periodical

ISSUE 2 January 2012

Risk, Reliability and Integrity Management

Many of the risk assessment methodologies in use today evolved into their present form in the years following the 1988 Piper Alpha disaster, in which 168 lives were lost. At the same time, regulatory regimes moved from prescriptive to performance based, with the intent that those who create risks should actively manage them rather than following the minimum letter of the law. In parallel with the evolution of the new approaches to safety, there emerged an increasing interest in optimization of facilities and operations in the face of risk and reliability.

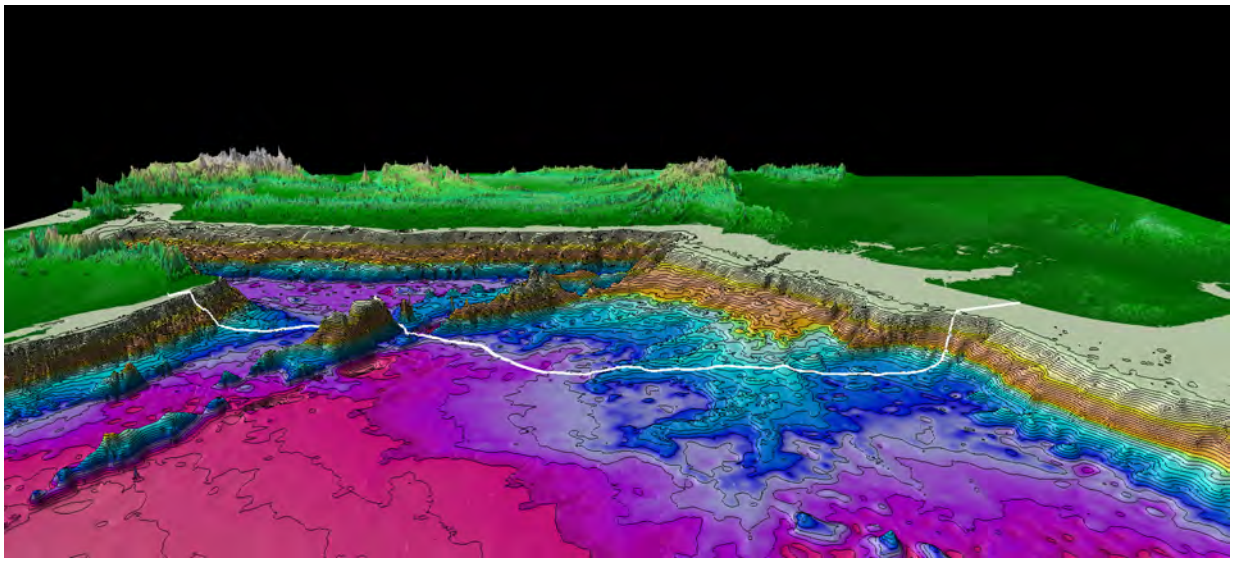
Peritus provides a comprehensive range of services in risk, reliability and integrity management. The overall goal of these services is to obtain the maximum return on infrastructure and equipment, while safeguarding workers, the public, and the environment. To achieve the overall goal, subsidiary objectives typically include selecting the best concept, optimizing the system configuration, optimizing the reliability, availability, and maintainability of equipment, managing mechanical integrity to minimize risks to people, environment, and business, reducing inspection, maintenance, and repair costs, managing ageing equipment, extending facility life, and reusing infrastructure for new developments.

The scope of services is different for every client and is based on discussion or preliminary studies to identify requirements. Many studies involve using several different analytical techniques and the integration of risk, reliability, economics and engineering to help produce optimum outcomes.

Risk Assessment

Quantitative Risk Assessment (QRA) is at the heart of our risk assessment services. QRA is particularly useful when there is a balance to be struck between conflicting objectives and the right solution is not immediately obvious, hence not amenable to qualitative risk assessment. As well as assisting the decision-making process, QRA also demonstrates to third parties that correct decisions have been made. QRA is a general approach and within it, many specialized methodologies have evolved, such as fire and explosion risk analysis, dispersion, toxicity, and smoke ingress analysis, evacuation, escape, rescue analysis amongst many others. Our personnel are experienced in conducting QRA and allied analyses for subsea systems, platforms, floaters, and offshore and onshore pipelines.

