

INSPIRED

Technology & Innovation in Wood Group

Issue 1 2016

Success story:

Nail it!

Success story:

Achieve
air quality
excellence



Welcome

Welcome to this first ever edition of our Wood Group-wide Technology & Innovation (T&I) Newsletter. We have branded the Newsletter “Inspired” because we hope that the impressive range of features will inspire many more of you to tell us about your own achievements and indeed might inspire you to be even more creative as you go about your daily work. Our aim is to showcase several of the most significant and impactful activities in the Wood Group T&I arena, to cover as wide a range of Wood Group skills as possible and to spark an interest amongst a wider constituency of employees across our business functions as well as the technophiles amongst you.

This Newsletter is just one element of Wood Group’s increased focus on the T&I space. For example, we have recently launched the Innovation Seed Fund, with the first few projects already underway. This year we will have a specific T&I webpage, accessible in one click from the Wood Group homepage. There are very sound reasons for this change of emphasis. Firstly, innovation is a key theme within our new Group strategy, one which will differentiate us and allow us to bring more value to our customers. Technology can change industries and the need for breakthrough innovation has rarely been more important than at this stage in the commodity price cycle, with our customers all reaching out for step-change improvements in the cost, efficiency, integrity and safety of their assets.

The world has entered an exciting period of rapid technological change, and enablers like digitisation, the Internet of Things, Robotics, Artificial Intelligence, Cloud based services all have the potential to bring disruptive change to the industries in which we work.

So please give us your feedback on this first edition and also allow us to tap into your ideas for future features. Contact us at: **inspired@woodgroup.com**

Steve

Steve Wayman
Group Head of Strategy & Development

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Profiles

Innovation is a core value for Wood Group because it characterizes our people, our ideas and the way we work. It also differentiates us to our clients and, in so doing, brings them added value over and above commoditised services. We'd like to introduce you to some of our Technology & Innovation leadership, who's role is to empower our people to deliver this innovation.

Steve Wayman
Group Head of Strategy & Development



I have technically been with Wood Group for 24 yrs, since I was part of the 'old' JP Kenny when it was acquired in 1992. I spent the last 12 years as Wood Group Kenny's CEO, and stepped aside from that role in April 2015 to take up my current position. I'm now responsible for heading up group strategy, managing the mergers & acquisitions team, ensuring smooth running of group business development 'machinery', and being the champion for Technology & Innovation.

I have always enjoyed finding, creating and building new businesses, products or service lines, whether it is an organic start-up, a new piece of software, a new office in a new territory, or an acquired company. The excitement comes from putting together a vision, marshalling everyone behind it, and then making it happen. I particularly enjoy the innovation area, both technology and business related. We have pockets of innovation going on all around Wood Group, but in this particularly challenging market we need much more, so we are ramping up the profile, the energy and the investment.

Kent McAllister
President Offshore, Wood Group Mustang



I graduated from the University of Arkansas with a degree in Chemical Engineering before kick starting my career in the U.S. Navy. Although this wasn't the traditional route to the energy industry, it did provide me with a solid foundation to build more than 25 years of engineering experience most of it serving the oil and gas industry. Currently, as President of the Offshore Business Unit at Wood Group Mustang, I direct business development, technical directions, project management, and resource development for our offshore projects.

I am passionate about providing innovative ideas, outstanding engineering, and cost efficient solutions for our clients. This could not be done without the opportunity for all Wood Group Mustang employees to share their ideas and have the support of leaders to initiate the ideas. Since the start of our Innovation Network, a process where Wood Group Mustang employees can share ideas and lessons, I've seen the positive impact ideas can have on our projects, processes or within a department.

David Millar
Business Performance & Deputy Business Manager, Wood Group PSN



I joined Wood Group PSN in August 2012 and for the past two years I have been the business improvement manager on the Shell integrated services contract (ISC) based in Aberdeen. I launched the Innovation, Improvement and Learning network in 2013 and going forward will be working closely with Ricky Duff, global strategy & development director. Ricky leads the innovation charge in Wood Group PSN and we have the goal of ensuring everyone understands customer needs and industry trends, to deliver technologies, services and processes that will broaden our offering and ensure we stay leaders of the industries we work in. My current role requires me to work closely with the contract leadership, team members and our customer to identify focus areas for innovation, improvement and learning, define initiatives and manage the portfolio of these through to successful delivery.

