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INTECSEA
WorleyParsons Group

THIS ISSUE

FIRST OIL ACHIEVED FOR JUBILEE, OFFSHORE REPUBLIC OF GHANA *by Cody Moffitt and Mac McKee*

The Jubilee field, located in the West Cape Three Points and the Deepwater Tano Blocks, is some 37 miles offshore Ghana. Kosmos Energy, Technical Operator, led an Integrated Project Team (IPT) for the development. The IPT also included key project personnel from partners Anadarko Petroleum Corporation, Tullow Oil and Ghana National Petroleum Corporation.

Tullow, the Unit Operator, has built in-country infrastructure and a production operations organization. The IPT handed over the facility to Tullow just prior to first oil in fall 2010.

When the concept work commenced in early 2008, field data was minimal and up-to-date detailed survey and bathymetry data did not exist. The fast-track nature of the project and this lack of field data blurred the line between concept engineering and Front End Engineering Design (FEED). Despite these challenges, INTECSEA engineers completed the field layouts, design basis document, technical specifications, and bid packages by August of 2008. The design philosophy was robust and flexible enough to incorporate and adapt to evolving parameters as new data became available.

Water depths in the development area range from 900m to 1,700m. The field is bisected by three active channels, with the intervening ridges exhibiting megaripples, near-surface faulting, and other features indicating a geohazard-rich environment. The largest channel, running north-south with a depth of up to 150m and a width of nearly 2km, divides the field and drove the layout to include east and west systems. Each side of the field is tied back to a turret-moored Floating Production, Storage and Offloading vessel (FPSO) located north of the drill centers and situated directly above the main channel.

The current subsea architecture consists of two riser bases, five production manifolds, two water injection manifolds, one gas injection manifold, nine production trees, six water injection trees and two gas injection trees. Additional trees may be added to the development at open manifold slots, if needed. The production manifolds are daisy-chained, with three manifolds on the west side of the development and two on the east side. Water injection manifolds are also in a daisy-chained arrangement on the west side of the field, while the single gas injection manifold is situated on the east side. Production system infield flowlines are looped to allow for round-trip pigging and are rigid, wet-insulated pipe. Gas and water injection infield pipelines are single lines made of rigid, non-insulated pipe.

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President's Letter

by Uri Nooteboom

Keep Dreaming

Many of my (admittedly aging) generation have most likely read several of Jules Verne's books, including From the Earth to the Moon (1865). Jules Verne was ahead of his time and can probably be credited with creating the science fiction genre almost 100 years before Isaac Asimov gave science fiction literary staying power. In From the Earth to the Moon he describes the launch of a manned capsule to the moon and apparently was able to perform some surprisingly reasonable calculations to size the space cannon. His vision and imagination preceded the first space flights by almost a century. When I read the book, man had not yet stepped on the moon.

What is unique about Jules Verne and others of his kind is the ability to not let perceived reality interfere with their imagination and vision. One needs almost a childlike capability for wild imaginations unbridled by the experience of what adults refer to as knowledge. Sometimes that prompts the term dreamer or even fruitcake. When I read From the Earth to the Moon many of his farfetched ideas had already been realized and soon afterwards we would put a man on the moon. Many of my grandparents' generation, however, would have likely dismissed his stories as simply entertaining nonsense.

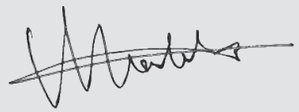
Dreamers like Jules Verne, whether they are novelists, mad scientists or rebels in their own field, serve as a catalyst to our scientific and industrial evolution. We need fantasies, the wilder the better, the "wouldn't it be nice if" type of dreams to stimulate our engineering genius so that somewhere, somehow, we can start making them into reality. One hundred-fifty years ago we had someone with the wild notion to send a man to the moon. We have been there, done that. Our current generation needs different dreams; they need the Steven Spielbergs and Star Trek to paint an imaginary off-the-wall future and a desire to make it reality. Our phenomenal scientific progress has made yesterday's impossible become possible. So we better dream boldly.

