

BOOSTING PROFITABILITY OF OIL & GAS DRILLING AND PRODUCTION

DEMANDS AN INTEGRATED 3D DESIGN AND
ENGINEERING PLATFORM

White Paper



OVERVIEW

Maintaining profitability in today's oil and gas industry has steadily become more challenging. The combination of falling fuel prices and rising costs—associated with offshore drilling and hydraulic fracturing—have squeezed profit margins, making increased design and manufacturing efficiencies vital to your success. Whether you're involved in developing equipment for oil and gas exploration and drilling, production and processing, or distribution and control, saving time, minimizing costs, and improving quality are critically important to maintaining and boosting your organization's profitability. This paper examines the challenges of an increasingly competitive oil and gas market, and how the integrated SOLIDWORKS® 3D development platform—including design, simulation, product data management, model-based definition (MBD), inspection, communication, documentation, and visualization solutions—can help you overcome trying market conditions and succeed.

FALLING PRICES, RISING COSTS MAKE GREATER EFFICIENCIES CRITICAL TO SUCCESSFUL OIL & GAS DEVELOPMENT

Drilling for oil and gas—whether on a land-based pad or from an offshore platform—has always put upfront capital investment at risk. Producers have long had to invest in leasing the rights to sub-surface hydrocarbons; in developing or purchasing drilling equipment; and in acquiring or building transportation, transmission, and distribution systems, with no guarantee that a well would prove fruitful.

However, until recently the risk to oil and gas exploration investment—once almost completely associated with whether drilling produced a big strike or an empty hole—was relatively small and deemed acceptable because the sizable profit margins from good wells could more than make up for money lost on bad ones. In fact, the value of productive wells in terms of upfront investment was once so great that oil and gas companies grew to become some of the most profitable businesses the world has ever known, and everyone involved in the exploration through distribution chain benefited.

Today's oil and gas landscape has changed dramatically. Although geological technology has improved to the point that drilling has gone from a hit or miss proposition to mainly hits, other economic factors—including far greater global competition and increased drilling costs—have resulted in a glut of oil and gas on a global scale, driving prices down substantially. Price pressure on hydrocarbons has proven to be a real game changer for the industry because of the greater costs associated with accessing oil and gas in harder to reach, deeper locations.

When the oil and gas industry drilled relatively shallow, conventional wells, upfront drilling costs were comparatively low. Now, the industry has to drill more than a mile underground—and then fracture sub-surface shale formations to release oil or gas through a process known as hydraulic fracturing—or pass through up to a mile of ocean before even starting to drill a well. In short, when you combine the far greater costs associated with reaching deeper oil and gas deposits with low hydrocarbon prices, profit margins tighten and put the squeeze on everyone who produces equipment to support the industry.

In other words, to succeed in an industry that is experiencing shrinking profit margins, oil-and-gas-related companies need to save time, eliminate waste, and improve quality. That's the only way that you can trim the costs that are eating into your smaller piece of the pie. Just as oil and gas exploration companies have had to adapt in order to tap harder-to-reach hydrocarbons, their supply chains need to leverage an integrated 3D development platform like SOLIDWORKS in order to minimize design delays and eliminate cost overruns by streamlining their development processes.



OIL & GAS COMPANIES NEED DRAMATIC PRODUCTIVITY GAINS TO COMPETE SUCCESSFULLY

With competition exploding worldwide and oversupply suppressing fuel prices, operations at all companies in the oil and gas market—not just the exploration and production giants but those doing business at every stage of the process—have become extremely cost-sensitive. This economic environment places a premium on productivity and rewards companies that are able to shorten design cycles, cut development costs, and consistently manufacture superior quality products, for which an integrated 3D design and engineering platform is necessary.

Locating and Preparing a Well Site

The cost sensitivity that pervades today's oil and gas industry gets passed along to all related businesses, beginning with the companies that produce the equipment used for selecting and preparing potential locations for drilling. Manufacturers of geological and seismic sensors, sub-surface mapping systems, and survey/site preparation equipment will all benefit from streamlining development and reducing costs in this market.



...a case in point

PRD Rigs, an award-winning Indian manufacturer of drilling rigs for oil and gas exploration, has designed, manufactured, and exported more than 350 drilling rigs to more than 30 countries around the world through its Paranthaman Exporters division. Until 2011, Paranthaman Exporters used AutoCAD® 2D design tools in combination with hand calculations to design and validate rig components. However, increasing customer requirements for faster development compelled the company to transition its development platform from 2D to 3D.

