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PRESIDENTBROWSE  
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PROJECTARCTIC  
NEWSOTC AND  
AOG

## WEST DELTA DEEP MARINE - 12 YEARS AND COUNTING

by David A. Smith and Jeremy Robson-Brown

INTECSEA's commitment to client satisfaction and technical excellence is personified by its longtime association with Burullus Gas Company and the West Delta Deep Marine (WDDM) development. Burullus is a joint venture company and developers of Egypt's first deepwater development in the Mediterranean Sea.

In 1999, the original joint venture company, comprised of BG Egypt, Egyptian General Petroleum Company (EGPC) and Edison Gas (who subsequently sold its share to Petronas Carigali), chose INTEC Engineering to undertake a FEED study for the WDDM prospect. The biggest challenges the project faced were the lack of deepwater development experience in the region and the lack of infrastructure required for such a development. In addition, WDDM also would be a pioneer with a 90 km tieback from its initial Scarab/Saffron field, one of the longest tie-backs at the time.

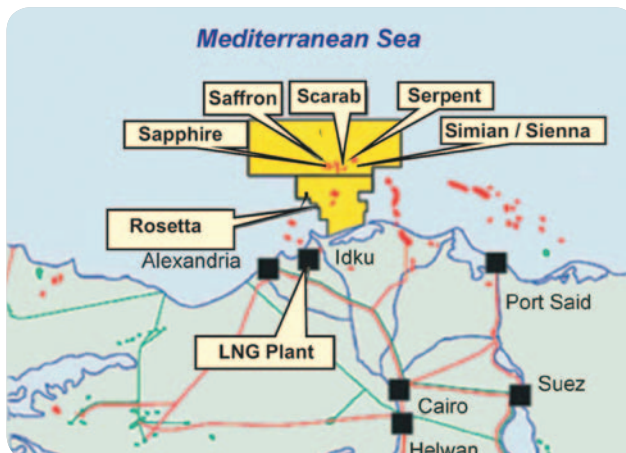
Since those early days, INTECSEA has continually worked alongside Burullus Gas through nine phases of field development and expansion. The initial eight wells in the development have grown to a committed 50 wells today with the possible expansion of more than 20-plus wells in the future. Tiebacks have been extended to 105 km and drilling has been extended from 300 meters to 1,024 meters water depth.

INTECSEA has been responsible for the conceptual design, Front End Engineering Design (FEED) and the Technical Assurance for all phases of the WDDM development to date, and is currently supplying

a Technical Assurance support team to Burullus on the latest Phase VIII development. Package Management for the subsea controls equipment and subsea trees purchase orders also is within INTECSEA's scope of work.

Natural gas from the first phase of the development was to be dedicated to existing shore reception facilities for the domestic market in Egypt. However, INTECSEA designed the core infrastructure of the main transmission pipelines from the Pipe Line End Manifold (PLEM) to allow for expansion. This PLEM segregates the gas to an onshore plant which then feeds an ELNG plant at Idku, Egypt, which was completed in 2005. Currently, WDDM produces around 2 billion standard cubic feet of gas per day.

All of the WDDM fields bear "S" names with the Scarab/Saffron field (Phase I) coming onstream in 2003 followed by Simian/Sienna (Phase II) in early 2005; Sapphire (Phase III) later in 2005, Serpent





## President's Letter

by Uri Nooteboom

When I was a young engineer fresh out of college almost 40 years ago, I had no particular knowledge of or interest in the offshore industry, so I

didn't include it in my job search. Until then my goal had been to design and build aircraft. Given the state of the industry, my initial job searches in that area did not prove overly successful and I widened my search to include the automotive industry. Then, by coincidence I noticed an advertisement from an offshore mooring company looking for structural engineers. The fact that they were located in a warm desirable location cinched the deal. I had just committed myself to a long career in the offshore industry.

In those early days the offshore industry was not very mature yet. Tools were rather primitive; systems, processes, regulatory requirements, codes and standards were still being developed, often on the back of projects. This was the era when relatively small groups of pioneers developed the plans for the first Floating Production Facility, Subsea Production System, and FPSO. Without guidelines, strict rules, and adequate tools many of these endeavors could be characterized as "flying by the seat of their pants" engineering.