And how about our own industry? Offshore oil and gas production didn't start until the 1950s and the first floating production system only arrived on the scene in the 1970s. It is fair to say that our industry has matured immensely in one generation. Some of the original pioneers who have made this possible are still active. Today there is no ocean depth we can't explore and produce from; made possible by tremendous equipment and technology step changes in electrical systems and underwater robots, to name just two. In 50 years our industry has gone from zero to where we are now. Some might wonder if we have reached our target and henceforth technology will no longer need to produce huge step changes but rather incremental refinements.

I believe what we need now is rejuvenation to prevent a false sense of maturity. This requires a new band of "imagineers", off-the-wall thinkers, to challenge us with the "impossible" and ask "why not?" Looking back at history most of our famous visionaries and inventors, Archimedes, Leonardo da Vinci, Christopher Columbus, Galileo, Isaac Newton, Thomas Edison, Albert Einstein, Linus Pauling, just to name a few, were in their 30's and early 40's when they made their discoveries unconstrained by conventional wisdom.

What better opportunity to let our next wave of 40-somethings, 30-somethings and 20-somethings start dreaming up and help realizing our future. And what better use of the "grey haired" generation to help shepherd the introduction of, and transition into, new technologies with an eye towards the lessons learned from the past. Together, our generations have all the right attributes including experience, vision, dreams and fantasies, to propel the industry far beyond its current level of performance and safety.

Personally I think we will be in good hands. No matter how mature we consider our (and for that matter all) current industry, I expect (and hope) that when we look back at it 25 years from now it will look downright archaic. In some ways I am envious of our future generations experiencing what we are just now starting to imagine in our own industry; not to mention of course interstellar travel, warp speed, teleportation, space elevators, instant healing, you name it. Beam me up Scotty!



Jubilee Project Offshore Ghana

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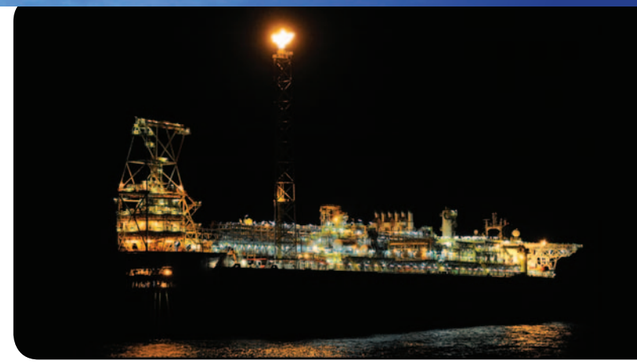
Two riser bases, one on each side of the channel, are each designed to accommodate four production risers and one gas injection riser. Both the east and west side riser bases are currently populated with two production risers and one gas injection riser. The gas injection line on the east side allows for gas disposal into two gas injection wells and provides gas lift to the production risers, as required, through a system of piping and valves interconnecting the production and gas headers. Since the west side of the development does not currently include any gas injection wells, the gas injection riser on the west side provides only gas lift functionality.

The nine risers are all flexible and are configured as pliant waves to avoid touchdown in the active channel and to provide lateral stability. Along with the four production risers and two gas injection / lift risers routed to the riser bases, the development includes two water injection risers terminating at a double-hub pipeline end termination (PLET), as well as a gas export riser which rests on a temporary subsea parking frame until such time as a gas export pipeline is installed. Two electro-hydraulic, multiplexed (EH-MUX) umbilicals are also hung from the FPSO turret, with one routed to each side of the field. These umbilicals communicate with and supply power, control fluid, and chemicals to the subsea hardware.

With the fast track nature of the project, the IPT decided early on that standard products and equipment would be chosen and utilized to the maximum extent possible for the Jubilee Project. Horizontal trees and standard four-slot manifolds were selected, along with standard controls packages for both the trees and manifolds. In addition, the riser base design incorporates all field-proven technology, inclusive of chokes to regulate the gas flow into the production lines. In an effort to expedite delivery of the subsea structures, the IPT selected to procure valves and connectors and free issue those items to the fabricators of the manifolds, riser bases, and PLETs. This approach allowed for the best opportunity for success and on-time delivery of equipment to support the ambitious schedule.