"To improve our competitiveness, we needed to accelerate development, validate designs with FEA (finite element analysis), and resolve the fabrication issues that are inherent to manufacturing equipment that's designed in 2D," says Design Head Ramesh Rajamani.

The firm implemented SOLIDWORKS 3D design and analysis solutions because they are easy to use, integrate FEA simulation tools inside the design environment, and provide the best value. Since implementing SOLIDWORKS, Paranthaman Exporters has cut its development cycles in half—doubling its custom rig development throughput—while simultaneously resolving a range of fabrication and assembly issues, which occurred frequently when working in 2D.

"Our customers demand that we complete all manufacturing drawings for a custom rig within 15 days," Ramesh notes. "Working in 2D, it was impossible to finish the drawings for a rig in less than 30 days. By implementing SOLIDWORKS, we have been able to consistently meet our customers' requirements, reducing our design cycles by 50 percent, which has substantially improved our competitiveness."

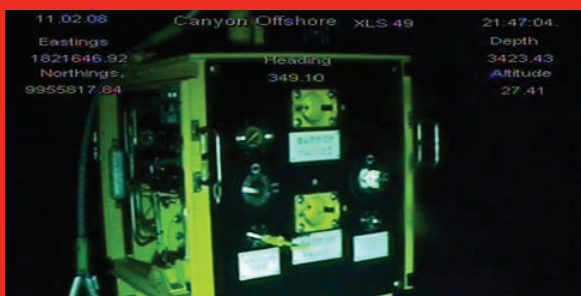
Read the full story here: [PRD Rigs \(Paranthaman Exporters\) Case Study](#)

SURFACE VS. OFFSHORE DRILLING

While offshore drilling for oil and gas has historically been costlier than surface drilling—requiring the construction of drilling platforms and the use of a range of sophisticated topside and subsea equipment—the advent of hydraulic fracturing to extract deep oil and gas deposits from land-based pads has made surface drilling quite expensive too. Manufacturers of offshore equipment, drilling rigs, tubing, downwell equipment, and cementing skids are also feeling the price pinch and face customer demands for shorter development lead times.

Production, Processing, and Distribution

After a well is drilled and hydrocarbons are found, exploration/production companies need a range of different types of equipment and facilities to process and transport oil and gas to market. Wellhead stacks (also known as Christmas trees) sit atop the well and need to connect with pipelines, compressor stations, storage tanks, test facilities, and control systems. Separators and heater treaters are frequently used to process oil and gas, and wastewater treatment/disposal facilities are often required, especially with hydraulic fracturing. Again, reducing development costs for all of these types of products and systems by using an integrated 3D design and engineering environment has become critical to business success.



...a case in point

Oceaneering International, Inc. is a leading provider of subsea technical solutions and engineered offshore products, including remotely operated vehicles (ROVs), mobile offshore production systems, and built-to-order specialty subsea hardware. With thousands of employees working in numerous countries around the world, the company's Deepwater Technical Services (DTS) division needed a product data management (PDM) system that could integrate its globally dispersed product development operations, according to PDM Implementation Manager John Mullen.

"We needed to implement a PDM system that our employees would actually use in order to save time and money," Mullen explains. "We believed that by providing everyone connected with the business with managed access to design data, we would realize substantial improvements in efficiency."

Oceaneering chose SOLIDWORKS PDM Professional (formerly known as SOLIDWORKS Enterprise PDM), implementing 200 seats worldwide. Since implementing the system, Oceaneering DTS has reduced its design cycles by 40 percent and cut time-to-market by 50 percent through greater design reuse (a 40-percent increase), tighter revision control, automated workflows, and dramatically improved design search capabilities.

"We are able to find designs more quickly, use what others have already made more frequently, and move quality product out the door more consistently," Mullen notes. "We have (also) saved money by going paperless, using the PDM system to drive workflows, and giving manufacturing personnel access to the latest model revisions. PDM has enabled us to reduce our development costs by 30 percent and completely eliminate ECOs (engineering change orders)."

Read the full story here: [Oceaneering Case Study](#)



CHALLENGES TO PROFITABLE OIL & GAS DEVELOPMENT

The mixture of falling prices and rising costs that is currently creating challenges for oil and gas production companies extends throughout the entire supply chain and affects the numerous suppliers and partners involved with oil and gas exploration, production, and transportation. For an oil and gas exploration/production company to maintain profitability, it needs not only to cut its own development costs but also expect additional savings from its vast network of partners and suppliers in the form of shorter lead times, reduced pricing, and improved quality—expectations that you can fulfill by implementing an integrated 3D design and engineering platform.

