Subsea Controls Down Under Conference 2018
Post-event Report

By Ian Wilson, SUT Perth Branch Committee Member

Pre-Conference Ice Breaker, Monday 22th October

At 6pm delegates boarded the Crystal Swan for a cruise on the Swan river.
Rob Bush of Yokogawa Australia opened the conference with a welcome address.
Everyone enjoyed an evening of networking, canapes and drinks before disembarking at 9pm for some rest.

Day ONE Tuesday 23rd October 2018

0915 Welcome by Rex Hubbard, SUT Perth Branch Vice Chairman

Rex acknowledged our Major Sponsors: Viper Innovations and Woodside Energy, Ice Breaker sponsor, Yokogawa Australia and Event Partners, One Subsea, Pressure Dynamics and Shell Australia.
It was mentioned we had 106 participants from 8 different countries and 20% from Opcos.
The Conference Theme is "Technology, Reliability & Availability through Collaboration"

0925 Welcome to Country by Irene Stainton, INPEX

Session A - Chaired by Ross Hendricks, TechnipFMC

0935 Keynote presentation by Miranda Taylor, CEO NERA

"Cluster isn't a dirty word: How innovative business models are changing the collaboration in landscape across Australia's energy resources sector"

Australia does not have a track record for commercialization of new technology, NERA want to change that. Australia needs a cultural change to gain the benefits of collaboration around innovation. Two innovation drivers are AI and big data.

Australia does great things, but we fail to co-ordinate these great things to market.

Industry Growth Centers

NERA's vision: Australia as an energy powerhouse

Through industry collaboration and innovation NERA is helping: refer to web site

Australia has developed one of the strongest natural gas industries in the world; x10 high value industry = every job in the O&G industry sustains another 10 jobs elsewhere in the economy

Miranda went on to discuss a number of NERA supported projects relevant to the O&G industry, including the TASER Living Lab

Questions from the floor:
What can you tell us about Clusters?

They do not work from top down!
Build on an immerging issue, seen as a community, team lead must have in addition to technical competence, capability of compassion and communication skills, facilitator and manager capabilities are critical to the cluster's success

Funding of a cluster?
Often helps if you have access to an organization which will nurture the growth of a cluster.
There are lots of government services and growth centers to support clusters

Clusters in Norway are working, why are Australia's clusters slow to work as well?
Fragmented funding and government (both Federal and State) drive is not cohesive. WA Govt is striving to develop

What is the value proposition of a small SME joining a cluster?
Evidence exists from around the world that supports benefits of cluster membership

1000 Manish Tomar, Chevron Australia "SEAR JIP Phase V The value of Sharing of Lessons Learned on Subsea Integrity and Reliability"

Sear JIP participants CVX, ConocoPhillips, INPEX, Quadrant Energy, Shell and Woodside

Goal: Reduce subsea equipment failures through collaboration and knowledge sharing

The Australian subsea environment has high sea water temperatures, high nutrient environment, high currents and cyclones when compared to other regions

SEAR Reliability Database
Vision: Low cost/high value method of capturing, sharing failures and lessons learnt for Australia

One difficulty was obtaining lessons learnt freely to place in a database including reliability data. The solution, supported by Legal, was to make the data sources anonymous

SEAR Testing Program:
Problem: unwanted marine fouling in subsea structures; significant interventions cost

Used crowd funding to get started during the industry downturn in 2016
Industry best practices guideline will be issued to all of industry at completion of testing

Problem: Unwanted gas in controls systems, a source of loss of insulation resistance?

ROV footage shown of the insitu living laboratory located offshore at Gorgon field in ~200msw

Questions from the floor:
Gas umbilical testing? Are you going to ask OPCO's to test all their umbilicals?

- Yes, the question remains how results will get into the reliability database.

1025 Stephen Auld, Sonardyne International Ltd, Case Study: Retrofitting a Subsea Pipeline Monitoring System to provide online, near-realtime feedback, replacing periodic vessel based data collection."

Following on from the presentation at 2016 SCDU Conference

Rewind to SCDU October 2016 defining the issue

b/n Oct 2016 and Oct 2017 Stephen explained the nature of the work done to establish an acoustic transponder array (AMT) to monitor movements of two flowline termination assemblies (FTA)

Initially data acquired only when a vessel visited the field, further development was required to provide near real time data using SMART (subsea monitoring, analysis and reporting technology) which records and configures data ready for upload when client requests

SMART calculates FTA positions every 60minutes by interrogating each of the 6 AMT's in turn, calculating position information and saving results for upload upon client demand

The 2016 SCDU Conference sparked the idea and subsequent collaboration delivered a solution, quickly and cost effectively.