An issue in any QRA is how to handle uncertainty. Monte Carlo simulation (MCS) is the traditional technique for incorporating uncertainty into a risk assessment and Peritus personnel have vast experience in developing custom Monte Carlo simulations. MCS requires a probabilistic description of each uncertain variable and of the dependencies between the variables. Often, this quantity of information is not available. In recent years, Peritus personnel have been pioneering the use of Probability Bounds Analysis (PBA) as an alternative to MCS for situations where hardly any data are available. PBA aims to calculate upper and lower bounds on risk rather than precise predictions. The bounds can be calculated without



Geohazards are an important consideration in QRAs for long-distance deepwater pipelines, such as the SAGE Middle East to India Deepwater Gas pipeline.

Peritus

From the CEO

Welcome to a New Year

I'm sure the Christmas and New Year holidays were a welcome respite for all Peritus staff, suppliers and clients. I hope you managed to have an enjoyable break however short it may have been. Our industry continues to prosper despite unsettling clouds looming on the world economic outlook and 2011 was a busy year for many of us at Peritus. At this time of year it is always good to spend quality time with families and friends, to reflect on the year gone and to plan for the New Year ahead. Most of us also promise that this year we will ensure that our work-life balance is better managed; I hope you all manage to achieve that balance.

New Year - New shareholder.

On December 22nd, Clough Engineering sold its shareholding in Peritus to SapuraCrest Petroleum, a Malaysian listed company. This change resulted from Clough's decision to exit the marine business and focus on being an Engineering led EPC Contractor.

Although I will be sorry for losing Clough as a shareholder and thank them for having the vision and commitment to support the launch of Peritus in February 2010, this is an exciting change for us all that will facilitate the next growth step for Peritus and also underpin our presence in Asia.

SapuraCrest is at the same time merging with Kencana Petroleum to become SapuraCrest Kencana Petroleum which will be the largest Malaysian oil & gas service provider and the fifth largest globally.

There will be little change in our business as a result of this shareholder change with Peritus continuing to operate independently offering the same high level consultancy, engineering and project management services to all of our clients.

New Year – New Perth and Houston Offices.

In Perth, Peritus moved into a new office in the Alluvion building. This office was custom designed and fitted out to our specifications and provides a state of the art facility for our staff complete with advanced audio visual and video conference facilities to support our commitment to global engineering. In Houston we have decided to seek new premises better located for our staff and clients so have moved out of our start-up office on North Sam Houston Parkway. As an interim we have relocated to an office at 2100 West Loop South close to Westheimer but will be looking to find more permanent facilities in Q1/2 of 2012.

In February we will celebrate the second anniversary of launching Peritus and despite the many challenges and changes that are part and parcel of starting new companies I am pleased to report that Peritus is well on track to achieving its mission and goals with exciting new projects starting and the ongoing recruitment of key staff to the Peritus family some of which are reported in this edition.

I hope you enjoy reading this edition of **Periodical** and I am looking forward to meeting with as many of you as I can in 2012.

Steve.

New Office

In December Peritus' Perth office relocated to the Alluvion building at 58 Mounts Bay Road. Located within the heart of the Perth CBD and directly linked to St Georges Terrace. Alluvion has been designed to achieve a 4.5 star NABERS Rating and a 4 star Green Star Rating. The key objective for our new office is to provide a working environment for staff which is professional, creative and modern with enhanced facilities and amenities. Currently the office occupies half of Level 7 which will accommodate up to 50 staff, agreements are place for future expansion to the whole floor which has the capability to house over 100 people.

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(Risk, Reliability and Integrity Management cont.)

making any assumption about the dependencies, which will give a safe result, though the bounds may be wider than is optimal. If information on dependencies is available, the dependencies can be modeled to produce narrower bounds. Although the concept of PBA goes back centuries, practical methods for its implementation are only now starting to become available.

Risk-Based Inspection (RBI) studies aim to optimize inspection, maintenance and repair programs. The optimum inspection and defect response strategy minimizes the sum of the statistical failure costs and the inspection/maintenance/repair costs. There are few standardized methods for RBI (API 581 for surface process plant and DnV RP-F116 integrity management of submarine pipeline systems are a notable exception). Typically, Peritus develops RBI models using normal QRA principles, with the RBI model being a QRA model that takes explicit account of the influence of inspection and repair on risks.