As a young engineer it was exciting and also empowering to grow up in this small team environment, unconstrained by rules and handed too much responsibility. It also put me in over my head on quite a few occasions when I lacked the required knowledge and without anybody to bail me out. Looking back, I was given way too much rope to hang myself; luckily I managed to avoid too many mistakes. Safety factors and a level of ignorance allowed me to sleep at night.

I was fortunate to get involved in one of the first FPSO projects. In those days much, if not most of the specific knowledge in regard to material selection and testing, offshore design codes, equipment development and qualification, etc. resided with the major operators. The fact that this project was a first of a kind prompted heavy client participation and they shared their knowledge freely; actually they insisted on it. After two years on this project I had gained five years of experience and was no longer a green engineer.

Times have changed. For one, our projects have become far more complex and capital intensive and require much larger project teams to implement. We have quality management programs, systems and processes, checks and balances to avoid expensive mistakes. We have

rigorous quality norms to link job functions with experience and grade level. We have also a serious shortage of capable and qualified people.

Over the last 40 years of experiencing several booms and busts, the oil and gas industry has not been a good shepherd of its human capital. Many talented individuals have left the industry and it has become a less attractive career path for engineering graduates. Replenishment of our talent and retaining them is one of the most pressing issues in our industry in the years to come. But, this creates somewhat of a dilemma...how do we train these people and make them productive offshore engineers before we lose the experienced mentors and coaches to retirement?

Training is one of the most important considerations for job satisfaction to our new generation of engineers. Some of this is a natural reaction to the limited availability, either real or perceived, of training opportunities. On the job training is still the only proven method to gain experience in our industry. Our young engineers don't need more classroom training; they need projects. The unfortunate fact is that the project environment is often inhospitable to young engineers; too often they are seen as not providing value, either by our clients or by our own project managers who don't want this unnecessary burden.

We can't afford to let these people leave our industry for want of training opportunities. Nurturing young talent is a mutual industry responsibility and we must join forces across corporate boundaries to accomplish this. Young talent development should be one of the key success factors on every project for all stakeholders, clients as well as service providers. Project stakeholders regardless of company affiliation must provide the mentorship and coaching for these young engineers.

I have no illusion the industry will reach consensus on such an initiative overnight. Nevertheless, if we do this right and share the responsibility we will be rewarded with a new generation of engineers trained by the best in the industry. Not only will they be ready to take on the type of challenges we were faced with in our earlier careers; they will be better equipped to do so.

That should allow us all to sleep a lot better at night.

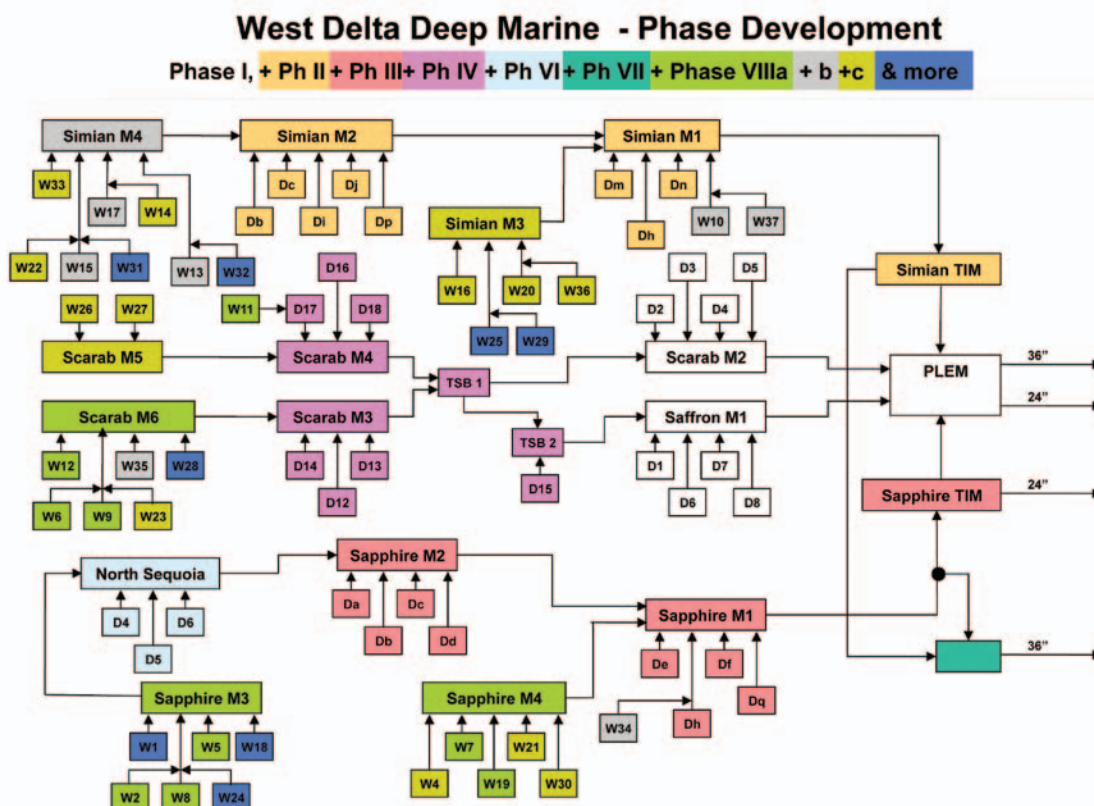
(Phase IV) in 2008, expansion of Scarab/Saffron (Phase IV) also in 2008, and North Sequoia (Phase VI) in 2009. With investment in compression facilities during Phase V along with additional pipeline capacity and compression capacity during Phase VII, the continued development of WDDM will allow development of additional reserves. Phase VIIIa is in the detailed design and fabrication stage and is due to be onstream by 4Q 2011. Phase VIIIb has completed its FEED stage and the EPIC was awarded in May 2011.