LiI batteries, need low power electronics to ensure battery life.
The more data processing completed subsea the better the results

Calibration of pressure sensors requires considerable time in the workshop (4 months) to establish the characteristics of the sensor before infield deployment

1120 Greg Smith, C-Kore, "The C-Kore Subsea TDR: Automated Cost-effective and Reliable Subsea Testing"

C-Kore started development work in 2010, the TDR development started in 2017.

TDR = Time Domain Reflectometry

Greg provided a brief history of the latest TDR tool and went on to describe the TDR traditional methods and compared these with the latest methodology using the C-Kore TDR,
Benefits being;
Matched impedance (no extra reflections)
Direct measurement
Automated and repeatable
Interactive result analysis

Case Study on fault finding; LIM shows IR failure on one channel, some spare cables available. If umbilical failed (suspected) will need to decide repair (end damage? Allows recovery to repair) or replace ($10M)

Located a bad umbilical with 2 conductors, first measure the good conductor to establish a baseline, then test the bad line. Use the TDR to find the fault location. Established midline defect which meant umbilical replacement

1148 Sam Johns, Castrol Marine & Energy, "New Subsea Fluid Technologies Enable Success in Long Offset Gas"

Sam described current conditions and described specific issues associated with gas hydrate formation in control fluids on long tie-back gas developments.

Risk mitigation – early recognition of hydrate risk is essential to minimize impact on costs and schedule. Sam explored fluid solutions and hardware solutions to reduce hydrate risks.

Subsea Compression Challenges, Sam explained the development of a new barrier fluid which is critical to reliable compressor operation and maximum output. The new fluid was co-engineered in conjunction with key equipment OEM's

Gas hydrates have been found to cause control system blockages in West Africa, India and Brazil.

Questions from the floor:
The move to all electrics subsea systems, will this see the demise of the use of control fluids?

- Sam did not see hydraulics disappearing completely

1210 Joel Woolerson, AFP & Espen Amundsen Ocean Team Fluid Care UK "Technical Flushing and the Supercritical Flushing Revolution"

Failure of subsea hydraulic systems, failures associated with contamination are currently managed by flushing prior to commissioning, ….

Joel and Espen explored the use of Supercritical CO2 (CO2 controlled with temperature and pressure so that it is neither a liquid or a gas) as a solvent. Use of a high velocity turbulent (Re > 4000) fluid to scrub the internal lining of a conductor was discussed

Joel and Espen described the application of SC CO2 back-flushing and unblocking using a number of case studies.


SUT
Society for

SESSION B – Chaired by Ian Wilson, SUT (Perth Branch)

1330 Panel Session

Helena Forsyth, INPEX; Harry Mackay, Woodside Energy; Ed Millar, Shell Australia; Martin Wisselink, PTTEP

Working on the theme on collaboration, what are the panel doing to invest in academic research to address technical challenges in the industry? What can you share?

- When assets get sold from A to B to C, what is done with the knowledge. Not doing much at the moment, and the new operator isn't doing much.
- Most of the work is being done in the SEAR JIP, to recognize the academic achievements of the living laboratory. It has an open level of academic involvement.
- Working with UWA, but not working extensively with the university. Encourages the universities to approach the panel.
- We actually do quite a lot. Sponsor future lab, here. Curtin / Monash and other groups. It's fascinating stuff, like building 3D jet engines and getting them to work. Adaptive metallurgy. Suggest asking Shaun Salter when he arrives tomorrow, as this is his realm of involvements.

Resources constraints in the new boom?

- Not able to support this out of Australia. Great success building manifolds out of Australia.
- Have some fantastic welders, and great fabrication facilities (Civmex) working on the stadium, which helps builds the stadium. Woodside have learned and built up local learnings, utilized more of their standards in a fit for purpose and fit to international standard way. Try to keep our internal standards with global programs.
- No easy answer to that one. Operators drive their lessons learned into global standards. They are all being rolled in to international standards. There is not easy answer, there are limited opportunities, all operators are in the same position. Pulling people in will not be as easy as it used to be.

There's a lot of talk about Big Data, and it's something the industry collects and managers. E.g. data lakes, and data analytics. These are the future of subsea controls opportunities. The next frontier.

- Lessons from INPEX is that now OEM's do the testing and controls testing is critical. There is not enough collaboration between the operators and the OEMs to properly test these systems in actual application.
- A lot of smaller projects that are affected by delivery times. This doesn't work for small developments and tiebacks. These long leads hurt the economics.
- It's the data. We have the smart system, and even the AI (which hasn't materialized to date) but will.

