionality of the integrated system, including expanding the scope of integration and testing the integration between AspenTech Zycad and Microsoft Excel. SEI will optimize integration with front-end design and data input into the business management functions and will integrate its system with other software, including PDMS, Documentum and in-house software.

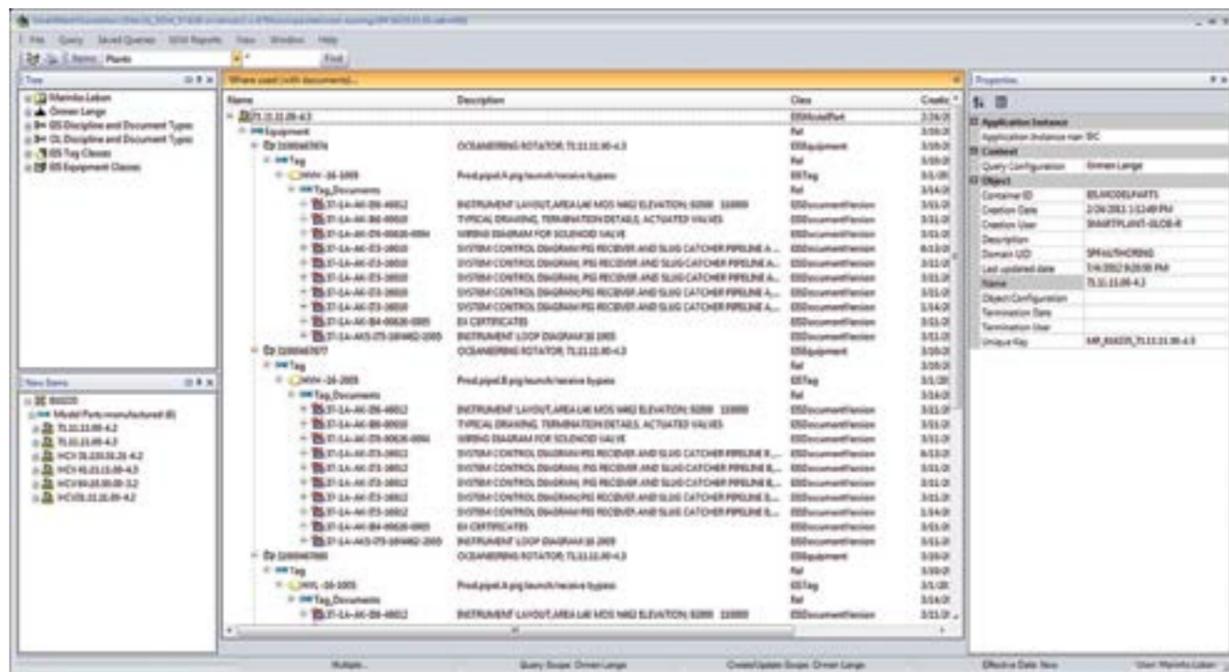
EXPANDED BENEFITS

SEI expects that SmartPlant Enterprise solutions will play a greater role in engineering design, changing the traditional design of organizational models and processes. SEI looks forward to closer collaboration with Intergraph and increasing its usage of SmartPlant Foundation, gradually establishing best practices in SEI to take full advantage of SmartPlant Enterprise.



www.sei.com.cn

OIL & GAS



costs. Reuse of repeatable design and vendor data from one project to the next reduces information review and handling costs. The intent is to go from a 'hardcopy' to an electronic environment, where information relationships are clear and up-to-date and the information is easily available to all users.

Once validated by Shell, the complete set of information should then stay in the EDW environment throughout the remaining life of the facility without moving it between systems. This protects data quality and enables the effective and efficient preparation of work packages, on-site, day-to-day operations, maintenance, project, inspection and turnaround activities. Furthermore, the EDW provides an effective means to support the management of change, as well as the effective exchange of engineering information between Shell and its contractors.

Maintenance engineers can "jump" straight from a maintenance routine in the Maintenance Management System to the latest revision of the drawing or maintenance manual to obtain additional information. Document controllers can add, track and report the creation of documents and drawings using traditional document control workflows. Data managers can create, maintain and export the master data using a data management tool that allows for bulk and incremental tag generation, Quality Assurance and update.

External parties are using the Smartplant Foundation Web Portal to access engineering information in the Ormen Lange asset. Together with Citrix-based access, Shell intends to grant access to the EDW to external contractors for selected assets.

SmartPlant Foundation applications, integrated with Shell's business processes and existing applications will soon form the heart of Shell's engineering portfolio. By integrating, standardizing and simplifying engineering data and documents

throughout the project lifecycle, the EDW fulfills Shell's overall vision for improved project delivery, asset integrity, increased general efficiency, reduction of maintenance cycles and increased safety.

ABOUT SHELL

Shell is a global group of energy and petrochemical companies. Its headquarters is in The Hague, the Netherlands, and its Chief Executive Officer is Peter Voser. The parent company of the Shell group is Royal Dutch Shell plc, which is incorporated in England and Wales. Shell's strategy to generate profitable growth remains to drive forward with its investment program, to deliver sustainable growth and provide competitive returns to shareholders, while helping to meet global energy demand in a responsible way. In Upstream, Shell focuses on exploring for new oil and gas reserves and developing major projects where its technology and know-how adds value to the resource holders. In Downstream, its emphasis remains on sustained cash generation from our existing assets and selective investments in growth markets.

www.shell.com



Designing a Tank Storage Terminal in One of the Largest Ports in Europe

Intergraph CADWorx flexibility and user-friendly interface provided Temco with all needed engineering data in a short time frame



PROFILE

Company: Temco

Website: www.temco.be

Description: Temco is an independent Belgian company offering engineering, maintenance, and consultancy services. Its activities cover the whole engineering project line from design to construction. With a team of professional consultants, engineers, and designers, Temco works on monodisciplinary and multidisciplinary projects in different industries, such as chemical, petrochemical, pharmaceutical, energy, and metals, among others.