Many projects employ team-based study techniques such as Hazard Identification (HAZID), Environmental Issues Identification (ENVID), Hazard and Operability (HAZOP) Study, Safe Operations (SAFOP) Study, Layer of Protection Analysis (LOPA), Safety Integrity Level (SIL) Assessment, Root Cause Analysis (RCA), Enterprise/Project Risk Assessment, and others. Peritus can supply experienced independent facilitators for team-based studies as well as skilled discipline engineers to serve on study teams.

Reliability Assessment

Reliability, Availability and Maintainability (RAM) Analysis predicts the performance of an asset over its life, typically with respect to availability (ratio of uptime to total time) and throughput. The objective of RAM analysis is to identify potential changes to system design or the manner of its operation or maintenance that would optimize its performance and maximize net present value of the project. Peritus uses powerful software for RAM analysis based on Monte Carlo simulation techniques. The software is capable of handling systems containing buffer storage and is infinitely extensible by means of user-defined functions for customized event handling and custom performance metrics.

Failure Modes and Effects Analysis (FMEA) is a qualitative technique for systematically identifying risks in product development, design or manufacturing and hence maximizing reliability of individual components. FMECA is an extension of FMEA to include a criticality analysis. The criticality analysis may be qualitative or quantitative. FMECA was developed in the 1940's by the US military and has been used for military and space projects. Peritus experience is that the objectives of FMECA can be better achieved by a combination of FMEA and fault tree analysis.

Peritus personnel also have experience in structural reliability analysis, using custom Monte Carlo simulation or First Order/Second Order Reliability Methods (FORM/SORM).

Management Systems

Peritus assists clients in developing and implementing their corporate processes for reliability management, technical risk management, and QHSE Management.

The Future

Peritus aims to combine expertise and innovation in risk-based methods to continuously improve and significantly advance assessment and decision-making practices. We would welcome the opportunity to discuss your requirements and help you minimise risk and maximise reliability for your project.

Peter Carr, VP Risk & Integrity Management

APPEA Paper - JOGMEC

In 2010 and 2011, Peritus in Perth led a development study for JOGMEC (Japan Oil, Gas and Metals National Corporation) in to the exploitation of methane hydrates as a potential energy source. This study focussed on a plan for an extended well test in 1,000 metres of water in the Eastern Nankai Trough, offshore Japan.

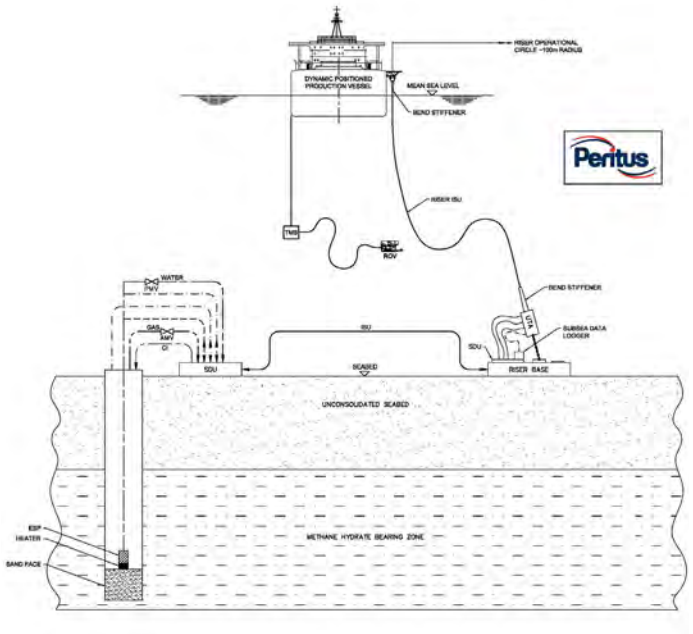
The principle is to drill 300 to 500 metres beneath the sea bed, into unconsolidated sand, containing substantial reserves of methane hydrate (estimates as high as 40 Tcf of methane equivalent).

The Peritus study was focussed on the feasibility of hosting an extended welltest from a dynamically positioned Offshore Support Vessel and producing enough engineering definition, with cost and schedule estimates to allow the client to evaluate this novel approach.

In May 2012, the annual APPEA conference is being held in Adelaide, and Peritus are presenting a paper to explain the study work completed for JOGMEC.