In 2015 we delivered over £16m in savings and improvements to our customers with full 12 month saving realisation of £39m. Our portfolio on innovation and improvement had over 60 initiatives covering areas such as standardisation, simplification, people & organisation, supply chain, logistics, efficiency and exciting new technology. All of the initiatives are focused to improve delivery performance for our customer, deliver innovative new process and technology and ultimately make Wood Group PSN services safer, more effective and efficient.

Mark Linton
Director - Technology & Innovation Wood Group Kenny



This is my 20th year with Wood Group. I joined the business in July 1996, starting out as the manager of the JP Kenny brownfield business in APAC. In 2001 we created and organically/acquisitively grew a global Integrity Management business which I led until last year, when I was appointed to the T&I director role in Wood Group Kenny.

Being involved in the creation and successful development of new and evolving service lines, is not only personally enjoyable and rewarding, it demonstrates conclusively the value Wood Group derives from investment and development in Technology & Innovation enables us to differentiate ourselves in a market of "me too" competitors. Showcasing some of these achievements and examples to all our Wood Group employees and clients in the "Inspired" magazine will greatly amplify and foster continued innovation and technology collaboration across our business as a consequence. William Pollard said "Learning and innovation go hand in hand. The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow". I look forward to working with my Wood Group colleagues in shaping our "tomorrow" and sharing our success stories with you via Inspired.

Success Story:

360° Repair Orders

One of the first developments to come out of the **XTEND** programme was **360° Repair Orders**.

Graeme Wilson

Repair Order Manager - UK

In the Wood Group PSN UK business the XTEND programme has been established to identify innovative, transformational solutions, which deliver sustainable business and cost efficiencies deployable across the UK business and beyond.

One of the first developments to come out of XTEND is 360° Repair Orders (ROs).

Repair orders are core to our business in the UK due to the late life stage of many of our customers' facilities. These ROs are larger than routine maintenance work and smaller than typical upgrade projects. They are smaller work scopes that require a certain amount of assurance and development, but are not large enough to be granted separate project status. The facilities we support can generate around 50 ROs per week.

Recognising the change in customer needs we quickly identified the opportunity to be more efficient in delivering ROs.

Our whole approach to ROs was challenged and a complete overhaul conducted to develop a new and innovative model of RO delivery. A key element of this was a continual and complete learning cycle around the whole process incorporating both Wood Group PSN and the customer giving rise to the term 360° Repair Orders.

The UK now has an established 360° RO team of hand-picked multi-skilled specialists dedicated to delivering repair orders from survey and assurance through supply and fabrication to final execution and close out. This flexible team can deliver a minimum of 15% savings on traditional RO offerings with one recent customer seeing up to 40% savings and 50% improvement on cycle times. This is achieved through multi-skilling our team members, use of latest scanning technology and a competitive commercial model.

360° Repair Orders is the answer to our customers' need for quick, efficient and cost-effective removal of integrity threats to ensure our people and those we work with go Safe Home and production keeps flowing safely for the benefit of our industry.



Success Story:

Driven by innovation, the UK business improved the **repair order process** by reducing cost and speeding up overall delivery time without adversely affecting safety or integrity.

It's not rocket science

David Millar

Business Performance & Deputy Business Manager

The UK business was looking for ways to improve the repair order process in terms of reducing cost and speeding up overall delivery time without adversely affecting safety or integrity. Driven by the innovation core value, David Millar wanted to challenge current practice and look for different and innovative solutions. He leveraged his external network and got in touch with one of his contacts in NASA, explained the situation and asked if NASA would be willing to share some insight into their repair process for the International Space Station. After a couple of emails, a teleconference was set up between the ISS Flight and Operations Control Lead and the repair order improvement team.

Following the teleconference it was clear to see that NASA's repair order process was simple and effective. Rocket science is pretty easy once you are up in space! This provided David and the team with new directions to investigate and pursue.

Key insights from the teleconference:

- ▶ Astronauts are multi-skilled in terms of executing repairs but do not have in-depth, discipline knowledge of the equipment or programmes.
- ▶ The repair team doesn't get any schematics or drawings in the workpack, just simple step-by-step instructions with supporting pictures in a Word document. If it's a more complex repair they might get a video as well.
- ▶ Their whole process is electronic – no paper.
- ▶ During the repairs, the team is continually connected to Flight Control via video and audio to ensure real time support as required during the repair.

