



SmartPlant® Enterprise
Engineering & Schematics



INTERGRAPH®

→ SmartPlant® Enterprise

Engineering & Schematics

INDUSTRY CHALLENGES

Engineering, Procurement, and Construction Companies (EPCs)

During engineering, there is increasing pressure on margins and intense global pressure and competition to deliver projects not only faster, but with a more efficient design to reduce operational cost. Change management and resourcing/outsourcing/insourcing issues must be addressed due to a growing number of retiring experts. There are many new technologies becoming available for process and control systems as well as engineering tools that challenge project execution. Engineering groups must also meet tight schedules and comply with government regulations. Global engineering is now required between far-flung domain expert offices or joint ventures. There are also the challenges of design reuse, fast-track projects, and providing additional value to win projects.

Owner/operators (O/Os)

During the operations phase, there are also several business drivers, such as supporting plant strategy, including production, quality, safety, and resource utilization. With increased plant safety, operational risks and production interruptions are reduced. Operations groups need to minimize turnaround planning and scheduled shutdowns, and conduct preventative maintenance planning. They desire to reduce the costs of inspection and overhead. The team is also driven to optimize production output and reduce energy costs. Production flexibility is needed to meet market demands.

BUSINESS = RISK MANAGEMENT

Saving time is an excellent but not always key business driver. Other issues to be considered include:

- Quality
- Innovation
- Differentiation
- Added value

It is important to be able to make the right decision as early as possible in the workflow to avoid costly rework, or worse, re-ordering of plant components. Integration is key.

Individual applications can offer many benefits, but integration of disciplines holds even more value. Engineering & Schematics applications significantly contribute toward the bottom line in terms of saving costs, reducing execution risks, increasing design quality, and offering tools and data to support the operational phase of the plant.

A CHANGING INDUSTRY

Technology is the enabler to address business needs. Creating an efficient design and plant that will operate with the lowest possible risks

is important. In addition to the traditional design, you can add value not only in the execution but also in the deliverables that can be used in operations. Engineering is the process of progressing from assumptions to a consistent and sound design. Intergraph® recognizes that making the right decision early in the engineering design process eliminates re-work, saving time and money. It has been shown that poor design can increase the cost of a project by 15 percent or more, with errors rippling through from the key P&ID design phase into the piping, instrumentation, equipment, and electrical phases.

The key is to focus on the engineering goal – the plant. Engineering is the way to create the plant, and technology is the enabler for the engineering and operational phases. Each phase in the plant life cycle has its own focus and associated value propositions. For example, engineering wants to execute as fast as possible; construction wants to ensure that all materials are just-in-time; commissioning wants to see all systems verified and documented to start plant operations; and finally, operations wants to reduce production risks. A solution needs to be selected to address all parties' needs, from engineering to safe and



“Much value has been lost in not bridging the gap between design, construction, operations and maintenance. We expect value measured in multiple millions of dollars annually from the capture and broad use of the plant information asset.”

Bob Donaho

Director Design Engineering/Design Technology
The Dow Chemical Co.



“The company chose SmartPlant Instrumentation because it has a complete database and update for instrumentation projects. All deliverables link with a report and an intelligent database to have better control of all information.”

Elisa Guinea Corres
Project Manager of Operations
Krupp Uhde Jacobs Engineering de Mexico, S.A. de C.V.

reliable plant operations. Each group has its own drivers, but in the end, the operational plant is the common goal.

SOLUTION

Intergraph’s Engineering & Schematics applications encompass many engineering disciplines and have been developed for today’s 24/7, global engineering workshare environment. All engineering disciplines are intelligent and fully integrated – so an engineering change in one area automatically triggers change in all associated objects, no matter where they are located, while the rule-driven environment prevents engineering errors.

Intergraph enables the rule-driven P&ID design of an intelligent plant asset configuration, the instrumentation engineering of the control system life cycle, and safe and reliable electrical engineering systems. The logical design and engineering of the plant are described in terms of process, control system, and power distribution.

Engineering & Schematics applications include a variety of powerful Intergraph software solutions:

- SmartPlant Electrical
- SmartPlant Explorer
- SmartPlant Instrumentation
- SmartPlant P&ID
- SmartPlant Process Safety
- SmartSketch®

DIFFERENTIATORS

Engineering & Schematics applications offer a variety of functionalities and benefits simply unmatched in the industry, including the following:

- **Intelligent Plant Assets**
Create and maintain connectivity for all plant items, which hold knowledge based on their data
- **Validation**
Check and flag the engineering content consistency and compliance to engineering practices/standards in your design
- **Integration**
Share relevant data once across all tasks
- **Data Management**
Manage the revision, notification, and distribution of engineering and workflows

■ **Market-Leading Solutions**

Rely on the worldwide market-leading solutions currently in use in both small and large projects, delivered by a company with more than 30 years of experience

■ **Partner in Project Execution and Plant Operations**

Take advantage of Intergraph’s approach to work closely with customers, offering services and support in 60 countries, supplied by engineering professionals with thousands of hours of experience

**THE SOLUTION:
ENGINEERING & SCHEMATICS**

Intergraph’s Engineering & Schematics solution enables you to efficiently configure your plant process, controls, and power distribution. All of these capabilities are driven by rules and specifications to ensure data consistency, quality, and compliance with engineering and customer standards. The solution is focused on the plant asset and its data, and relationships between the plant assets. This unique engineering approach enables you to make the right decisions early in project execution.

Engineering & Schematics applications break down the discipline silos in your organization. Each task, such as SmartPlant P&ID, offers a step change in engineering and design, and dramatic benefits. When used in the SmartPlant Enterprise environment, the equation 1+1=3 becomes a reality, in which a much greater value is yielded when information flows between the tasks, changes are managed, and engineers are notified if changes are made in associated tasks.