This morning we heard from Miranda Taylor, who talked about collaboration. Why do you think we're lagging behind Norway and other counters? Do you think it's companies that lag behind supporting the collaboration industries?

- Don't agree. I think we are collaborating. We conducted the SEAR JIP engagement last week in London to support the development. Wouldn't be fully visible to many companies currently out there, but these discussions are ongoing. Yes, we have a lot of experience working with the other operators, which are on this table. WE have to share issues like the SEAR JIP, as it doesn't just hurt one company but the whole industry, as we are competing any Shale Gas.
- People may not know, but there is also the Symphony group, and this group looks at the collaborative initiatives between the companies.
- The level of collaboration in Australia is better than what I've seen in other countries all around the world. Symphony has been established, but we understand the challenges especially the legal teams that need to be aligned. If you're working in Australia, you're going to be experience challenges which the industry is attempting, as a group to resolve.

1330 Panel Session (cont.)

All electric has been a buss word in the industry, and some people have mentioned it. But it doesn't see an industry update on this technology on this as one would have expected?

- They looked at it and weren't comfortable with the downhole valve technology at that time. They're waiting on this technology to further developed.
- We have been taking a slowly approach to this. They have started to install electric actuators. On one system they have all-electric actuators. We have a multiple projects with E-actuators and are trying the technology out. There are pilots out there, working with AE in some fields. Once companies get in to ultra-long step outs, then we'll see all electric systems gaining more traction in the industry. But it does take a little bit of time. Getting the field experience, and reliability will take some time.

What subsea technology enablers need to be established before we move forward with Long Distance tiebacks.

- Subsea production, Unmanned facilities. To get these benefits you need to get the reliability there. The operators need to make the systems cheaper, simpler, more reliable.
- Industries are moving to Standardization, which they see as a necessary step forward.
- More of the economics behind it. There's not one single magic bullet. It's how the industries can make it standardized. We're certainly seeing more from subsea, with Subsea processing (Boosting, separation, compression). We would love to see standardization, with standard spare parts as lead time are significant. Symphony is a forum that would standardize on that.

Each of the panellist that have one widget that they would like to add to their systems to improve the reliability and available?

- Anti-Hydrate (2)
- Would like something that works out of the box as per the instructions
- Just deliver something on time

In regard to operability and availability, what does it mean?

- When operators state 25years design life they mean it. All the technologies out there need to work as stated. They don't need the bells and whistles. They just need to work as stated. The design of these things has been worked backwards to minimize the design. SEAR is an example of where we could improve the capabilities of the system.
- When you look at OREDA it's not consistent with the reality of the industry. We need real data with real honesty.
- Reliability is a key issue for them. We're about to move forward with a new generation of trees and controls. They want to reduce the infrastructure going subsea. One operator wants to use one LP line and one Core, but what came out of the forum was that they need that redundancy. They can't do one LP line and one core because the systems aren't reliable.
- Today they keep they fields running because they have configurability and redundancy.
- 27 SCMs fail per year. Martin is surprised that we don't provide a vessel with a spread that's available to perform recovery operations. The production gains are significant. If this can be achieved via collaboration, then everyone would be happy.
- What do we have in Perth? Nothing, all OEM's are sending their hardware oversees? The panel challenged the industry to work together. A lot of opportunity here.
- Control modules that fail, we can't have that, but we do have that. MIL Spec boards that have been in operation, with minimal downtime. They have the communications of fax machines. But newer systems, then had a spike in reliability. The newer systems have shown a rebound with their reliability. We can't go back. Standardization.
- Focus needs to be on the quality of the product and the reliability of the product.

1415 Simon McManus, MacDermid Offshore Solutions, "Update on Subsea Hydraulic Fluid Developments"

The anatomy of a control system was described using the human body, with blood vessels and the heart as examples. Simon predicted more closed systems would be developed. He noted 1 litre of MEG discharged to sea, will deplete all oxygen from 78,000 litres of seawater as a result of MEG breakdown.

Future hi tech fluid developments will focus on long term stability, efficient energy transfer, recycling within closed systems and environmental efficiency from open systems.

Simon provided a comparison between ISO 13628-6 and the migration to API 17F. He noted API 17F is not a qualification (pass/fail) procedure. API 17F creates a resource manual for the fluid product for use by engineers.

1440 Neil Douglas, Viper Innovations Ltd, "The True Consequences of Umbilical Electrical Insulation Failures: Copper Loss and Hydrogen Generation"

Neil described three earthing systems, TN, TT and IT, the later having no deliberate electrical connection to earth. He described how IT (isolation terra) systems continued supply with one ground fault. Should a second or greater number of ground faults occur the system will progressively degrade and subsequently fail to operate. The first ground fault needs to be repair ASAP to limit further system degradation.