Based on these insights the following opportunities are being developed further as part of the improvement programme:

- ▶ **Up-skilling / multi-skilling** our people offshore to further their development and better manage costs of specialist and expensive vendors.
- ▶ **eWorkpack process** to provide a paperless system to speed up cycle time during execution and close out using the latest intrinsically safe Zone 1 and Zone 2 rated tablets. This will minimise desk time offshore and increase tool / wrench time.
- ▶ **Offshore live system** using same Zone 1 and Zone 2 rated tablets to connect offshore and onshore live to get expert eyes on offshore locations and kit to support our people in executing work in the safest and most efficient manner.

Taking the time to think differently, challenge current practice and look at how other industries work allows us to truly pursue sound and innovative solutions to our challenges. It's stories like this that differentiate Wood Group from our competitors.

For more information on these innovations please contact david.millar2@woodgroup.com

Success Story:

In order to support our customers and help make their business sustainable and fit for the future, we have been working on numerous cost reduction and efficiency improvement opportunities through our UK transformational change programme, **XTEND**, and local business improvement activities on contracts and projects.

Nail it!

Andrew Crawford
Engineering Delivery Manager





Across our UK business our customers are facing unprecedented challenges due to low oil price and increasing costs associated with late life facilities in the UKCS. In order to support our customers and help make their business sustainable and 'fit for the future' we have been working on many cost reduction and efficiency improvement opportunities through the UK-wide XTEND programme and local business improvement activities on contracts and projects.

Earlier in the year we embarked on a joint Counter Intuitive Problem Solving (CIPS) workshop with one of our customers focused on Engineering Delivery on a contract. The output from this three-day workshop was five concepts that were supported by senior leaders with a commitment to deliver these in the business.

Two of these concepts were titled Nail the front-end and Nail the back-end and were focused on improving the overall cycle time of the modifications delivery process on the contract. The average cycle time of the end-to-end process was circa 400 days.

Nail the front-end was focused on the front-end of the modifications delivery process that started at approval of a change from the customer to production of a basis for design by Wood Group PSN for approval by the customer prior to going into detailed design. On average this could take circa 100 days to complete.

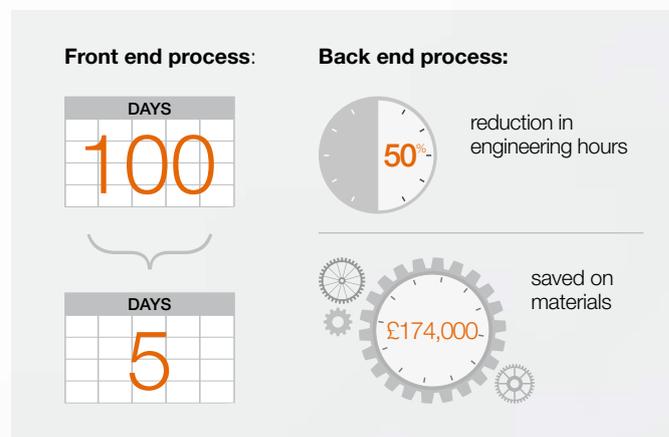
The Nail the front-end concept was to compress 100 days into five days! This was achieved by working collaboratively with the customer and our engineering delivery teams to propose a new integrated approach to deliver a basis for design in five days and then pilot this on two actual jobs. On both occasions the basis for design was delivered to the customer after five days ready for review and approval. The Nail the front-end process has now been included in the standard modifications delivery process to ensure this is how we work for every new job.

Nail the back-end was focused on the onshore and offshore execution part of the modification delivery process that started at approval of basis for design to delivery of work packs for execution offshore. On average, this process as well as offshore execution could take circa 300 days to complete.

The new concept was to identify high value scopes with the customer and push these through a fast track delivery process. This involved compressed planning templates and an alternative team working ethic. Sponsored by a senior engineering delivery leader and led by a project engineer, this approach involved implementing a different set of behaviours, visual management and relentless pursuit of improvements in schedule and costs. These expectations were discussed and agreed with the team from kick-off and enforced throughout the process.