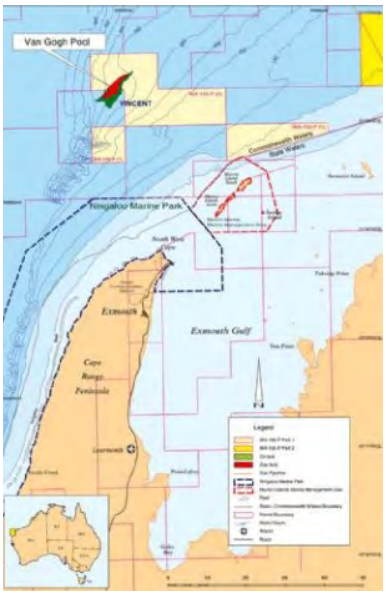
John Ballantyne will present the work in the form of a digital poster, supported by a peer reviewed paper.

We would be pleased to meet you at APPEA and talk about this interesting project.



Peritus Support Apache on Ningaloo Vision Rectification Project

The Van Gogh development and the Ningaloo Vision FPSO are located in the Exmouth Basin offshore North West Australia in water depths of 330m, approximately 65 km north of the township of Exmouth, and 30 km from the boundary of the Ningaloo Marine Park. The development consists of a total of 13 subsea wells including 10 multi-lateral wells tied into two templates, one two-way gas injection/flow back well, and two water injection wells. These subsea wells are tied into the Ningaloo Vision FPSO which was recently purchased from Prosafe Production Services Pte. Ltd. Equity holders in the Van Gogh Field are Apache (52.501%, Operator) and INPEX Alpha, Ltd (47.499%).



Location of the Van Gogh Field

Apache and its JV Partner, INPEX are also developing the nearby Coniston Novara field by using a subsea tie-back to the Ningaloo Vision FPSO. In order to warrant the type of investment associated with the Coniston / Novara project, it is essential that the Ningaloo Vision FPSO is operating reliably, at high uptime, within its original design capacity, for the foreseeable field life.

On this basis Apache will implement a “shipyard” scope of work called the Van Gogh Upgrade Project to gain better assurance regarding issues of reliability, maintenance and processing of Coniston/Novara fluids.

Since April 2011 Peritus have been supporting Apache in root cause analysis of production shortfalls, formulating the scope of the new works, executing preliminary engineering studies and developing execution strategies and plans. The project is now in the execution phase and Peritus are providing experienced personnel to support the Apache project team in key project engineering and management roles.

Ningaloo Vision FPSO

Steve Sinclair is leading this work on behalf of Peritus.

Peritus is very pleased to be supporting Apache and Inpex in this work and look forward to working with Apache and its contractors to make this a successful and safe project.

Peritus Support Apache on Balnaves FPSO and Subsea Development

The Balnaves oil field, operated by Apache Energy, is located in the Northern Carnarvon Basin, offshore Western Australia, and lies in 140m of water with reserves estimated to 17 million barrels of oil and 30 billion cubic feet of gas.

The field will be developed using the Armada Claire FPSO (formally known as Griffin Venture), owned by Bumi Armada, with production capability of 80,000 barrels of oil and 50 MMcm/d of natural gas and a storage capacity for 750,000 barrels. The development includes two production wells, one water injection well to maintain reservoir pressure and one gas lift/injection well to re-inject the gas into another reservoir to be produced later through the Wheatstone LNG project. The wells will be tied back from a single drill centre to the floating facility via four flexible flowlines/risers and one electro-hydraulic umbilical. First oil is scheduled for Q1 2014.

Since 2010, Peritus has been involved in the Balnaves project through the pre-FEED and FEED studies providing engineering support to Apache Energy. During the project execution phase, the Peritus’ involvement includes engineering services related to the procurement of flexible flowlines/risers and umbilical as well as the delivery of the FPSO, disconnectable turret (RTM type) and mooring system.

Peritus is very pleased Apache Energy utilises our expertise for the various phases of the field development.

Peritus Secure BHPB Macedon Support

In September 2011 Peritus were awarded a contract to provide subsea engineering support services to BHP Billiton during the execution of the Macedon Gas Field project. The contract duration will be upwards of 12 months and requires Peritus to review design and installation deliverables prepared under the McDermott EPCI on behalf of BHP Billiton. An option exists for Peritus to provide support during the fabrication phase of the project.