Employees: 65

Industry: Engineering

Country: Belgium

PRODUCTS USED

- CADWorx
- CAESAR II
- Navigator

KEY BENEFITS

- A clear 3D presentation, easy to understand even for technically unskilled people
- Very good assistance by Intergraph before, during and after implementation
- Save time by
 - Short training period
 - Easy to use
 - Rapidly produce isometrics, layouts, and bill of material

IDENTIFYING GOALS

SEA-Tank Terminal Antwerp, a member of the SEA-Invest Group, opened a new terminal for the storage of fuel oils, gasoils, gasoline and biofuels. The terminal, built at quay 254-312 at the 6th Harbour dock in the Port of Antwerp, includes 511,000 cubic meters (18,045,794 cubic feet) of storage capacity in 30 liquid tanks ranging from 1,000m³ up to 48,000m³. The project was proposed for competitive bidding.

Temco is an independent middle-size Belgian company offering services to the industry, including engineering, maintenance and consultancy, from design to execution. Temco had used CADWorx in smaller projects, but it was the first time it was going to be used in such a large project. The flexibility and user-friendly interface to sketch enabled the company to present 10 different layout proposals of a pumping plate within one week. This way Temco could make a very good first impression. The project ran from the beginning of 2009 to September 2010 and included 6,000 hours of engineering. The average crew comprised of four people, with peaks being handled by 10 experts.

OVERCOMING CHALLENGES

The timeframe of the project was critical and engineers needed to get up to speed quickly. This was possible thanks to the CADWorx interface being very easy to learn, particularly for those with a basic knowledge of AutoCAD.

The basic engineering schedule was an excellent example of a fast track development. That's the reason why the basic study appeared to be unfinished at the moment Temco started the detail design. Vendor information of appendages and equipment came in very slowly. The design suffered several changes through the project, including dimensions of valves and actuators, nozzle orientations of pumps, type of filters, pipesizes, and pipespecs. However, those changes were easy to implement "thanks to CADWorx being such a flexible tool," explains lead designer Maaik Mertens.

- With one command you can change the pipe spec for all selected components
- It's easy to copy sections of the design and renumber everything

- Material take off on isometrics is changed automatically
- Standard AutoCAD commands like copy, move and stretch also work in CADWorx
- Thanks to routing lines, it's less work to change the pipe size

REALIZING RESULTS

In addition to managing the project, cost control and planning, the engineering work comprised 3D design, the creation of PIDs, isometrics, layouts and bill of material, in addition to the interference with the civil and structural design.

All preparations made for 3D design determine the result and timing needed to get a better result in generating isometrics and layouts. "Once the 3D-model was complete, generating the documentation for construction was much easier with CADWorx, as the tool includes the set-up of equipment and piping layouts from automatically generated sections with automatic annotation functionality", says Mertens. "We also saved time in extracting materials and making bills of material, in a way that we could do in half a day what normally takes a week".

Another functionality Temco experienced as an advantage was the compatibility with CAESAR II, with which Temco performed stress analysis and stress isometrics. The EPC could export and transfer data easily from one tool to another.

The company developed some tool customization to create its own pipe specs and added some appendages that were not standard in the catalogue. During the construction phase, the biggest advantage became clear: The contractor confirmed that even with a minimum of field welds and a lot of prefab, there were no clashes concerning piping design.

MOVING FORWARD

Temco is expanding the use of CADWorx and increasing the number of engineers trained in the tool. Temco has currently 65 employees, 10 of which have been trained to master CADWorx and were up to speed in five days. Currently, the company is using CADWorx in two of its larger projects and four trained engineers have been outsourced to customers.

The company is currently looking into expanding its knowledge of other Intergraph software like CADWorx FieldPipe, which enables the use of laser-scan and laser-trace technology to capture the real as-built, in addition to SmartPlant Spoolgen® for automatic generation of isometric spool drawings for construction.



www.temco.be



ABOUT INTERGRAPH

Intergraph is the leading global provider of engineering and geospatial software that enables customers to visualize complex data. Businesses and governments in more than 60 countries rely on Intergraph's industry-specific software to organize vast amounts of data to make processes and infrastructure better, safer and smarter. The company's software and services empower customers to build and operate more efficient plants and ships, create intelligent maps, and protect critical infrastructure and millions of people around the world.

Intergraph operates through two divisions: Process, Power & Marine (PP&M) and Security, Government & Infrastructure (SG&I). Intergraph PP&M provides enterprise engineering software for the design, construction, operation and data management of plants, ships and offshore facilities. Intergraph SG&I provides geospatially powered solutions, including ERDAS technologies, to the public safety and security, defense and intelligence, government, transportation, photogrammetry, and utilities and communications industries. Intergraph Government Solutions (IGS) is a wholly owned subsidiary of Intergraph Corporation responsible for the SG&I U.S. federal business.

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The logo features the word "INTERGRAPH" in a bold, white, sans-serif font. A white, curved line arches over the letters "I", "N", and "T", starting from the left and ending above the "P". A registered trademark symbol (®) is located to the right of the word.

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