This approach has also been piloted and has demonstrated circa 50% reduction in engineering hours and circa £174,000 savings on materials by using repeatability efficiencies and constant deliverable and supply chain challenge. Learnings from the pilot are being captured and this new approach will also be codified into our modifications delivery process to become a standard way of working for high value scopes and at least halving the normal process cycle time.

To find out more email:
andrew.crawford@woodgroup.com



Success Story:

Top honour for technology

Kristi Krupala

Communications & Marketing Lead

Top honour for technology challenge shows we have the innovative edge.

David Winsor, a technical professional based in our Eastern Canada office, scooped the top prize along with his former university teammates in the G20 Global Business Challenge competition held in Australia.

The G20 Global Business Challenge is a unique and highly innovative competition that attracts top graduate students from leading business schools and universities and is designed to leverage both technology and business strategy to formulate solutions to major global challenges. David entered along with three other team members from Memorial University in 2014.

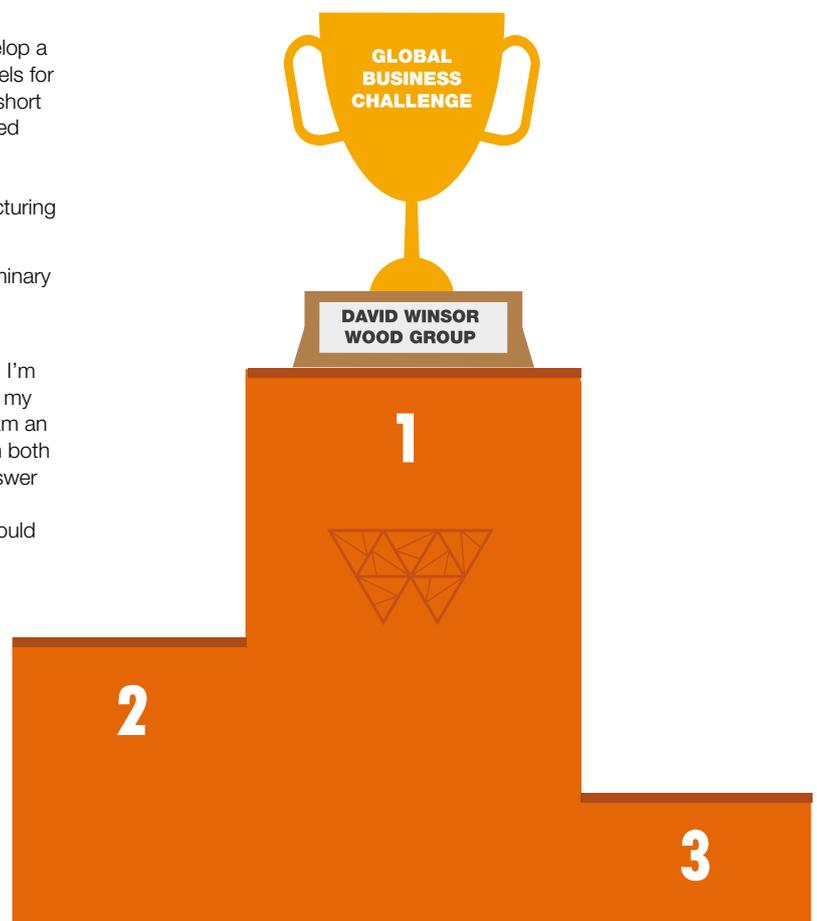
The challenge presented a unique opportunity for teams to develop a technical solution and design novel business and financing models for maximum economic, social and environmental benefit in a very short time period (under 24 hours). The team's winning solution focused on using seawater for irrigation purposes to reduce the reliance of freshwater in the agriculture industry. This in turn would allow freshwater to be used in other applications, such as for manufacturing or domestic use.

To make it to the finals, David and his team competed in a preliminary round and beat 40 other groups from 18 countries before being chosen as one of the top six finalists.

"Looking back on the experience since winning the competition, I'm very proud of what our team accomplished," David said. "I think my experiences working at Wood Group PSN certainly gave our team an advantage as we could explain the underlying technologies from both the engineering and business perspectives and were able to answer some of the tougher questions from the judging panel regarding project management challenges and mitigation strategies that could be encountered/used in such a development."

According to David, the experience has also proved useful when put in similar time-sensitive challenges at Wood Group.