Discussion on insulation monitoring devices (IMD), cable insulation integrity measurement and leakage currents led to the experimental set-up and subsequent findings.

We were provided with an example of how the V-LIFE and V-LIM products worked. Key points where summarised as;
Low IR and the use of a LIM results in copper loss in the wiring
Applying voltage to subsea lines with two ground faults can create significant conductor damage
Hydrogen generation is a by-product of low IR in sea water on energised cables
Few subsea engineers understand the possible consequences of operating with low IR.

1535 Jack Vincent, OneSubsea, "New Frontier Wireless Acoustic Telemetry"

Jack described the AUV development at OneSubsea called uROV and the development challenges for subsea acoustic telemetry to support the uROV. Attenuation, ray bending, multipath, doppler, noise and computation where all addressed as challenges.

The Onesubsea uROV platform uses Schlumberger technologies on a Saab Sabertooth ROV. It was noted that Schlumberger was best in class for down-hole telemetry, achieving data streams up to 6bps over 15km in drilling mud.

The development timeline of the Dolphin wireless technology was discussed and presented.
Jack finished by addressing what's next in the AUV space; wireless networks, multi-physics communications and residency-SPS interface.

1600 Moshsen Shokri, BHGE, "Distributed flow metering"

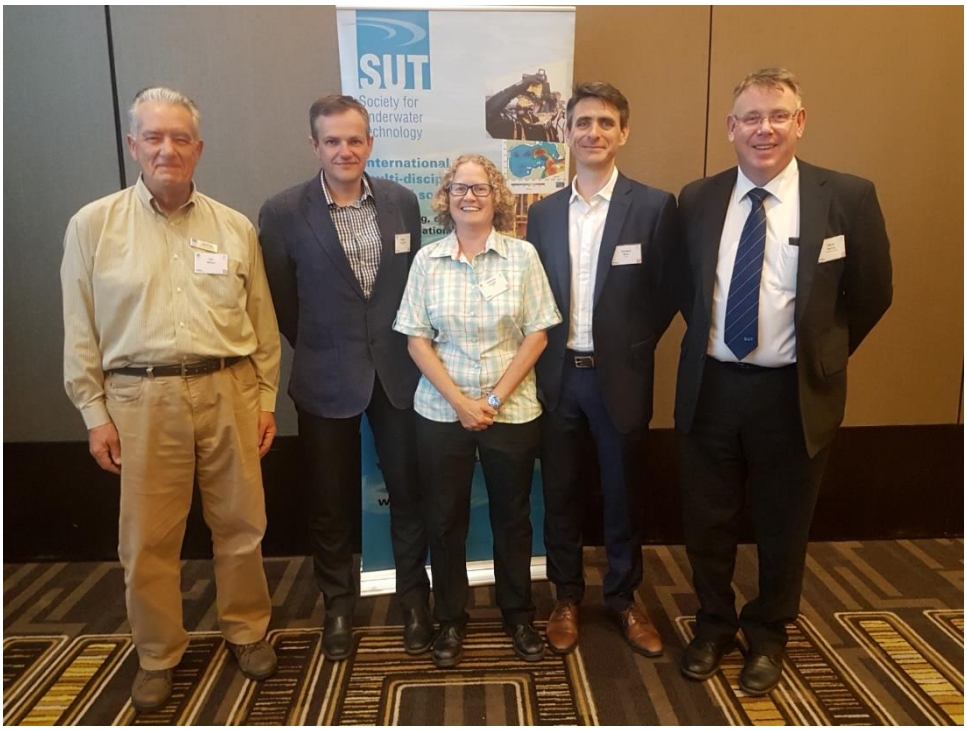
Moshsen described the concept of distributed flow metering and how BHGE arrived there. He went on to talk about virtual flow metering and its application. Expanding to include virtual multi-phase flow metering and distributed multi-phase flow metering.

The concept validation process was discussed addressing model validation, the virtual flow metering test campaign and field comparisons.

Moshsen introduced the Tulsa university fluid flow program (TUFFP) which researches multi-phase flow in pipes and was used to develop the field comparisons.

1625 Jan-Tore Ervik, SensorLink, “Corrosion Monitoring on Welds using Ultrasound”

Jan-Tore described the Sensorlink value proposition as improving pipeline integrity management by using installable non-intrusive high precision direct wall thickness monitoring. Comparisons where made between the more traditional means of pipeline scanning by diver or ROV and pigging.
Permanent monitoring by Sensorlink was discussed and addressed the hardware, methods and results.
Monitoring on a weld was discussed in detail with field examples presented.