INTECSEA engineers participated in the technical reviews of bids for installation and for supply of valves, connectors, and flexible risers. Following contract awards, INTECSEA's owner's engineering services transitioned from FEED to package engineering for the risers and other major equipment packages, such as manifolds and riser bases. Along with this package engineering, the INTECSEA team completed detailed design engineering, following from optimization of the overall field layout and from flow assurance and operability analysis.

As equipment was delivered and installation activities commenced, INTECSEA supported the installation and commissioning with personnel and engineering services. Personnel were embedded in the installation team, supporting and reviewing engineering that was being developed by the installation contractor. In addition, INTECSEA personnel participated in the offshore campaign during the installation of flowlines, PLETs, and manifolds.

INTECSEA assisted with commissioning and start-up of the subsea system by developing the procedures for these activities. Personnel were then dispatched to Ghana to support the work. With first oil achieved late November 2010, INTECSEA continues to support commissioning and start-up operations for the remaining wells in the field.

While this project proved to be quite challenging, with the aggressive schedule, minimal data at the onset of the project, and an active subsea environment, the entire project team worked as a cohesive unit toward a common goal. With first oil for Jubilee, INTECSEA and the entire IPT have pushed the boundaries of the fast-track project, all the way from concept through to production.

The Jasmine Field Development

by Stuart Black

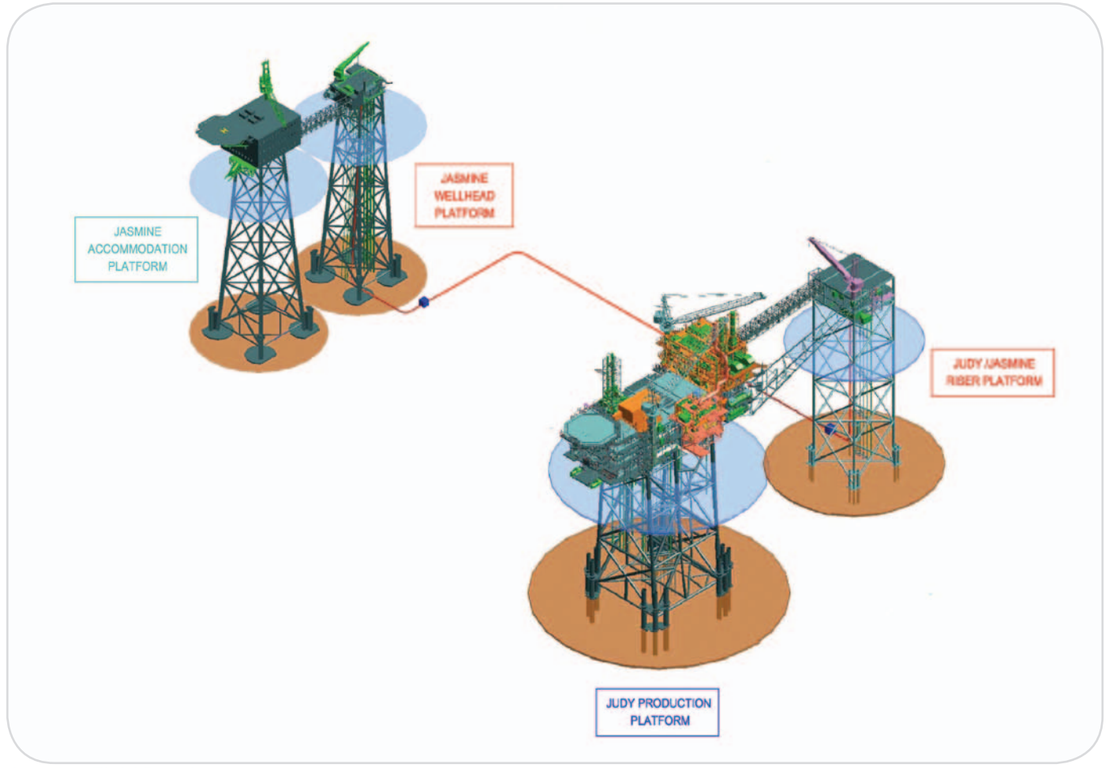
In early 2009 WorleyParsons Europe started work on the ConocoPhillips Jasmine Field Development. Initially awarded the Pre-FEED scope, with options for FEED and detailed design, the project is now well into the detailed design phase with planned work continuing into 2011 and construction support into 2012.