Time is Money

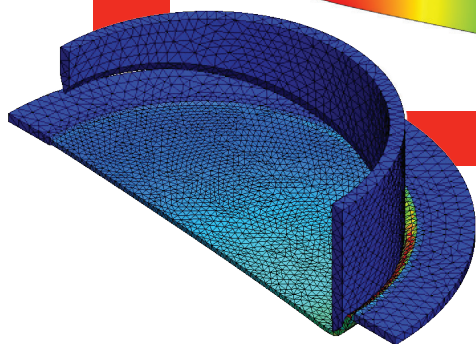
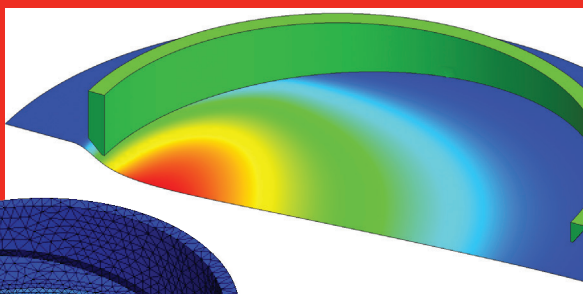
The old adage, time is money, fits this situation perfectly. If you are developing products for the oil and gas industry using the long, error-prone design cycles commonplace to 2D and have not taken advantage of data management technology to automate your workflows, you more than likely will be unable to satisfy customer demand for shorter lead-times. Ask yourself: how efficiently does your organization handle engineering change orders (ECOs)? Are your interactions with suppliers and partners fast, clean, and effective? How much time and effort is required to produce equipment operator instructions, user manuals, or other types of documentation?

Cutting Costs to Support More Expensive Drilling

Developing products to support more expensive and sophisticated drilling offshore and as part of hydraulic fracturing requires you to find ways to reduce costs. These types of drilling systems are more complex and use more costly materials, often leaving little room for error before you've blown the budget. To control costs, you need to avoid or minimize the factors that add cost to the process, including ECOs, design errors, and manufacturing mistakes. You also can leverage simulation and automation technologies to reduce prototyping and production costs.

Avoiding Field Failures

Developing products more quickly and affordably will be meaningless to your bottom line if your products fail in the field. Field failures are a sure-fire way to lose a customer, and you can't cut corners to save time and money at the expense of quality. Have you evaluated design errors to identify the source? Are these errors related to a lack of design analysis and validation or the absence of revision controls? Maintaining high quality is just as imperative as saving time and money in today's challenging oil and gas market.



...a case in point

Pronal Asia Manufacturing is a leading manufacturer of elastomer engineering products, including fixed jacket buoyancy and grout plug products for offshore oil and gas platform installations. The company sought to differentiate itself by improving the performance of its offshore products with the help of nonlinear analysis tools, beginning with its jacket diaphragm closure.

“When the jacket is upended and set on the seabed, a diaphragm closure is utilized at the bottom of the jacket leg or sleeve to maintain buoyancy. The pile must be able to penetrate the diaphragm closure into the seabed while trying to minimize vibration in the structure in order to extend platform life,” says Regional Project Manager of the Pronal Offshore Division Muhammad Irwan Nordin. “If the pile fails to penetrate the diaphragm closure by its own gravity, pile hammering will take place, and consequently, customers stand to lose a full day of offshore costs, about \$500,000. If hammering begins prior to penetration, the entire structure will be prone to high vibration over time.”

Pronal evaluated leading nonlinear analysis tools before choosing SOLIDWORKS Simulation Premium software because it is easy to use yet provides robust nonlinear analysis capabilities. Using the software, Pronal improved the performance of its jacket diaphragm closure design and is now leveraging the software to improve the performance of its mud wiper and grout packer products. Since pioneering the use of SOLIDWORKS Simulation Premium software for this purpose, Pronal has experienced business growth of 60 percent.

Read the full story here:
[Pronal Asia Manufacturing Case Study.](#)

Effective Communication among Suppliers, Partners, and Drillers

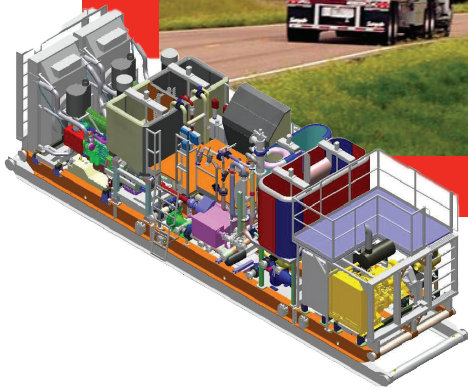
One of the unnoticed contributors to lengthy development cycles, unnecessary costs, and design errors—related to confusion or misunderstandings—is data incompatibility and the lack of effective communication tools. Are you and your partners/suppliers on the same integrated design and engineering platform? Can you trade data back and forth without losing feature and dimension information? Have you had issues with data conversions or file translations? Do you have access to robust design visualization and communication tools?