Day TWO – Wednesday 24th October 2018

0900 Welcome by Julien Levadoux, OneSubsea

Julian acknowledged the contribution of the original organising committee and SUT in the creation of SCDU and the current organising committee for the ongoing success of SCDU.
Julian introduced David Keilty as Chair for this morning's session.
Since its introduction in 2007 there have been 18 different iPhones in 11 years
This session focuses on Obsolescence

Session C Chaired by David Keilty, Chevron

0905 Ned Chapman, BHGE, "Life of Field - Obsolescence Management"

Working on obsolescence for about 14 years, introducing the subject to OPCO's at field start-up generates surprised responses

Brownfield Asset Obsolescence – transition from availability from the original manufacturer to unavailability (Ref: Joint Operator Specification 3428B)

iPhone 1st Generation phone, new in box unopened sold for $37,000

Spares availability over the product lifecycle, 2 years notice to end of supply is about average notice

Ned discussed Risk Based Criticality and reliability assessment conforming to the Joint Operator Obsolescence Management Specification (JOS3428B)

Obsolescence RAM modelling findings – after 10 years, have about 2 years notice of impeding obsolescence so need to plan ahead for sparing and remediation

Discussed how BHGE have responded to legacy

Questions:
How would you manage Obsolescence?

- The devil is in the detail, hardware and software have to be considered.
- Software upgrades are they all necessary?

0930 Tore Erntsen, Proserv UK, “Extending Life of Brownfields and enabling New Standards”

Tore identified OPCO challenges relevant to Subsea systems and services. Also addressed the challenges for non- OEM subsea systems upgrades

Looked at subsea upgrade of an SCM and discussed the SCM SEM retrofit, bespoke interface and new SCM options

Proserv Co-Exist communication technology operates on existing system hardware at a different frequency either on the same OEM powerline or alternatively via spare conductors if available.

Upgrading of topside systems: Industry development of the MDIS interface based on the OPC-UA protocol, provides the potential support for a non-proprietary and flexible upgrade solution.

Torsen discussed the Visund Field Norway, Brownfield upgrade project which provided a refurbished SCM and a new SCM solution.

Siemans OEM system provider worked with Pro-Serv to interface with and test the upgraded SCM and the upgraded topside system.

OPCO Equinor Energy AS challenged the market to deliver an upgrade solution.

Industry JIP to Standards, Torsen commented on IWIS, SIIS, MDIS, SEAFOM and SWiG

Questions
When will MDIS be available for industry? Does it address obsolescence?

- Why did it take so long? Given the vast number of different protocols, it took years to get agreement on suitable protocols to take forward.

0955 John Lovas, TechnipFMC, “Planned Obsolescence, Midlife Updates & Next Generation”

Midlife upgrades – challenges and solution - have a safe and painless transition during midlife upgrade

John discussed a retrofit case for a manual valve installation to be replaced with an electrical actuator

Looked at the control system generations and number of systems in-place. SEM generations slide shows electronics obsolete, end of life notification and midlife upgrade availability.

John discussed a SEM upgrade case noting TFMC have been doing these upgrades successfully since 2012

Topside Power and Communication upgrade case, MCS changes can be completed in phase and only needed if customer wants additional functionality

Discussed Woodside Angel project upgrade

Several levels of obsolescence – focus on the most critical components

John discussed the Next Gen systems and modern technology advantages

Improved Manufacturing Process Goal is to reduce from 43 to 4 weeks for SCM delivery

Technology developments – if don’t change something that works then obsolescence will get you down the track because it was not allowed for previously

Challenges yesterday and today
- Low volume market
- Varying Customer specific requirements

Solutions
Configurable products and system building blocks
Extensive product & component qualification
Focus on obsolescence

Questions:
What one thing would you do?
- Continued testing
- Observation by Harry Mckay noted TFMC input into WEL Angel Project upgrade

1050 Majid Talebi, Pressure Dynamics “Protecting Subsea Multiphase Pumps through reliable subsea accumulator modules”

Case study on Woodside Ngujima-Yin FPSO on Vincent Field Development

Framo multiphase (helicon-axial) pumps located on seabed in 375msw using 1.8Mw

MPP failure consequence; ~$10M per pump (cost to replace) and 2 years loss of production (time to replace)

The multi-phase pump barrier fluid is critical – prevents production fluid and sea water from entering the electric motor/pump assemblies

While FPSO was in dry dock, the MPP needs to have the barrier fluid charged. Charging by ROV at ~$800k per event. The alternative solution provided by PD was a subsea accumulator module.