The Jasmine field is located in about 80m of water in blocks 30/6 and 30/7a in the UK sector of the Central North Sea, about 240km southeast of Aberdeen, in the ConocoPhillips operated J-Block Area. The J-Block Area currently comprises three fields: Judy, Joanne and Jade. The Judy Platform currently serves as a hub for petroleum operations from production wells situated on the Judy Platform, fluids from the Joanne subsea manifold and fluids from the Jade normally-unmanned Wellhead Platform.

The Jasmine Development comprises the following:

- New Jasmine Wellhead Platform (JWHP)
- New Jasmine Accommodation and Utility Platform (JLQ), bridge linked to the Jasmine Wellhead Platform (JWHP)
- New Judy Riser and Separation Platform with additional Judy well slots (JRP), bridge linked to the existing Judy Platform
- New 16-inch Multiphase pipeline from Jasmine Wellhead Platform to the Judy Riser Platform

The Jasmine development will utilize the existing processing capacity on the Judy Platform.



Jasmine Field Development

JWHP Riser Pipe-in-Pipe Bends

JWHP Riser Pipe-in-Pipe Bulkheads

Jasmine Field Layout

The scope of work has been divided up between various WorleyParsons entities, with the London office performing the overall project management and topsides/process design work. The steel jackets are being designed by WorleyParsons Ranhill in Kuala Lumpur and the subsea pipeline, risers and flow assurance work by the INTECSEA UK office.

The design of the pipeline system has presented many challenges. The pipeline system is short, only 8.6km long, design pressure (150barg) / temperature (155°C) and classed as sour service. In order to comply with HSE requirements, a fortified zone is required at each end of the pipeline. This fortified zone extends for 150m from each platform, terminating at an SSIV and is designed for 'no global yield' under full wellhead shut-in conditions (641.2barg at 180°C).

INTECSEA's Pre-FEED activities included preliminary engineering work on 3 options; a wet insulated single pipeline, a conventionally S-laid pipe-in-pipe system and a pipeline bundle. Due to the high temperatures of the fluids, a preliminary design of a subsea cooler was also developed. Cost estimates for each of the options (with and without subsea cooling) provided the main deliverable from this phase of the work. Due to the fast track nature of the project, detailed design of the 16-inch x 22-inch pipe-in-pipe JWHP production riser had to start in this phase in order to meet the jacket installation date of early 2011.

Moving into the FEED phase, the wet insulated option and subsea cooler were disregarded, mainly due to cost complexity and material restrictions, leaving the pipe-in-pipe and bundle options for consideration. Engineering was performed by INTECSEA for the pipe-in-pipe option, resulting in a trenched solution (to protect against fishing interaction) with expansion spools required every 2km in order to prevent upheaval buckling. Requests for quotation were issued for the JWHP riser material, and the contract awarded to Tata Steel.

ITTs were produced for both the bundle and pipe-in-pipe options with the bundle option finally being selected by CoP for development. An EPIC contract for the detailed design, construction and installation of the pipeline bundle was awarded to Subsea 7.

The current scope for INTECSEA is for the detailed design, procurement and construction support for the 'fortified zones', i.e. the high pressure JWHP and JRP Risers and tie-in spools. Material for the JWHP riser has now been fabricated and is currently being shipped to the jacket fabricator in Italy.

The JWHP riser will be installed with the jacket in early 2011. The order for the JRP riser and riser tie-in spool materials has now been placed, with delivery due December 2011. INTECSEA's scope also includes supporting CoP in their management of the Subsea 7 contract through the design and construction phase. The JRP riser will be installed with the JRP jacket in 2012, with the pipeline bundle following soon after. The target for first gas is October of the same year.