Meanwhile, INTECSEA has just finalized the WDDM Phase IX Concept Study for BG which examined the feasibility of expanding the facilities by more than 20 wells. INTECSEA personnel David A. Smith and Jeremy Robson Brown have been involved with the WDDM project since 1999. Smith, an original INTEC employee, has been involved with since Phase II and has shepherded the WDDM control system. Robson Brown, who previously was employed by Cameron, joined the INTEC team in 2006 and has managed the Technical Assurance of the WDDM expansion from Phase V onwards.

While the overall system design generally used proven technology, there were several challenges associated with the development of the systems and the required instrumentation including avoidance of hydrates, control of chemical injection, gas rate measurement and sand detection. Wherever possible, diverless subsea technology was employed.

The subsea control system had to overcome several technical challenges, including long distance step-outs, mono-ethylene glycol (MEG) injection delivery network, gas and condensate monitoring, sand detection and interfaces to multiple control system vendors. Developments in communication technology showed that a copper cable-based system was feasible, but due to lack of proven installations subsea and the benefit of increased local content, a dedicated, unmanned controls platform was installed 60 km from shore during the Phase II and III FEED, thus facilitating communications. This approach increased the complexity, particularly with respect to a shore-to-platform link.

INTECSEA is proud to be a part of this successful long-term regional development and of its long-term relationship with Burullus.





# Browse LNG Project - Challenges and Solutions

by Alaa Mansour, Ph.D., Marine Engineering Manager

# ENGINEER

The Browse Gas fields are located offshore Western Australia in the Browse Basin, approximately 440km north-northwest of Broome. The Upstream LNG Development consists of a number of deepwater production facilities including a Central Processing Facility (CPF) in 100m water depth and two Tension Leg Platforms in 600m water depth, which process the gas and condensate prior to sending to CPF and the onshore processing facility.

INTECSEA has been playing a key role in supporting the development of the Browse LNG deepwater offshore facilities, from the concept select phase to the current FEED phase of the project.

Leveraging on INTECSEA's reputation as a leading international Concept-Neutral Floating Systems company, Woodside contracted INTECSEA in 2006 to screen for the most effective deepwater development solution.

The screening study included studying Tension Leg Platform (TLPs),

Semisubmersibles, Floating Production Storage Offloading (FPSO) and LNG Barge concepts.