"Since the G20 Competition, I've moved into a contract administration and business development role in St. John's and I've been able to use both my technical and commercial skills in developing relationships with our existing clients and bidding on new opportunities in the region, which can adhere to similar tight time constraints."





Case Study:

Optiview™

Donogh Lang
Director Drilling & Wells



A new productivity-enhancing tool for the offshore drilling industry.

One of the problems faced by the offshore drilling industry is how to take the outputs from engineering work that is conducted in advance of drilling any new well offshore and translate that effectively into actionable “decision-grade” information.

Typically, a large volume of engineering analysis work has to be undertaken before each offshore well is drilled in order to generate what are called the Well Specific Operating Guidelines, or WSOG. Amongst other things, the WSOG stipulate the environmental conditions (wind, wave and ocean current) in which the drilling rig can continue drilling and when it must go on standby.

One of the main activities of Wood Group Kenny’s Drilling and Wells business is performing the engineering analysis that is required to develop the WSOG for offshore drilling contractors and oil & gas companies. However, it is currently a rather labour-intensive process to take the results from what may be hundreds of analytical load cases and distill these down to a succinct set of operating guidelines.

To address this challenge, Wood Group Kenny’s Drilling and Wells and Software businesses have collaborated to develop OptiView™, an innovative new software tool that dramatically reduces the time and effort required to generate results that can be used by drillers offshore. OptiView™ takes results generated by Wood Group Kenny’s drilling riser analysis software DeepRiser™ (already the industry-standard tool for this application) and collates these into a number of succinct plots that can be quickly and easily interpreted in an offshore operational environment.

This capability brings a number of advantages. Firstly, by automating what was a labour-intensive process, OptiView™ substantially improves the efficiency with which results are delivered to the client.

This can be of enormous value in a time-sensitive context where a client may, for example, have a drilling rig on standby awaiting the results from an analysis of a planned operation. Secondly, gone are the days when a client must leaf through a report that may run to hundreds of pages to find the key results of interest; instead, they can quickly and easily access these results interactively using a tablet device running OptiView™.

Paper reports remain one of the deliverables from an analysis job, however these can now be accompanied by results in softcopy form and an OptiView™ license, valid for the duration of the drilling program. Thirdly, thanks to its intuitive, interactive interface, OptiView™ presents only the results that are most relevant – results that are not of interest can easily be filtered out.

The capabilities provided by OptiView™ generate significant efficiencies in the generation, presentation and interpretation of key operational guidelines for offshore drilling operations and the tool is set to become an industry standard. Further developments of the software are planned, including a possible linking of OptiView™ to cloud storage, allowing results generated in the office to be made available offshore immediately, providing a crucial link to facilitate offshore operations support.



Success story:

Achieving air quality excellence

Philip Black
PE Environmental Practice Lead





ENVision™ generates certified emissions values as frequently as every six minutes and sends them directly to operator boards. The system constantly monitors the results and alerts multiple plant personnel before non-compliance occurs, providing time for an intervention.

Refineries, petrochemical plants and other industrial facilities worldwide are operating with increasing environmental oversight. Air quality regulations are requiring more continuous emission monitoring systems (CEMS) to take high-speed measurements while passing stringent quality assurance tests. Adding to the complexity of monitoring and reporting is the exponentially growing volume of data needed to satisfy both regulators and management.

Until now, many plants have relied on custom spreadsheets with complex macros for monitoring and collecting information for use in reports. Performance tracking information has generally been available only on a daily or monthly frequency. Regulators and even shareholders are now demanding companies demonstrate their ability to take specific, immediate action before an avoidable incident occurs.

To meet these ambitious goals, facilities are turning to ENVision™, Wood Group Mustang's real-time environmental analytics platform, to manage large amounts of continuous process data. ENVision generates certified emissions values as frequently as every six minutes and sends them directly to operator boards. The system constantly monitors the results and alerts multiple plant personnel before non-compliance occurs, providing time for an intervention.

ENVision's comprehensive storage enables a level of analysis never before possible. Multi-year datasets are available in a single location, allowing the tracking of long-term environmental performance at a higher level of detail. Near misses are tracked along with the deviations, providing insight into the underlying causes.

A notable example of ENVision's capabilities is a 100,000 bpd refinery that was tracking compliance using 25 linked Excel spreadsheets. Data transfer from multiple sources was labor-intensive.