The Macedon project involves four offshore production wells supplying a wet gas pipeline to an onshore gas treatment plant to be constructed at Ashburton North, 17 kilometres south west of Onslow. The domestic gas plant will have a design capacity of 200 million standard cubic feet per day. A sales gas pipeline will be connected to the Dampier to Bunbury Natural Gas Pipeline for sale to the domestic gas market in Western Australia. The four production wells are located in water depths between 160m and 180m. The wells will convey wet gas to an onshore gas plant via a 75km long offshore pipeline and a 15km long onshore pipeline. The field will be served by an 100km long umbilical traversing the same route as the pipeline. Infield there will be a manifold, an ILS (in-line sled), PLETs, SCMs and SUTAs all interconnected to the wells by flexible flowlines, rigid tie-in spools and various types of flying leads. BHPB is the operator (71.43%) and Apache have a 28.57% non operating interest.

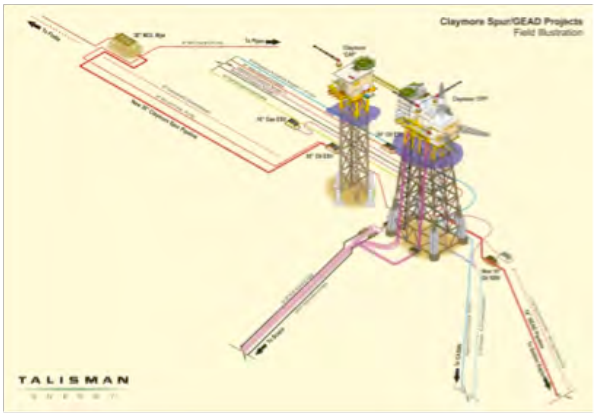
The Peritus scope of work will primarily comprise the review of the design and analysis of the manifold, PLETs, ILS and rigid tie-in spools design together with review of transportation and installation analysis associated with these structures and the umbilical and flexible flowlines . One of the major challenges of this project will be the transportation, trans-spooling and installation of the integrated steel tube umbilical system . To this end a 2000Te and a 500Te carousel will be required to transport the umbilical from Rosyth in the UK to Batam in Indonesia where it will be transhipped to McDermott's installation vessel NO102. The 2000Te and 500Te carousels will be designed by McDermott and are part of the review scope. These carousels will also transport several flexible flowlines associated with the project

Scott Sneddon is leading this work on behalf of Peritus. Peritus is very pleased to be awarded this work and look forward to working with BHPB and its contractors to make this a successful and safe project.

INGL

The UK office has signed an agreement with Israeli Natural Gas Lines to provide them with Offshore Engineering Support. The first project with INGL is the Rock dumping of a 28" gas pipeline primarily for span reduction. The company Van Oord will be dumping approximately 100,000 tonnes of rock along the pipeline and the role of Peritus starts with us reviewing the Van Oord documentation as well as site visits and inspections. This will culminate with Peritus providing personnel on board the rock dumping vessel for the duration of the work.

We are also assisting INGL with other aspects of the projects such as the design of armour protection for cables which fall within the rock dumping area.



Talisman Claymore

The UK office is currently performing the FEED design of a 4.5km 30" Oil Pipeline located approximately 100km north of Aberdeen, Scotland. The project has some challenging areas due to the very high water cut and CO_2 within the pipeline, providing a number of issues associated with internal corrosion. Peritus has been awarded an additional study to review Dual Bore Pigging.

Dual Bore Pigging Study

Peritus have been awarded a study for Nexen (via Talisman) to determine the feasibility of installing a subsea unequal wye and performing pigging of the smaller diameter pipeline (14") into the larger diameter pipeline (30") via an unequal wye. The scheme will involve launching a pig in the 30" pipeline which pushes or bulldozes the smaller diameter pig through the 30" pipeline to the onshore reception facility. The scope includes identifying potential pigs, the wye structure configuration and specifying any proving trial requirements, together with the schedule and costs to prove the system.

Staff Profiles

Jeremy Gordonnat

Previously based in Singapore, I had the opportunity, through business trips, to appreciate Perth is a beautiful place and perfect for family-orientated life.