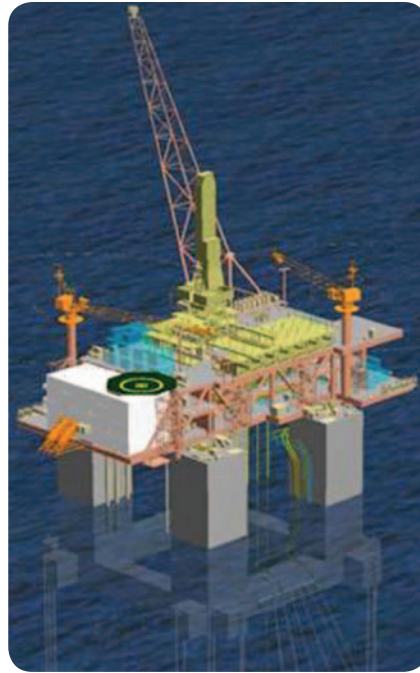
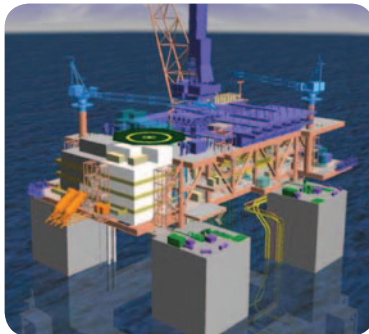
The key objectives of this study were to identify issues related to motion,

air-gap and mooring

design which may impact the viability of a given concept.

The study also identified the appropriate riser concepts especially for the export risers where export Steel Cantenary Risers (SCRs) and export Top Tensioned Riser options are considered. The study illustrated the challenges associated with each riser solution.

Later in 2008 and 2009, Woodside sought INTECSEA help through its parent company, WorleyParsons, Group to assist in further defining the deepwater solution. This evaluation included the TLP concept, semisubmersible and Deep Draft Caisson Vessel (DDCV) concept in more detail. This study also included identification of the required qualification to deliver a challenging SCR export risers solution.



INTECSEA work over the years has played a significant part in helping Woodside conclude that the most appropriate deepwater development concept solution is a Tension Leg Platform with SCRs.

In 2010 INTECSEA continued to support the Woodside Browse deepwater development by contributing to the development of the project Basis of Design (BoD)

and writing the Floating Structure Standards for Woodside. INTECSEA completed the BoD and Engineering Standards in a timely manner and with outstanding quality. This key milestone enabled Woodside to be in a position for FEED entry in early 2011.

Taking into consideration the outstanding technical standards and commitment that INTECSEA has shown over the years, Woodside has just recently selected INTECSEA to be the DTU Owners Engineer during the FEED and Execute phases of the project. Woodside has also selected specialist engineers from INTECSEA to become embedded within the Woodside Deepwater Tension Unit (DTU) team for the Browse Deepwater FEED. This includes several key roles in the Hull, Mooring and Riser fields as well as interface management and quality assurance positions.

The Browse TLP will be the first in northwest Australia and will also be the first Not Normally Manned floater worldwide. The export SCR will be a world first of this diameter in this water depth with clad pipe. The exciting challenges of this world class LNG development are such that the Browse project receives the full commitment, interest and support of INTECSEA management and employees. INTECSEA has been associated with several of the most successful world-first projects and is fully committed to support Browse as a world Class LNG project, helping to ensure that it achieves its first gas milestone in 2017.



During the week of March 14, 2011, the worldwide Oil and Gas industry descended on the International Conference and Exhibition Centre, Accra, Ghana for the 'Offshore West Africa 2011' Conference, which

was hosted by GNPC. Eighty percent of the 1100+ attendees came from the region, demonstrating the importance given to the rapidly growing interest and investment in Angola, Nigeria, Ghana and other countries in the region.

During the proceedings, Phil Cooper, Operations Director of INTECSEA Woking presented a paper entitled "Minifold - A New Concept for Flowline-Attached Production Manifolds" which was well-received and generated considerable interest.

Taking advantage of the timing and availability of some key E&P and local VIPs being in town, the official launch ceremony and celebration of WorleyParsons Atlantic and the Accra-based INTECSEA office was held in The Palm Hotel. Guests senior Ghanaian government officials, members of the official opposition, members of the international diplomatic corps and national and international operators and suppliers.

The formal speakers included David Blacoe, Augustine Felli, MD of WPA and Rick Clark, INTECSEA's in-country manager. These were followed by the launch of the WorleyParsons logo and presentations. A well-known local song and dance troupe treated the guests to a highly entertaining dance and music performance.

Early in the development of its local office launch, INTECSEA decided to devote some of its energies and charity efforts in contributing to a really worthwhile Ghanaian charity. With guidance from Augustine Felli, it was decided to 'adopt'

the local Children's Hospital. Claire Dockley, Woking's HR Manager, who had also been instrumental in helping set up the INTECSEA presence in Accra, took on this very worthwhile and challenging task.