Monitoring of SAM pressure by acoustic monitoring, visual check of pressure gauge or via Tronic connector interface. Monitoring is required to ensure recharge can be scheduled in a timely manner.

Local design collaboration between PD, Fugro and Woodside, followed by local fabrication and FAT.

Questions:
Mentioned design was to limit ROV intervention, expectation is that pressure will be maintained for the year required. However, recharge can be achieved by ROV if required

1115 Eirik Ravnas, Innova A/S and ATV S.p.A., “Electric Valve Integrated Solution”

Why electric?

- Market exists, electric systems are maturing, and electric actuators are reliable (8M running hours to date)

Challenges:
Concern of the unknown
Power Infrastructure – every watt counts
Power management raises new questions
Valve actuation times are high

In transitional phase from hydraulic to electric is incremental to reduce risk, however missing out on the advantages of new functionality

Integrated electric valve provides opportunity for new functionality

Condition monitoring of the valve via the actuator is possible

Eirik presented two case studies:

- 5 1/8” 15ksi gate valve (in 3000msw) with electrical actuator and compared with standard and balanced valve assemblies
- 22” ball valve using standard worm gears requires 62 turns to close compared with 19 turns with a spur geared valve, using the same torque in both cases

Concluding

- Energy efficiency is essential
- Integrated electrical valve is the way to accomplish this
- Smart valve allows predictive analytics/maintenance

Questions;
Valve override limitations vs applied torque?
Reliability – how to cope with higher temperature?

- Have not designed integrated actuator yet, currently looking at drop-in actuator.
- Need OPCO feedback to drive development of integrated actuator.
- Li-I based battery packs are the norm

1140 Carsten Mahler, OneSubsea & Markus Glaser, Aalen University “Application of Functional Safety in all-electric control systems”

Current market conditions driving OG21 recommendations to cut costs and enhance recovery:

- Standardisation
- Simplification
- All-electric technology

Carsten introduced failsafe concepts for all electric systems

Carsten discussed JIP for Intelligent Safe Subsea Actuation
Participants SubCtech, Wittenstein, OneSubsea and Aalen University

Challenges where identified and the application of functional safety discussed

Markus spoke on the functional safety principles. Use of a standard to apply a consistent approach to functional safety management.

He addressed system architecture with redundancy (HFT) for availability and safety

Probability of failure on demand, lowered by development and enhanced diagnostics provides immediate detection of failures without additional components.

All electric actuation system summary

Questions:
What are the test conditions for the results shown?

- Used a statistical assessment with OREDA or similar database numbers

Industry has been talking about all electric systems since the ‘80’s why are we still waiting for this?

- K5 experiment with electric actuators has had some connector failures, connections seem to be the significant driver of delay

Session D Chaired by Harvey Smith, Woodside Energy

1305 Panel Discussion

Neil Douglas, Viper Innovations; David Keilty, Chevron Australia; Warren Lund, Quadrant Energy; Sean Salter, Woodside Energy.

What are the drivers for long tie backs?

- Reduced infrastructure

What do you see as the most reliable system?

- Hydraulic is most reliable compared to alternates

What is the biggest risk?

- We as an industry run the risk of being left behind if we do not embrace all electric when compared to other energy supply industries
- Biggest risk is chasing all electric when the technology is not ready
- NWS centric focused on long step outs for gas
- How do we reduce the cost of developments?
- Use of new technology to assist with intervention
- Low oil prices put pressure on suppliers to deliver to industry
- Long step out – steel tube umbilicals, multi-phase pumps

There has been a push on standardisation, panels thoughts please?

- One size fits all? 30msw cf 300msw not possible, however NWS big bore gas is a common area we can focus on
- Don't think standardisation is a one size fits all is the answer, allow innovation to drive step changes, necessity is the mother of invention, compare with the current motor industry.
- Our competitors are the onshore producers, so offshore needs to be proactive to improve our business to remain competitive

What is the main blocker to those new standards being created in the Subsea controls space?

- Make a decision
- There are standardised equipment out there that we can use, however our small size means we will not be driving the change
- "we will be first to be second approach" is holding back this industry. Providing feedback to our OEM's is limited and could be better

Is long tie-back going to drive localised power generation or new shore-based power supply?

- We looked at submarine nuclear power, but it did not fly
- There are a number of options available,

1305 Panel Discussion (cont.)

Does the panel have any ideas about how we can take technology from other industries that we can learn from?

- Yes IoT, wireless communications adoption, agrees we have a lot to learn
- Life of Field of 25years cf Apple iPhone's 18 versions over 11 years. We are a small industry and we have done great things
- We do lag these other industries, intervention costs have been excessive. Retail industry and things like electric cars and reliability. Digital technology needs to be brought in
- We should be proud of what we have developed compared with other industries

Break throughs in subsea technology, comment on the supply chain and OPCO intervention in the chain?