Open to new professional opportunities, I came across Peritus and was immediately attracted by the high level of expertise offered to the oil and gas industry. During my interview, I felt the dynamic inherent to a new organisation and it became obvious to me that I wanted to be part of this team and participate in building the engineering capability. I therefore decided to live this Australian experience with my pregnant wife and my 2-year-old son.

As expected in that kind of relocation, the first couple of months were a race to get everything sorted out but went as smooth as possible helped by the advice and kindness of the Peritus people. We were amazed by the natural beauty of this region, the majesty of the Swan River and the exceptional blue sky. A few months later, my daughter, Elisa, was born on a 42-degree summer day!

Meanwhile, I was involved with a conceptual design for JOGMEC, a very interesting study and different in many aspects from the projects I used to work on. I am presently seconded to Apache's premises for the Balnaves development, allowing me to gain experience with an operator.

Ryan O'Kelley

Joining Peritus International has been a life changing decision that has opened an entirely new set of opportunities for me and my wife.

I was drawn to Peritus because of its commitment to establish itself as an industry leader through high end engineering services and employee development. I was initially recruited by Peritus through contacts in the Houston office, but I also explored available options with the group in Perth. Peritus was helpful in discussing my career goals and supportive of me choosing the avenue which I felt best suited me and my family. The prospect to join a burgeoning pipeline systems team in Perth and help progress the department was an exciting challenge which I found particularly intriguing. In addition, the unique and specific pipeline design challenges associated with the Australian region offered immense potential for professional growth which I greatly valued. Although moving to Australia meant leaving behind friends and family back in Texas, the chance to experience this side of the world was something I could not pass up.

Once I accepted my position with Peritus, I was faced with the realisation that I would be packing up my life in Texas and starting anew in Australia. This daunting task was further complicated by the fact that, at the time, my wife and I were in the midst of planning our wedding. The support I received from Peritus made the relocation process as smooth and stress free as possible. The specialists and coordinators provided to me were easily worth their weight in gold, and allowed me to focus on more pressing issues like where to go for my bachelor party!

I have now been with Peritus for 8 months, and I am surprised how much I have learned and grown in that short a period. The diverse backgrounds of the employees and multidisciplinary collaboration promote creative thinking and drive innovation within the company. I am excited to be a part of the team and I look forward to helping with Peritus' continued success.

Welcome Aboard

Andrew Millar

Peritus welcomes Andrew Millar as the new Regional Manager and Global Lead for the Subsea Systems Group. Andrew has thirty years experience in offshore oil and gas specialising in subsea controls and subsea systems design and includes experience with subsea vendors, design consultancies and operators. He has played key roles in several developments in offshore NW Australia including concept definition, FEED design and delivery and commissioning of subsea systems. Andrew brings an innovative approach to subsea engineering, having successfully managed the implementation of novel technologies and techniques.

Malcolm Reeson

Malcolm Reeson joins the Perth team as Senior Technical Consultant, within Field Development. His experience includes working for a wide variety of clients in many countries including Australia, Norway, UK, China, Trinidad, Canada and the USA. His key skills include Field development planning and Front-end projects and opportunity evaluation including alternative identification and evaluation, concept selection, contracting strategy and strategic planning; Project and Engineering Management. Malcolm has specialist technical knowledge of deepwater development technologies.

Nigel Watson

Peritus APAC welcomes Nigel Watson to the Perth Office as a Senior Engineer in the Floating Systems Group. Nigel has over 16 years experience with vessel and floating structure hydrodynamics. His experience includes design of ships, hull stabilisers, gyroscopic platform stabilisation and associated hydraulics, structural and mechanical design. He is also familiar with model testing, design programs and programming methods extending to met-ocean data and its application to operational availability of floating systems through statistical methods. Recent activity has involved the analysis of FPSO vessels and riser turret spread-mooring systems in Orcaflex. Nigel holds a BEng (Hons) in Naval Architecture and a PhD in Engineering.

Michael Putrino

Peritus APAC are very pleased to welcome Michael Putrino to the Perth team. Michael brings to Peritus over 6 years of post graduate flow assurance experience in offshore environments in intermediate and deep water. He has an excellent understanding of thermal hydraulics, and fluid and phase behaviour, with technical skills in the areas of modelling steady state and transient multiphase hydrocarbon systems (gas, condensate, heavy oils) between the reservoir and processing facilities. Michael has a good understanding of remedial and prevention measures dealing with hydrates, wax, and wellbore / flowline / riser hydraulic stability. Michael's flow simulation software experience includes programs such as OLGA and PIPESIM, with experience in fluid characterisation of waxy and complex fluids for transient modelling.