The UK office had already planned to hold a 'Comic Relief' fundraising day which tied in with the Ghana office opening. As Comic Relief is Africa based Claire was given the opportunity to visit the Princess Marie Louise Children's Hospital. The visit proved a real shock when comparing to the norm found in Europe and the U.S. The hospital is a Victorian building, and has had no work or updates carried out for years. There is one incubator, minimal food or water and very basic conditions. For example, one ward has no toilet facilities whatsoever. Some wards were too upsetting for words. Mothers were expected to sleep on stone floors next to their babies' cots.

Father Campbell, a priest originally from Dublin is head of the hospital and along with Augustine Felli will be closely consulted on INTECSEA future involvement and objectives. Since the visit, the UK office after hearing the presentation and seeing the visit photos, has raised a considerable sum of money. INTECSEA hopes to continue its efforts alongside the growth of the Accra office to benefit both Ghana's oil and gas developments and its citizens.



INTECSEA's UK office has been particularly well publicized over the past year with a number of papers presented at global conferences such as OTC, OMAE and DOT. The following is the abstract of one such paper, presented in China.

## **Deepwater Rigid Spools Slugging Flow Fatigue**

**Design,** Tao Zhao, Philip Cooper, Joost Brugmans (INTECSEA Delft), OMAE 2010, Shanghai.

Tie-in spools form an important part of any deepwater flowline system. Successful designs have the potential to deliver significant savings in fabrication, transportation and installation costs, whilst protecting project schedules. For multiphase flowlines, slug-induced fatigue damage has emerged as a governing design criterion in recent projects. Spans have become the focus of attention for slug-induced fatigue damage. These may occur at tie-in spools used to connect flowlines in deepwater developments.

Conventional piping design software tools are commonly used for rigid spools design. Limitations/disadvantages of conventional tools were identified by comparison with detailed simulation of critical aspects of the design using more advanced numerical simulation tools. Rigorous 3D numerical dynamic analysis was used to simulate gravity variation of the slugs and bubbles, and the dynamic impact effect

due to the passage of slugs through bends. Resonance effects of spools exposed to slugging flow were inspected and the cause of spools resonance was investigated. The consequential fatigue damage was computed using a time-domain FEA and rainflow counting algorithm. While conducting slugging flow fatigue FEA, bespoke pipe-soil interaction models were developed to simulate cyclic lateral and vertical resistances of the very soft seabed soils typically found in deepwater fields. A contact technique with nonlinear normal and decoupled bi-axial tangential interactions was implemented using FORTRAN subroutines.

The analysis procedures developed are outlined, and typical spool designs are presented. The paper seeks to understand the slugging flow effects to the deepwater spools fatigue design, especially while the spools resonance cannot be mitigated, and provide the optimized spool configuration in which the slugging effects are minimized, taking due account of the complexities outlined above.

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The following is a complete list of papers produced and published by the UK office over the past year.

**Increase Allowable Sagbend Pipe Strain Limits for J-lay Pipeline Installation,** Erwan Karjadi (HMC), Alastair Walker, Sherif El-Gebaly, OPT 2010, Amsterdam

**Test on CRA Lined Pipe for use in High Temperature Flowlines,** Alastair Walker, Paul Montague (Cladtek), Duncan Wilmot (Cladtek), OPT 2010, Amsterdam

**Predicting Consolidation Settlement in Very Soft Clay: Comparison of Conventional 1-D Theory and 3-D Numerical Simulation,** Dan Lee, Shulong Liu, Philip Cooper, Ian Nash, Nigel Evans, OTC 2010, Houston

**Application of Finite Element Analysis in the Prediction of Consolidation Settlement of Foundation Structure on Highly Voided Soil,** Dan Lee, Shulong Liu, Philip Cooper, Ian Nash, Rob van den Heuvel (INTECSEA Delft), ISOPE 2010, Beijing

## **Simplified Methodology for Fracture Integrity of Cold**

**Formed Pipe-in-Pipe Systems,** Andrew Low, Simon A Don, Iain C MacKellar, Dan Lee, Henryk Pisarski (TWI), Simon Dugat (ITP Interpipe), Christian Geertsen (ITP Interpipe), Elgar D Kleijne (HMC), ISOPE 2010, Beijing