STREAMLINE OIL & GAS DEVELOPMENT WITH THE SOLIDWORKS INTEGRATED SUITE OF 3D DESIGN AND ENGINEERING SOLUTIONS

Although the current conditions in the oil and gas market may seem daunting, you can overcome these challenges and improve your organization's profitability by leveraging the SOLIDWORKS integrated suite of 3D design and engineering solutions to streamline your development processes. SOLIDWORKS software is the most widely used 3D CAD platform in the oil and gas industry and the preferred engineering solution of oilfield equipment leaders Halliburton and Baker Hughes. Using integrated SOLIDWORKS design, simulation, product data management, model-based definition (MBD), inspection, communication, documentation, and visualization solutions, you will be able to achieve the greater efficiency, cost reduction, quality improvement, and effective communication goals that are vital to your success.

Design Equipment Faster and More Accurately

SOLIDWORKS 3D design and engineering solutions will help you design better, more accurate products more rapidly—50-percent reductions in design cycles are common—allowing you to satisfy demands for shorter lead times. For the design of rotary drill strings, the SOLIDWORKS constraint manager at the sketch level monitors whether a sketch is over- or under-constrained, helping you avoid errors. Because SOLIDWORKS is parametric, and updates and generates design changes to models and drawings automatically, making design changes doesn't create duplicative effort or delays. With the addition of SOLIDWORKS PDM capabilities, you not only can automate workflows to further shorten design cycles but also increase design reuse and simplify ECO processing. SOLIDWORKS MBD software can also help you accelerate production. Preparing equipment operating instructions, user manuals, and online animations is also much faster with SOLIDWORKS Composer technical communications software, helping you save additional time.



...a case in point

Sanjel Corporation is the largest privately owned oilfield services company in Canada, with international operations stretching around the globe. Until 2004, Sanjel engineers used 2D design tools. That's when the rapidly accelerating pace of oil and gas exploration, drilling, and production compelled the company to evaluate 3D CAD solutions to speed development, control costs, and boost quality.

The company standardized on the SOLIDWORKS 3D design platform because it is easy to learn and use, helps engineers overcome design challenges and create innovative concepts, and provides access to integrated SOLIDWORKS eDrawings® communication and SOLIDWORKS Simulation analysis tools.

The move to SOLIDWORKS software has enabled Sanjel to dramatically compress its development cycles. For example, an oil-drilling customer in the Middle East needed a specialized redundant cementing skid. Sanjel engineers designed and manufactured the equipment in a fraction of the time it would have taken without SOLIDWORKS software. The company not only slashed development time for the SCM (Sanjel Cyclonic Mixer) cementing skid from two years to six months, it also realized a 40 percent reduction in design time across the board.

"SOLIDWORKS software helped us deliver quickly on an important product," Senior Mechanical Designer Kris Sato notes. "SOLIDWORKS software gave everyone involved a clear picture of what we were working on and working toward—and kept us moving fast."

Manager-Engineering Jeff Spence attributes the efficiency improvements to the combination of design reuse and virtual prototyping. "SOLIDWORKS software enables us to develop equipment rapidly, which gives us a definite advantage," Spence says.

Read the full story here: [Sanjel Case Study](#)

Cut Development Costs

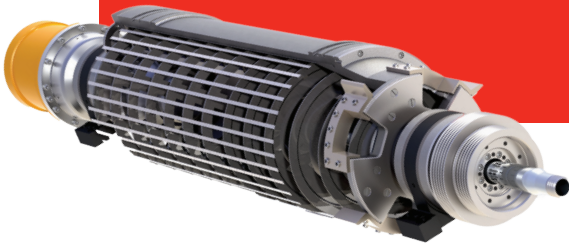
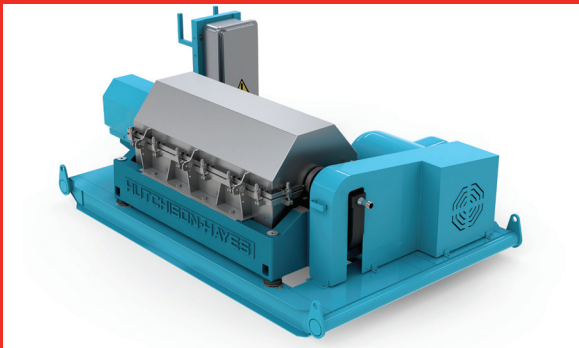
The SOLIDWORKS integrated suite of 3D design and engineering solutions will enable you to dramatically reduce and more tightly control development costs, providing relief to shrinking profit margins. Time is money, and while shortening design cycles and accelerating ECO processing will help you cut costs, SOLIDWORKS 3D design visualization, parametric design, and integrated simulation capabilities lets you more easily pinpoint and resolve problems before a design is released to manufacturing. This serves to eliminate the rework and retrofits on the shop floor that can significantly increase costs. Plus, with integrated SOLIDWORKS simulation tools, you can cut additional costs by drastically reducing prototyping requirements. Instead of bearing the cost of multiple physical prototype iterations, you can use SOLIDWORKS Simulation software to perform virtual prototyping of designs, resulting in the need for just one prototype in almost all cases.