Technology Pioneer Award - The DeepStar Project

by Brian McShane

In October, INTECSEA was recognized by the Ocean Energy Center, along with several other companies, as a Technology Pioneer for their participation in the DeepStar project. Brian McShane accepted the award on behalf of INTECSEA at the Ocean Star Gala event.

The vision for Deepstar evolved in 1991 when some individuals at Texaco recognized that significantly more technology and knowledge would be required to explore and produce reservoirs in deep water successfully. Texaco started initial framing studies with INTEC Engineering and evolved the concept that the industry as a whole would benefit more by doing it together. Texaco then took the concept to industry by selling “shares” in projects which became known as “The DeepStar Project” that is currently managed by Chevron.

Membership grew to 26 Operating companies by the mid 1990s with technology studies strongly influencing successful developments in the Gulf of Mexico, and from there, the technology has translated around the world. Since its start, The DeepStar Project has performed over 300 technical studies and initiatives categorized in 9 different technical areas that include Geosciences, Regulatory, Flow Assurance, Subsea Facilities, Surface Facilities, Drilling and Completion, Reservoir Engineering, Metocean and System Engineering. To keep the program fresh and relevant every 2 years new and diverse projects are added.

Projects now feature operations in over 10,000 ft water depth and include both dry Christmas tree production and pressure boosting subsea production that will allow satellite fields from 50 miles away to successfully produce. Today over 1,800 industry personnel are active in the program with operators, contractors and service companies contributing, monitoring and communicating via The DeepStar Project website and meetings.

Ocean Energy Center recognized the pioneering efforts of all the individuals and early companies who participated in the development of the first phase of the DeepStar Project. INTECSEA is proud to have had the opportunity to participate in this program and is thankful to all the individuals who invested so much time and energy in the program that has made it a valuable contribution to the industry.

INTECSEA Arctic and Sub-Arctic Region Subsea Technology JIP

by Julie Burke

Historically, INTECSEA has been an industry leader in subsea processing application studies. A previous Subsea Processing Joint Industry Project (JIP) conducted in 2007 concentrated on identifying Subsea Active Production Technologies (SAPT) for deep water and/or long offset tie-backs to host facilities or to shore. A State-of-the-Industry report highlighted available equipment and technology, current operational status and future strategic direction within this subset of the industry. Follow-up from this study led to the publication in *Offshore Magazine* of the 2010 Worldwide Survey of Subsea Processing: Separation, Compression, and Pumping Systems–State of the Industry Poster (http://www.offshore-mag.com/etc/medialib/platform-7/offshore/maps-and_posters.Par.21618.File.dat/SubseaProcessing-022410ADS.pdf).

INTECSEA has recently begun its latest Subsea Processing initiative, an Arctic and Sub-Arctic Region Subsea Active Production Technology JIP. A key deliverable of the project is a technology characterization database to consolidate objective information for Operators to match their needs at an early conceptual stage with the most appropriate conventional, enhanced and active subsea production technologies.

INTECSEA launched the JIP via a kick-off meeting on December 8, 2010 in St. John’s, Newfoundland, Canada with active participation from 3 other companies: Husky Energy, Repsol and Suncor Energy. Husky Energy and Suncor Energy are producing operators offshore Newfoundland and Labrador and Repsol is a partner in several discovery licenses offshore Newfoundland and in Arctic environments. They represent a group with future subsea processing interests associated with potential brownfield expansions and greenfield developments.

The current study will use information gathered during Phase One along with additional information on conventional and emerging subsea technologies and relate them specifically to the participant’s interests of offshore Newfoundland, Labrador and in Arctic environments. The JIP will focus on the generation of a database and a simple user interface tool to explain and select a wide spectrum of SAPT elements such as separation, boosting, compression, and direct electric heating that are suitable for typical stranded and existing field developments, along with the power and controls required to implement the technologies. The JIP will also address system installability, operability, reliability and maintainability issues that are specific to the environment.