Jamie McLellan

Peritus AMER are thrilled to introduce Jamie McLellan as a new addition to the Houston team. Jamie joins as a Senior Engineering Specialist in the Marine Risers Group. She has over 5 years of experience in the oil and gas industry. Her experience includes riser analysis and design of mooring lines for semisubmersibles and FPSOs, geotechnical design of suction anchors as well as mooring integrity. Jamie graduated from Texas A&M University with a BS in Civil Engineering specializing in Ocean Engineering.

Ennio Morgante

Peritus EAME welcomes Ennio Morgante to their team. Ennio has over 25 years experience in engineering design and project management of onshore and offshore pipelines for oil and gas. Experience ranges from feasibility studies and cost estimates, FEED level work, to detailed design and construction support for both onshore and offshore pipelines. Specific capabilities include project management and engineering supervision, and mechanical design including stability, spanning, bottom roughness, buckling, fatigue, subsea tie-ins, and shallow water pipelines and shore approaches. Ennio holds a BSc in Mechanical Engineering from the University of the Witwatersrand.

Dr. Tzi Piau Cheong

Peritus EAME are pleased to announce that Dr Tzi Piau Cheong has joined the UK team. Piau is a Finite Element analyst with 10 years experience in both research and engineering practice specialising in advanced numerical analysis of soil-structure interaction using both 2-D and 3-D finite element and finite difference methods. Piau specialises in geotechnical engineering and lately in offshore engineering focusing in subsea pipeline design for oil and gas. Piau holds a PhD degree in geotechnical engineering from the University of Cambridge.

Events and Activities

On Tuesday 25th October, 12 staff from **Peritus' Perth office set sail** on two Foundation 36 yachts on the beautiful Swan River. With the team split into two, each member was given an onboard task. Following a safety briefing we set sail - noting that one yacht was a little top heavy with two seasoned sailors (no prizes for guessing who).

The race was on with the experienced yacht reigning supreme for most of the course, however with slight confusion as to the last mark, the underdogs took the opportunity to take the lead and gallantly sailed to victory. Prizes of premium wine were awarded and a gourmet bbq provided on the lawns of the Royal Perth Yacht club overlooking the Swan River and the Perth sky line. Partners and family were also invited to enjoy the bbq and an enjoyable time was had by all.

The Peritus Social Club hosted its inaugural event on November 3rd by organising a **beer brewing** bonanza open to all staff. The event included two separate trips to the Billabong Brewery to brew and bottle our very own beer.

After extensive debate and deliberation, the group agreed on brewing imitations of Corona and New Castle Brown. The first trip to the brewery was spent carefully measuring and mixing ingredients to recreate the designated recipes. Two weeks later the beer was ready for bottling and the group returned to reap their rewards. The group established an assembly line, complete with a QA station, to streamline the bottling process. In the end the beer brewing event was a fantastic success, sending home each participant with a sizable bounty of cold beers to be enjoyed with friends and family.

The month preceding December shall forever be known as **Movember**. That is the time when men of all ages throw off the shackles of convention and grow moustaches in aid of men's health charities including the Prostrate Cancer Foundation of Australia and Beyondblue: the national depression initiative. Peritus put a team in who went by the name Jean Has a Long Moustache comprising Scott Sneddon, John Ballantyne and Henry Sheil. Incidentally the team name was code used by the allies during World War II to communicate messages to the French resistance. Having endured a month of discomfort, wary glances and general mocking the team managed to accrue the grand total $1120 for worthy causes, $210 of which was donated from the Peritus morning tea collection.

The APAC office held its **Christmas party** in the Swan Valley with a round of Supa Golf followed by a delicious dinner at the Mash Brewery. The staff donned their tackiest shirts and took to the links for a fun filled afternoon. Prizes were awarded for the best and worst golfers as well as the most awesomely bad shirt. After drinks at the 19th hole, spouses arrived for dinner and everyone was treated to a quiz night, overseen by John Ballantyne, and a Secret Santa, starring Steve Rivers. The party marked a fitting end to another successful year at Peritus.

Message to Clients

Showcase your company here!

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