Improve Quality, Avoid Field Failures

In addition to saving time and money, integrated SOLIDWORKS 3D design and engineering solutions will allow you to continually improve and consistently maintain product quality, helping you to avoid the field failures that can negatively affect your business. With SOLIDWORKS PDM capabilities, you can more tightly control design revisions, eliminating the possibility of rolling a previous problematic version into the field. You can use SOLIDWORKS Simulation software to identify and resolve potential performance issues that could result in field failures, as well as to optimize designs to improve performance. With SOLIDWORKS Inspection software, you can boost the effectiveness of your inspection effort, helping you to catch and correct problems and defects on incoming, outsourced parts or components produced using your own manufacturing facilities. With fully validated designs and thoroughly inspected parts, your quality has nowhere to go but up.

Communicate Effectively

The integrated SOLIDWORKS 3D design and engineering platform provides you with a range of design visualization and communication tools that will improve the effectiveness of your interactions with suppliers, partners, and customers. The inability to communicate design information or share design data can extend design cycles, add costs, and create opportunities for error. Working in the common SOLIDWORKS environment—the most widely used CAD format in the oil and gas industry—will enable you to eliminate data translations and file conversions, which can often lead to confusion, misunderstandings, and errors. You can leverage SOLIDWORKS eDrawings capabilities to communicate effectively with anyone, irrespective of whether they have SOLIDWORKS software installed. You can also more efficiently create technical illustrations to communicate with suppliers, partners, and customers, and tap the rendering capabilities of SOLIDWORKS PhotoView 360 to create eye-catching photorealistic design visuals.



...a case in point

Since pioneering the development of liquid/solids separation technology in 1928, Hutchison Hayes Separator, Inc. has grown to become a major supplier to oil and gas services companies, including Halliburton and Baker Hughes.

To support growth and expand its product line, company management decided to reevaluate the AutoCAD 2D and Autodesk Inventor® 3D design software that it had used, according to Sales Manager Hans van der Voort. "Our business plan required us to develop new products for additional applications," van der Voort recalls. "To support the increased activity, we needed a 3D development platform that would enable us to tighten up development and manufacturing. By doing so, we could shorten delivery lead times and free up resources to go after new opportunities."

Hutchison Hayes standardized on SOLIDWORKS Premium design and analysis software and soon added SOLIDWORKS Simulation Professional analysis software because they are easy to use and provide the range of design, simulation, and communication tools that the company needs at the best price.

In addition to helping Hutchison Hayes expand its product line, the move to SOLIDWORKS enabled the company to cut lead times in half and energize its sales effort to support a 20 percent annual growth rate. "From a sales perspective, SOLIDWORKS is helping us grow," van der Voort stresses. "We use eDrawings extensively with customers, and having 3D renderings available is a substantial improvement from the black-and-white 2D pictures that we used in the past. It helps to accelerate the selling process."

Read the full story here: [Hutchison Hayes Case Study](#)

MAKE OIL & GAS DEVELOPMENT PAY WITH SOLIDWORKS SOLUTIONS

Even though growing global competition, an oversupply of hydrocarbons, falling fuel prices, and rising drilling costs have put companies that operate in the oil and gas industry in a bit of a bind, your organization can still compete effectively, earn profit consistently, and continue to thrive by streamlining design cycles, cutting development costs, and improving product quality. With the SOLIDWORKS integrated suite of 3D design and engineering software—including design, simulation, product data management, model-based definition, inspection, communication, documentation, and visualization solutions—you'll be able to satisfy industry demands for shorter lead times, lower prices, and improved quality without cutting into the profit margins that are crucial for your business.

To learn more about how the SOLIDWORKS integrated suite of 3D design and engineering solutions can improve your oil and gas development and production processes, visit www.solidworks.com or call 1-800-693-9000 or 1-781-810-5011.

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