The JIP work is being led out of INTECSEA’s St. John’s office and is being managed by PRAC (Petroleum Research Atlantic Canada) on behalf of the participants. The project is being supported by Ian Ball, Richard Voight, Julie Burke, Cody Moffitt and Dr. Kalyana Janardhanan of INTECSEA and is scheduled for completion by the end of 2011. For further information on this project, please contact Julie at Julie.Burke@intecsea.com.

INTECSEA and FEESA Agreement

by Scott Bufton, Global Flow Assurance Leader, INTECSEA Houston

INTECSEA and FEESA recently signed an agreement to formalize a unique relationship for the MAXIMUS steady-state production modeling tool. INTECSEA will adopt MAXIMUS as part of its suite of flow assurance tools and will be available across all of its worldwide offices. Present at the contract signing were Philip Birch and Neil Hawkes from FEESA, Steve Cowley, Phil Cooper and Garry Mahoney from INTECSEA.

Commenting on the agreement, INTECSEA’s Chief Technology Officer, Garry Mahoney, said “Collaboration is an important dimension to enabling value propositions and creative solutions. We have been impressed with FEESA and the MAXIMUS tool. This agreement recognizes the tool’s value and the growth potential, and takes INTECSEA one step further in its ambition to offer comprehensive end-to-end flow assurance capability for complex hydrocarbon developments and integrated projects. This is a direct response to our customers’ feedback and we have a new and exciting story to tell them in response.”

Our global flow assurance community are ready and primed to discuss further.

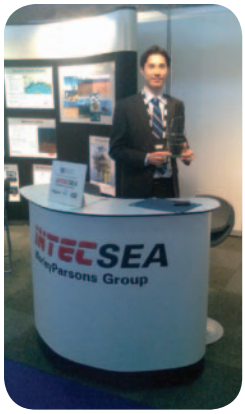
DOT AMSTERDAM 2010

by Jeroen Timmermans

The Deep Offshore Technology (DOT) Conference was held in Amsterdam, Netherlands, from 30 November to 2 December. INTECSEA was well represented at the conference with a stand in the exhibition area, four technical papers and participation on the conference committee. As usual, INTECSEA sponsored the conference proceedings, which were distributed at our booth. This provided good opportunities to meet potential clients and to discuss the state of the industry with old acquaintances.

The INTECSEA papers presented were:

- "At the Frontier of Deepwater Large Diameter Pipeline Design" by Thomas Dronkers
- "Minifold – A New Concept for Flowline-Attached Production Manifold" by Philip Cooper
- "Pipeline Strain Concentration During Deepwater Installation and Operational Conditions" by Sherif EL-Gebaly
- "The South Stream Project, Taking the Industry Another Step Forward" by Martijn van Driel



The paper "At the Frontier of Deepwater Large Diameter Pipeline Design" was awarded the prize for Best Paper, which was accepted by Thomas Dronkers. Congratulations on this excellent achievement to Thomas and his co-authors, Ping Liu, Martijn van Driel, Arjen Meijer and Shirley Zhou.

Next year the DOT will be held in New Orleans, so Delft and Woking are passing the baton back to the Houston office to ensure that INTECSEA continues to be represented as one of the industry leaders in deepwater technology.

A HOLE IN ONE

by Cody Moffitt

Jack Maingot made a HOLE in ONE at the Woodforest Golf Course Members and Guests Annual Tournament. I had invited Jack to play as my guest and after hitting just 10 to 12 practice balls on the driving range to warm up we proceeded to our starting hole. The other two guys that we were playing with had hit their tee shots on the 123 yard par three 7th hole of the back nine, and Jack then stepped up to his ball with an 8 iron and on his first stroke of the tournament hit a shot that headed directly for the hole. The ball landed on the front edge of the green and then rolled directly into the hole. Jack was in utter disbelief and was somewhat speechless as the realization of what he had just accomplished. Immediately a smile spread across Jack's face that could not be chiseled off. After 50+ years of playing golf Jack made his first Hole-in-One on a course he had never played before, and on the first stroke. You can see his excitement in the picture. Congratulations Jack, on a job well done!

Jack Maingot

For comments and additional information, *please contact Michelle Lang via email: Michelle.Lang@intecsea.com.*

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