Manual processing meant a delay that prevented any adjustments to avoid excursions. The process was difficult to document for external review. By implementing ENVision, the refinery streamlined its cumbersome reporting process and eliminated 90 percent of its spreadsheets. Operators know they are in compliance and can make immediate process adjustments to avoid incidents. The standardization across units and the detailed audit log maintained in the system has reduced the time spent during external reviews. The results are automatically transferred to the corporate EH&S management system, providing the ability to better track key performance indicators (KPIs). Aided by comprehensive analytics and seamless integration with existing tools, ENVision enables air quality excellence.

Case Study:

SAFE

In 2015, Wood Group Kenny developed an app to allow mobile device users access to Wood Group Kenny's SAFE (Safety Awareness for Everyone) web-based safety observation system first introduced in 2011.

Peter Doherty
Senior Engineer

SAFE observations are measured and managed so that specific actions can be taken to improve safety issues which could otherwise go undetected. They also provide valuable data enabling trends to be detected, performance to be improved and HSSE objectives to be achieved.

Using the SAFE app, users working remotely, often at a contractor or other remote work site, are now able to log a safe/unsafe activity or work conditions through a clear and user-friendly interface with additional photo-upload capability. Users can also read SAFE observations posted by Wood Group Kenny employees worldwide using their mobile device.

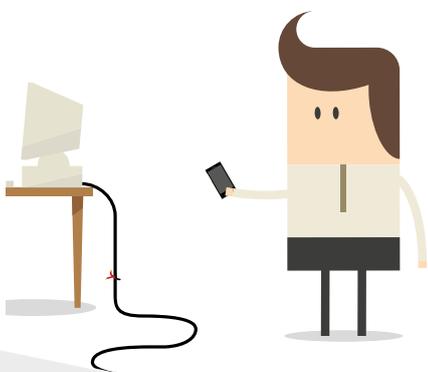
The user's recommended corrective action can be logged using the app, permitting timely review via the app or desktop by the company's HSEQ team.

The app is designed to encourage employees to observe and communicate SAFE observations, take positive steps to ensure a safer workplace and instill a positive safety culture. SAFE observations can be assigned to specific projects or to a designated Wood Group office. The early logging and review of unsafe acts/conditions can also prevent injuries and serious accidents to Wood Group employees and our clients.

A multi-disciplinary team from Wood Group Kenny Paris, London, Brisbane, Houston and Aberdeen collaborated to design and build the app with internal funding from Wood Group Kenny's Technology for Business (T4B) program, bringing knowledge and experience from across the company. The SAFE app will be available for users of iOS and Android before end Q1 2016.



Photograph any safe or unsafe acts or conditions in the office for your report...



Or any safe or unsafe acts or conditions on site...



Then log your report and view other SAFE reports





Case Study:

Virtual metering achieves significant cost reductions

Dale Erickson
Vice President Technology

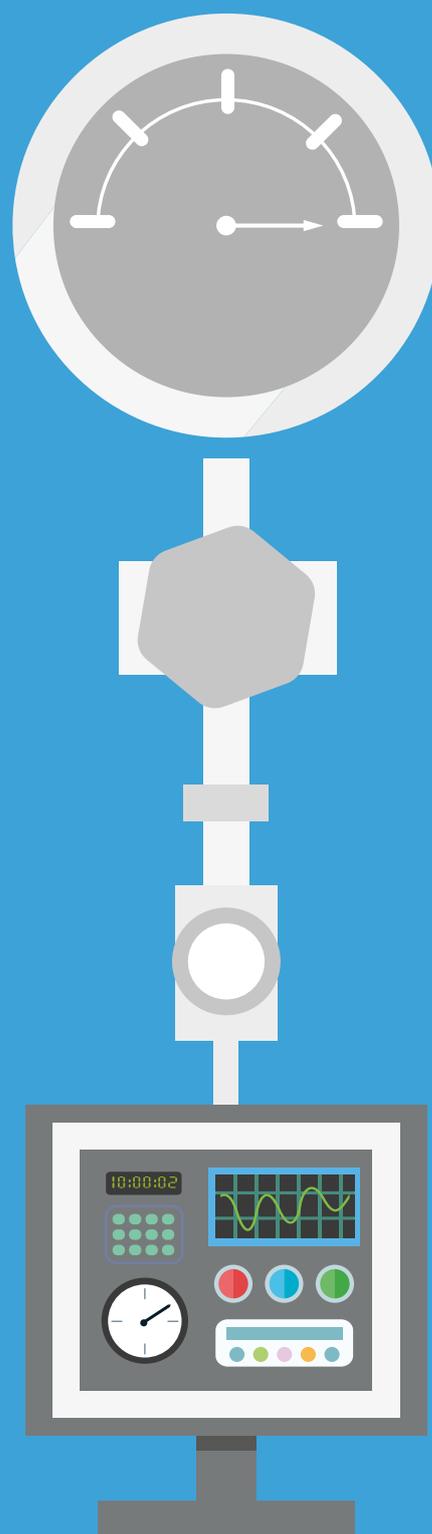
Developed in Wood Group Kenny, the Virtual Metering System® (VMS) technology uses normally available field instrumentation and sophisticated proprietary software to produce online well flowrate estimates.