**Bending Capacity of Pipe Bends in Deepwater Conditions,** Shulong Liu, Alastair Walker, Philip Cooper, OMAE 2010, Shanghai

**Simulation Driven Design for Offshore Oil and Gas Field Developments,** Dan Lee, Sherif El-Gebaly, Jianwu Wei, NAFEMS 2010, Oxford

## **"Minifold" - A New Concept for Flowline-Attached**

**Production Manifolds,** Philip Cooper, Colin Bickersteth, Roland Ogilve (HMC), DOT 2010, Amsterdam

**Pipeline Strain Concentration During Deepwater Installation and Operational Conditions,** Sherif El-Gebaly, Alastair Walker, Philip Cooper, Dan Lee, DOT 2010, Amsterdam



# Prominent INTECSEA Presence at the Inaugural Arctic Technology Conference

by Duane DeGeer and Mike Paulin

arctic news

The success of the inaugural Arctic Technology Conference (ATC) was clearly evident in Houston on February 7–9, 2011 with over 1,200 participants attending nearly 150 technical presentations and poster sessions, and visiting over 50 exhibits. The ATC, which has been modeled after the perennially successful Offshore Technology Conference (OTC), was launched to showcase the burgeoning Arctic arena and to facilitate networking opportunities amongst key Arctic industry players.

Hydrocarbon development in the Arctic presents numerous technical, social, environmental, and economic challenges, so it is no surprise that INTECSEA's presence at this event was very strong. A primary sponsor of the event, INTECSEA also had an exhibit (shared booth with WorleyParsons), co-chaired one session, and presented the following three papers:

- **Analysis and Solutions for Warm-Up of Insulated Offshore Arctic Pipelines during Winter Construction** by Ben Eisler (INTECSEA) and Mac McKee (INTECSEA)
- **Alaskan Beaufort Sea Pipeline Design, Installation and Operation** by Glenn Lanan (INTECSEA), Todd Cowin (INTECSEA), and David Johnston (ENI Petroleum)
- **Leak Detection Systems and Challenges for Arctic Subsea Pipelines** by Ben Eisler (INTECSEA)

Representing INTECSEA at the conference were Todd Cowin, Duane DeGeer, Ben Eisler, Glenn Lanan, Michelle Lang, Brian McShane, Richard Voight, and Bill Westcott.

In coordination with the ATC conference, INTECSEA also rolled out its latest poster product in the February edition of Offshore Magazine, with a poster entitled:

## 2011 Survey of Arctic & Cold Region Technology for Offshore Field Development

Hard copies of the poster were handed out at the conference. It was very well received and it was clear that all recipients were impressed with the poster contents. The poster, and the significant amount of technical information it contains, will undoubtedly serve as a primary reference for all those involved in Arctic developments. Copies of the poster can be obtained by downloading a copy from <http://www.offshore-mag.com/index/maps-posters.html>, or by emailing a request to [arctic@intecsea.com](mailto:arctic@intecsea.com) (limited quantities). Congratulations to the Poster Team for an excellent product: John Brand, Joe Cocker, Todd Cowin, Duane DeGeer, Benjamin Eisler, Glenn Lanan, Michelle Lang, Mac McKee, Brian McShane, George Osborne, and Mike Paulin of INTECSEA; and E. Kurt Albaugh - Consulting Engineer.

For more information on INTECSEA Arctic and cold region capabilities, please contact Mike Paulin (Operations Director, INTECSEA Canada) at [mike.paulin@intecsea.com](mailto:mike.paulin@intecsea.com) or Duane DeGeer (Manager of Arctic Projects, INTECSEA Houston) at [duane.degeer@intecsea.com](mailto:duane.degeer@intecsea.com).



**EDITORS NOTE:** A map of Greenland was inadvertently included in the last issue under Arctic News. This map had no relevance to our article on INTECSEA's Arctic and Sub-Arctic Region Subsea Technology JIP.