- The down turn has saved funds, the supply chain has diversified to survive, hope there will be improvements and best practises from this trend
- Industry has been driven by risk management hence very conservative, observing WEL look into data science – went open source, provided option for a large number of alternate suppliers, while limiting the closed offerings from some suppliers. Consumer electronic trends? Can they be brought back into our industry?
- Difficult to predict the future, will it be the same as previous cycles, industry will have a significant demographic change soon which in of itself will drive change in our industry.

1350 Rodrigo Lima, Aker Solutions "Long tie-back controls technology in the Barents Seas"

Askeladd Controls systems highlights

- New AC highway 3kV 3-phase AC power transmission

Johan Castberg SPCS configuration described

Askeladd SPCS configuration described, mentioned the scalable system architecture benefits

Standardisation opportunities where discussed for the Vertical XT mounted SCM

What was the main outcome of SCM standardisation?

- The fact that we have three projects where we can utilise the same SCM design helped the argument for standardisation.

1415 Peter Baker, Wood, "Long Distance Subsea Power Transmission and Distribution"

Why are we looking at this technology? Firstly an enabler (technical), for subsea production and subsea heating

Presentation framed with the following parameters;
Power ~30MW
Voltage ~110kV
Distances up to 600km offshore (driven by cable qualification)
Water depths to 1500msw

Technology Options:
1) High Voltage Alternating Current – HVAC (50Hz)
2) Low freq High Voltage AC – LFHVAC (16 2/3Hz), requires frequency converters at each end
3) High Voltage Direct Current – HVDC

DC advantage - losses are fewer compared with conversion between AC and DC and back

Cable options - Typical distance limitations with 30MW
HVAC 150km
LFHVAC 300km
HVDC currently around 600km, 730km (due in 2021)

Relative cost comparisons:
Cable costs are all relatively similar
Terminal costs are the biggest differentiator

Qualified Technologies:
Cables and shore equipment are qualified including dynamic HVAC cable (being developed for floating offshore wind farms)
Real issues associated with subsea equipment 50% of which need qualification

Addressed advantages and disadvantages of each system
Examples of HVAC Power transmission <50km and >50km where presented

Summary of applications based on transmission distance:
HVAC,150km
LFHVAC >150km < 300km
HVDC >300km <600km
Questions:
Why is low frequency set at 16 2/3 Hz?
- Simply 50Hz divided by 3

1440 Brett Phillips, Oceaneering, "ROV Workover Control Systems (RWOCS)"

Address the evolution of RWOCS from 2010 in Brazil to 2014 in Australia.
Latest version for Statoil delivered recently. FAT completed Dec 2017, Q1 2018 two skids delivered, Q2 20018 two LARS delivered

Main components ROV Skid, topside HPU and topside test panel

Clean fluid bladders 4off for delivery and an additional bladder for receipt of all return fluids.

Described interfacing with the SCM, Master Controller is now in a Pelican case, quite portable. Controls and Condition monitoring capability available

What sets this technology solution apart from other options?

- Works with multiple ROV's
- Built in redundancy

Pros and Cons of the RWOCS system were presented and a development timeline:
2018 OII will build multiple rental systems
2020 70% of the market will adopt RWOCS

Questions:
What can the RWOCS do to support the Subsea Controls System?

- It can provide hydraulic override functions up to 15 controls up to 10k psi currently
- Can use two different control fluids
- Can receive dirty control fluids
- Can provide topside PC control via ROV umbilical requires interface with OEM

What are the differences between OII RWOCS and other suppliers?

- OII has the most encompassing system for hydraulic and electrical functionality, particularly hydraulic functions
- Operator uptake is required to allow the industry to develop further

Compare RWOCS with Topside delivered equivalent services via an umbilical?

- No difference in functionality
- Positives for RWOCS, smaller equipment and personnel foot print topside, reduced HSE risks with HP during operations
- Potential for fluid contamination which can be mitigated
- Various other trade-offs can be achieved

1535 Eldar Lundanes, TechnipFMC and Francois-Xavier Pasquet, TOTAL, "Subsea Chemical Storage and Injection Collaboration Project"

Studied separately at TechnipFMC and Total, then decided to collaborate and develop jointly.
Objective – develop and qualify a system to be ready for industrial piloting in 2020/21
What – a system for seabed storage and pumping all required injection chemicals
Whole of field solution not just a single SCM. Applicable to Green and Brown Fields

Project Schedule

- 2018 system definition
- 2019-2020 hardware and integration
- 2021 Pilot system design, build & test

Technical Challenges
HSE – safety values (LP system pressure balanced)
Operations – tank re-filling (efficient and safe operations)
Power System – motor operation in high voltage range

Discussed Safety Barriers, Operations (frequently operated components to be designed for regular change out, e.g. Stab seals) and Motor operation (variable speed drive selected for pump qualifications)

Conclusion
New Technology – still safe and reliable/using technology from other industries/system development approach has been used
Designed for Subsea application to ensure a cost-effective solution
No show stoppers

Next Step – Qualifications

Questions:
What type of pumps do you envisage being used?