At a recent Wood Group Kenny subsea forum held in Houston, many operators have experienced challenges with the long-term reliability of subsea multiphase meters. Maintenance cost, reported to be greater than \$100K per month, and replacement cost, greater than \$3 million per event, of subsea multiphase meters can run into tens of millions of dollars over the life of a field. However, Wood Group Kenny has an alternative, called the Virtual Metering System® (VMS).

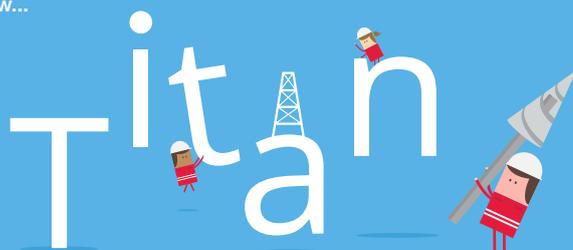
This technology uses normally available field instrumentation and sophisticated proprietary software to produce online well flowrate estimates. In one field, where the Wood Group Kenny VMS was installed as a backup for physical multiphase meters, all of the physical devices failed within six months of installation. Even after two years of operation, the total of the “virtually metered” flowrates matched the total of the export meters to an error of less than 0.5%.

In another example, the customer has a variety of subsea multiphase meters, topside multiphase meters, and meters downstream of the production separators. These various meters have been shown to require meter factors (to get them in balance) of up to 10%. In this field, virtual metering (VM) is used to reconcile flowrates that are then exported to the distributed control systems (DCS) for display in the control room and to the process data historian. So an additional benefit of having a VMS is that it can provide a total allocation system for the client, where flow is intelligently allocated back to each well for reservoir management - even when there are errors in the upstream meters.

For these reasons, many companies are considering not installing subsea multiphase meters at all (or reduced numbers) and just using VM. One of the drawbacks of VM in the past has been the issue of thresholds for detecting water breakthrough. However, with a recent technology advance, Wood Group Kenny has increased the sensitivity of water detection by approximately a factor of ten. This technology has been validated with field data for both a North Sea system and one in South East Asia.



Did you know...



Wood Group Mustang designed the Lightest Topsides ever built on a floating structure with full drill capacity in 4000ft water depth.

Success Story:

The smoothest running compressors in our fleet

Jordan Grose

Manager, Vibration Integrity Group

Wood Group's vibration and dynamics analysis leads to improved offshore production platforms. A client's offshore brownfield production field required additional compression to enable gas lift in an enhanced oil recovery scheme. The existing platform only had a cellar deck available to house this intensive production machinery. As this compression otherwise would require a new platform to be built, the client was interested to determine the possibility of installing two reciprocating compressors on the platform's cellar deck. The operator retained BETA Machinery Analysis (Wood Group Kenny) as its vibration and dynamics consultant during the planning, detailed design phases, and to coordinate all vibration issues across the different engineering disciplines, including piping integrity, structural, and rotating equipment teams.

Modifying a production platform, especially when adding or changing the rotating machinery, can create vibration and increased operational risks. This is because the machine generates forces that can cause the platform deck to vibrate. The resulting vibration creates significant reliability and operational problems for the equipment, as well as high risks that can lead to piping fatigue failures. In this case BETA's engineers took on the challenge of designing a safe, and reliable reciprocating compressor installation on this platform.