## INTECSEA Intern Contributes to Poster

One of the "Arctic & Cold Region Technology" poster team members was Joe Cocker, a student at Memorial University in St. John's, Newfoundland, who was also an intern at INTECSEA Canada. Joe was a key team member who researched and assembled much of the information provided by other poster team members and other contributors. He worked under the direction of Mike Paulin who made sure that Joe "learned something new every day" as he worked on the poster. In the spring of 2011, one of Joe's engineering classes covered Arctic topics and he felt that the Arctic & Cold Region Technology poster would be a great contribution to his class. Offshore Magazine and INTECSEA donated and shipped 50 posters to Canada for faculty and student use. Joe Cocker spoke briefly on the poster and distributed the poster to his professor and classmates. Great job Joe, many thanks for your help in making the poster a great success.



# INTECSEA Networking - Out and About

## OTC 2011



The 2011 annual Offshore Technology Conference (OTC) left no doubt that it continues to be the premier offshore event of the year. It reached a 29 year high in attendance of 78,150, up 8% from last year, as the offshore

energy experts from around the world came together at the world's largest event for offshore resources development. The conference and exhibition had 2,250 companies from 40 countries, including 306 new exhibitors, and added exhibitors from Egypt, Hong Kong, Indonesia, and the Philippines.

INTECSEA and WorleyParsons worked together seamlessly throughout the week, sharing a booth in the Reliant Center for the fourth year in a row. The shared booth offered a great place

for clients and colleagues to gather and discuss upcoming work and answer technical questions on various projects.

A technical paper was presented on behalf of INTECSEA by H. Kelle, Y.J. Wong, INTECSEA; and J. Schlatt, WorleyParsons, all from Melbourne, Australia entitled "Floating Regasification Terminals: Selections and Marinisation of Regasification Equipment for Offshore Use."

A press release distributed May 2 on the INTECSEA led JIP for Arctic Subsea Processing is garnering great interest. INTECSEA was also featured on the cover of two of the industry's leading publications' OTC editions. Offshore Engineer ran the cover picture and article provided by Glenn Lanan, Todd Cowin, and David Johnston (Eni) for the Bundled Pipeline project in the Beaufort Sea, entitled "Establishing the Beaufort Sea Baseline." Offshore Magazine dedicated most of its April issue/cover to the Jubilee Project in Ghana which included the article "Jubilee deploys flexible subsea system" by INTECSEA's Cody Moffitt and Mac McKee

The 2011 OTC Conference was a huge success and plans are already underway for the 2012 show to be held April 30-May 3.

## AOG EXHIBITION AND CONFERENCE, FEBRUARY 2011, PERTH WESTERN AUSTRALIA *by Tilak Dulam*

The annual Australasian Oil and Gas (AOG) Exhibition and Conference returned to the Perth Convention Exhibition Centre in Australia on 23-25 February 2011 and was a huge success. The entire spectrum of the oil and gas industry was represented including exploration and production technology covering gas processing, pipelines, offshore services, engineering, design and construction. The event provided an extensive marketing platform with more than 450 exhibitors showcasing their latest products and services to over 10,000 local, interstate and overseas visitors.

The exhibition was supported by a comprehensive seminar and conference program covering the topics Subsea Technology, Health and Safety and Flow Assurance. A great number of oil and gas delegates attended the Conference, with leading industry professionals presenting the latest global and Australasian subsea developments in commercial and technical arenas including FLNG, subsea integrity and environmental management, global pipeline buckling, riser technology, geophysics and geohazards.

INTECSEA was well represented at the conference with three papers presented:

- "Assessment of Numerical Modelling of HTHP Pipeline Lateral Buckling with Complex Soil Friction" by Kin Yin Chee and Alastair Walker.
- "Strain Capacity of Lined Pipe Girth Welds for HTHP Flowline Applications" by Philip Cooper, Andrew Low and Simon Don.
- "Advanced Finite Elements Analysis of Pipe-in-Pipe Lateral Buckling in Deepwater Environments" by Shulong Liu, Dan Lee, Philip Cooper and Sherif El-Gebaly.

Contact the authors for more information on these papers.

Kin, Alastair, Philip, Andrew, Simon, Shulong, Dan and Sherif, special thanks for your efforts—and a great many thanks to all the staff members who were involved in making INTECSEA's presence at the expo a great success.

The 2012 AOG International Exhibition and Conference will take place on 22-24 February at Perth, Australia. More information is available at the AOG website:

<http://www.aogexpo.com.au>

*For comments and additional information, please contact Michelle Lang via email: [Michelle.Lang@intecsea.com](mailto:Michelle.Lang@intecsea.com).*

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