- Volumetric pump types are preferred

Deepwater applications and Calcium Carbonate deposition in NWS area is a problem have these been included?

- No

Why have permanent storage tanks not been considered?

- It could be developed in future, but for now focus is on retrievable tankage.

Have you considered increasing the JIP membership, WEL have been looking at this also?

- Do not know, expect it may be possible

What is the umbilical length that drives the use of this new application?

1600 David Walker, Yokogawa, "IoT and the Future of Subsea Controls"

Significant innovation in the last few years

IIoT = Industrial Internet of Things

IIoT Top Use Cases

- Remote monitoring
- Energy efficiency
- Asset reliability

IIoT Technologies
Edge Computing

- Edge computing allows data from IoT devices to be analysed at the edge of the network before being sent to a data centre or cloud

1535 Eldar Lundanes, TechnipFMC and Francois-Xavier Pasquet, TOTAL, "Subsea Chemical Storage and Injection Collaboration Project" (Cont.)

IoT Devices:

- IoT Sensors a networked device infield that undertakes computations in real time
- Fibre Optic Sensing Technologies, can run fibre optics for 50km and sample every 1m
- Vibrating Sensing Technologies
- Subsea Controls, discussed Edge Computer Attributes and their application to subsea controls.

Communications:
Why would we want to use wireless communications?

- No physical or 'wet mate' connections required
- Requires long battery life (10+years) to be viable

Radio Telemetry:

- Bluetooth equivalent = Seatooth (by WFS)
- about 5000 units deployed to-date

MQTT – sensor level communications likely to be seen more in IIoT

MDIS – MCS DCS interface standard

Analytics and Cloud Computing:

- Pay for what you use
- Data Lakes – massive data storage
- Data Analytics - converts data to information
- Subsea Applications - comparing model against actual

David provided an example of Closed loop cloud-based computing used in the petrochemical industry, soon in subsea?

Challenges and Benefits of IIoT

- IT/OT Convergence, different priorities
- Improved asset management
- Improved reliability

Questions:
Are you suggesting what you deploy needs to be reliable? Yes, with more sensors provides more information to help run assets

APCUA adoption?

- Have not seen a project on which it has been used yet.

1625 Darren Burrows, BlueZone Group (formally UBS) “Kallaini Telemetry Bouy”

‘Subsea to Space Communications’

Darren has a background in ROV/Robotics

Rapid Environmental Assessment (REA):

- Environmental knowledge for Naval support vessels preparing to enter into shallow littoral waters to deploy or recover plant, equipment and troops
- Critical factor for the conduct of joint military operations
- Real time access to subsea instrumentation, with reliable transmission of data
- Deployable Geospatial Survey Teams, team of people with sensors systems in pelican cases to provide regional data to assist the landing vessel do its job
- SEA1770, provides position (wide area DGPS), wave, current, tide, temperature, sound velocity and seabed sediment type information with 30 days endurance at 20 minute sampling rate

Kailani Telemetry Buoy:

- Kailani = between the Sea and the Sky
- <600mm diam and < 40 kg
- Onboard processing & forwarding of data
- Line of sight and beyond line of sight communications

Darren presented and discussed the four design iterations of the Kailani Buoy.

The following IoT developments where discussed:

- Z boats for the army to replace manned boats into mangroves for surveillance
- Z boats for civilian survey and surveillance work
- DL25 – Extended memory & control for ADCPS
    - Long term data logging
    - Remote control including remote and local data access
    - Application in rivers and subsequent use for dredging/monitoring flume dispersal

Conclusion - Internet of Things @SEA

- Real time access to subsea instruments
- Decision making in real time
- Technology options for use of drones
- Smaller and more networked sensors

Questions:
Power capability of Kailani Telemetry Buoy only 30 days?

- could be increased if required

Any military specific products that cannot be used in civil applications?

- no, it uses all readily available technology.

1650 Session Close and Conference Closing Remarks by Harvey Smith, Woodside Energy

1700 Conference Close, depart for the SEA Forum