The scope included:

- ▶ FEED — including layout, design options, and specifications for vibration/dynamics
- ▶ Pulsation, mechanical analysis, and torsional design of compressor packager (per API 618)
- ▶ Skid dynamics and lifting
- ▶ Structural vibration and dynamics due to machinery loads
- ▶ Piping vibration including small-bore piping designs
- ▶ Pipe stress analysis, with particular focus on piping affected by vibratory loads.

Given that cellar decks are not typically designed to handle production machinery (too flimsy), BETA used specialized dynamic analysis and compressor simulation tools to discover localized resonances in the deck that were excited by compressor forces and pulsation loads. To compound matters, when running two compressors at the same time, it was expected that the interaction of the units would cause excessive vibration levels on the piping and compressor system. BETA's design and field experience were combined to correctly assess and solve the dynamic issues with effective modifications to the equipment and structure, despite time and cost restrictions.

Piping vibration, especially pressure safety valves (PSVs), blind flanges, drain lines, and other small diameter connections were another area requiring special concern. All "off-skid" piping in the new area of the platform was assessed and many modifications were implemented to avoid resonance and excessive vibration.

To resolve the engineering issues, BETA worked closely with the compressor vendor, engineering company, and owner to come up with the final design. Such collaboration guarantees that all dynamic loads will be taken into account, resulting in a smoother and more reliable design. Using a single vibration consultant for managing all vibration issues avoided costly mistakes, re-work, and delays. BETA's early and continuous involvement from pre-FEED and planning to execution and delivery ensured substantial cost savings, schedule improvements, and a successful application of production machinery on an offshore platform cellar deck.

After commissioning the new compressor units, the owner and operator were extremely happy with the project achieving reliability metrics of above 97%, calling them "the smoothest compressors in our fleet." This project highlights the importance of working closely with all parties (compressor supplier, EPC, and vibration consultant) to address vibration issues from the pre-FEED stage to the final design. Doing so will help a project with major technical challenges to be completed on-time, on-budget, with exceptionally high reliability, and resulting low life cycle costs.

Did you know...



Wood Group executed pre-FEED, FEED and detailed design for 18 FPSO projects worldwide.



This project highlights the importance of working closely with all parties to address vibration issues from the pre-FEED stage to the final design. Doing so will help a project with major technical challenges to be completed on-time, on-budget, with exceptionally high reliability, and resulting low life cycle costs.



Standard SAGD Well Pad Design

The Wood Group Mustang standard SAGD well pad design was developed in response to growing concerns in the thermal heavy oil industry around escalating costs for in-situ facilities, especially SAGD well pads.

Sam Smith

Vice President Engineering & Design - Canada

Increasing costs for the design, fabrication and construction of these facilities is forcing owners to seek innovative methods for becoming more competitive and the Wood Group Mustang standard SAGD well pad design is our response to that challenge.

Ongoing engineering costs and schedules are significantly reduced using templating and an efficient replication process. Engineering deliverables require no modification for fabrication and only minor site specific inputs for Issued for Construction packages. Fabrication takes on a lean manufacturing model due to the standard design, where efficiency and quality is highest.

Our design is based on disciplined execution which provides the following advantages:

- ▶ A **proven, low cost, fit for purpose** SAGD well pad design that **meets or exceeds industry standards**
- ▶ **Avoids over design and optional requirements** that add cost and complexity



- ▶ A proven mechanism that allows for low cost template replication of the design **reducing engineering work hours and significantly reducing schedule**
- ▶ A commercial model that shares risk and reward and **drives costs down on subsequent pads**

The elimination of much of the owner's costs associated with engineering, procurement, and project management offers significant savings. Allowing us to manage these activities, in particular the interfaces with third parties, significantly reduces the risk of change and cost escalation.

Our design accommodates pad sizes up to 12 well pairs. The design uses a drilling pattern whereby wells are drilled at 10 meter spacing with the production wells and steam injection wells in two parallel rows. Electrical Submersible Pumps provide the mechanical lift for the production wells.

Wood Group Mustang offers our clients a turnkey pre-commissioned well pad using our standard SAGD well pad design and execution.



Inspired is written, edited and produced in house by the Wood Group communications team. Submissions and feedback are welcome and can be sent to: inspired@woodgroup.com