To execute projects more quickly, ensure design consistency, and implement best practices for constructability and operability, companies rely on their best, most experienced engineers who have performed many of these types of projects in the past. With a younger workforce, some of this experience is leaving the industry.

Engineering & Schematics applications can capture this experience in the rules to ensure that design and safety analysis are completed in the most efficient way, ensuring the highest design quality based on the company’s years of experience. At the same time, the tools enable fast and easy modification to allow for innovation and adjustments based on new technologies.

BEST PRACTICES AND VALUE PROPOSITIONS

Task	Action	Benefit	Estimated Savings
Workshare Project Consolidation	<ul style="list-style-type: none"> ■ Subcontractors release their designs to the main contractor ■ No data inconsistency due to single design basis and seamless merge of the individual project scopes in a single project 	Consistent design using single design basis, and no need for data consolidation verifications	2 hours per P&ID x 700 P&IDs x \$60/hour labor costs = \$84,000 saved
Electrical Design	<ul style="list-style-type: none"> ■ Lay out the plant distribution and distributing loads from the mechanical group ■ Optimize safety and eliminate redundancy ■ Enforce rules to comply with engineering and company standards 	Efficient way to design optimal distribution with shorter cables and reliability	.5 hours per load x 400 electrical designs x 5 designers x \$60/hour labor costs = \$12,000 saved

Plant safety is a key element, and strictly enforced by regulations. SmartPlant Process Safety enables you to automate design analysis to ensure that the design is sound, and in case process conditions change or equipment fails, the plant returns to a safe state thanks to protective devices, for example.

SmartPlant Explorer is your solution for viewing, querying, and reporting on data generated by PDS® and Engineering & Schematics applications via the Web. SmartPlant Explorer turns design data into usable information that fits your needs. The software provides a “common user experience” for all supported applications, enabling you to navigate through and report on PDS P&ID data, SmartPlant P&IDs, SmartPlant Instrumentation data, and PDS 3D model information. This enables easy, live data access, and the solution is rules-based.

BEST-IN-CLASS WORK PROCESS

Engineering & Schematics applications offer the opportunity to implement your best-in-class work process for project execution and plant operations. Intergraph goes beyond the CAD

world of mere graphic depictions with limited data on symbols. Streamline your workflow with access to plant items and their relationships to understand change impacts, create scenarios for engineering updates, and more.

Take advantage of unique capabilities, such as multiple projects for what-if scenarios. You can compare the what-if scenario with your original design, and consolidate them if the change is approved. Copy your existing design, and during the copy, a transmission routine can modify the original design on-the-fly. For example, change the symbology tag numbers and process data, and then the P&IDs with the newly modified design are recreated from the database. This gives you a valuable jumpstart on your new projects, boosting productivity, data consistency, and innovation.

Engineering & Schematics applications streamline your plant process and configuration design with data validation, your link from safety analysis to design safety and operability in the plant. As part of the work process, SmartPlant Instrumentation will expand your functional control system design from the P&ID into the physical design, offering support for new technology, such as fieldbus.



“SmartPlant P&ID provides data that is more accessible and consistent. This saves us time in both engineering tasks and material procurement. SmartPlant P&ID was selected because it gives data intelligence to pipe and instrumentation diagrams, and uses that intelligence to leverage the accessibility of the data to other specialties. It also enables our process engineers to work directly in final designs.”

Miguel Villalobos
Information Technology Manager
Tecnoconsult

SmartPlant Electrical will help create safe and reliable power distribution, taking the input from the mechanical drawings and P&IDs to interface with other vendors' analysis products, such as ETAP, to verify design. SmartSketch is the engineering companion to assist with conceptual designs and deliverables throughout the plant life cycle.

MEASURING THE RETURN

- Industry research reveals that an environment using Engineering & Schematics technology delivers engineering efficiency increases of up to 28 percent, and handover savings of up to 60 percent.
- For a \$2 billion, six-million-tons-per-year capacity LNG plant project involving 700 P&IDs, 900 equipment items, 1200 control loops, and 2 product trains, with engineering communications spread across three countries, total estimated savings of 19 percent using Engineering & Schematics on the project were quantified at \$683,000, or 11,384 man hours.
- Dow Chemical's project savings estimate for the SmartPlant environment is 0.3% of total installed costs.

THE INTEGRATED SMARTPLANT FAMILY

Beyond standalone use, Engineering & Schematics is also part of the SmartPlant Enterprise. SmartPlant Enterprise offers best-in-class applications and a low-risk, step-wise implementation approach to realizing a truly integrated engineering enterprise. SmartPlant Enterprise includes:

- 3D Modeling & Visualization
- Information Management
- Engineering & Schematics
- Materials Management & Project Controls
- SmartPlant Alliance Program

NEXT STEPS

Engineering & Schematics applications are fully supported by Intergraph's global service network and can be tailored to meet each user's specific requirements. The solution can be up and running within weeks, including user training. In addition, we offer data conversion services to move legacy data such as P&IDs or instrumentation data into the SmartPlant world. To discover how this solution could help your business, contact us today.

About Intergraph

Intergraph Corporation is the leading global provider of spatial information management (SIM) software. Security organizations, businesses, and governments in more than 60 countries rely on the company's spatial technology and services to make better and faster operational decisions. Intergraph's customers organize vast amounts of complex data into understandable visual representations, creating intelligent maps, managing assets, building and operating better plants and ships, and protecting critical infrastructure and millions of people around the world.



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