SubOptic 2016

www.suboptic.org

Dubai

18th-21st April 2016

Conference Programme

Emerging Subsea Networks

Celebrating 30 years of SubOptic

The world's expanding treasure

Hosted by e-marine

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Celebrating 30 years of SubOptic

Dubai

SubOptic 2016
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The SubOptic 2016 Programme Schedule

TIME	Monday 18th April	Tuesday 19th April	Wednesday 20th April	Thursday 21st April
Exhibition Timings	6.00pm – 8.00pm	9.00am – 6.00pm	9.00am – 6.00pm	9.00am – 5.30pm
8.00 – 9.00 am		Registration 8:00 am - 9:00 am		
	Conference Room C / Conference Room D	Conference Room C / Conference Room D	Conference Room C / Conference Room D	Conference Room C / Conference Room D
9.00 – 9.30 am	Registration 8:00 am - 6:00 pm	OPENING CEREMONY	Keynote 2 GERD LEONHARD	Workshop 2 - EXTENDING SYSTEM LIFE
9.30 – 10.00 am		Keynote 1 - DR BASTAKI	Round table 2 THE CASE FOR CABLES	Round table 3 REGIONAL LEADER FORUM
10.00 – 10.30 am		Break	Break	Break
10.30 – 11.00 am		Paper session TU1A THE FIBRE CORNER / Paper session TU1B CABLE FINANCING & CONSORTIUM ENVIRONMENT	Paper session WE1A MANAGING SYSTEM LIFETIME / Paper session WE1B MARINE ACTIVITIES	Paper session TH1A LINE DESIGN / Paper session TH1B PROJECTS AND IMPACTS
11.00 – 11.30 am				
11.30 – 12.00 pm				
12.00 – 12.30 pm		Lunch	Lunch	Lunch
12.30 – 1.00 pm				
1.00 – 1.30 pm	Masterclass 1 EXTENDING CAPACITY & REACH / Masterclass 2 LEGAL INNOVATION & JURISDICTION CREEP	Paper session TU2A UNREPEATERED APPLICATIONS / Round table 1 PROJECT FINANCE WILL THE EXCITEMENT CONTINUE?	Paper session WE2A NETWORK TOPOLOGY / Paper session WE2B MARINE ASSETS AND OBSERVATORIES	Paper session TH2A WET AND DRY TECHNOLOGIES / Paper session TH2B THE LAST SESSION
1.30 – 2.00 pm				
2.00 – 2.30 pm				
2.30 – 3.00 pm	Masterclass 3 POWER BUDGETS / Masterclass 4 COMPETING SEABED USERS	Break	POSTER SESSION	Break
3.00 – 3.30 pm		Paper session TU3A UNDERSEA TECHNOLOGIES / Paper session TU3B THE MARINE CHAIN		Keynote 3 30th ANNIVERSARY OF SUBOPTIC
3.30 – 4.00 pm				CLOSING CEREMONY
4.00 – 4.30 pm	Break	Workshop 1 THE PROMISE AND REALITY OF OPEN NETWORKS		Free
4.30 – 5.00 pm				
5.00 – 5.30 pm	Masterclass 5 MYTHBUSTING / Masterclass 6 OIL & GAS PROJECTS & TECHNOLOGY			
5.30 – 6.00 pm				
6.00 – 6.30 pm				
6.30 – 7.00 pm	Welcome Reception	End of Day 6.00pm	End of Day 6.00pm	Gala dinner
7.00 – 7.30 pm				
7.30 – 8.00 pm				

Dubai

WELCOME REMARKS

WELCOME FROM THE HOST - OMAR JASSIM BIN KALBAN, MD & CEO (E-MARINE)

On behalf of E-marine, I am honoured and delighted that the 9th edition of the SubOptic Conference, "SubOptic 2016" is being held in Dubai, United Arab Emirates from 18th to 21st April 2016. SubOptic will be 30 years old with the staging of the SubOptic 2016 in Dubai. This leading event in the submarine cable industry is being hosted for the first time in its 30 years history in the Middle-East Region (outside Europe, Japan and the USA) and E-marine is indeed proud to be the host in Dubai. It is the longest running event in the submarine cable industry with its various unique characteristics and organization.

Interestingly, the 30th SubOptic anniversary has coincided with the region's forming crossroads for links between the Asian and European continents and thus has become an essential hub for the undersea communication network in recent years.

Submarine cable systems carry most if not all international data through hundreds of different cables linking all major continents and most countries with coastlines around the world. There are hundreds of thousands of kilometres of cable, deployed to a great depth, all installed by companies and participants at the SubOptic conference.

The internet and so many aspects of global living from banking to education, health to entertainment, depend on being continuously and effectively on-line; on-line means connected to a submarine cable system. Most governments recognise their submarine cable systems as being vital to the national economy. Over the last two decades, UAE in particular and the Region in general has invested heavily in undersea cable infrastructure projects mainly in Telecom, Oil & Gas business sectors.

The theme for the SubOptic 2016 conference is "**Emerging Subsea Networks – The World's Expanding Treasure**" as the world becomes ever more connected and we become closer and closer globally. Given that the conference is held only every three years and the time cycle in our industry for major projects tends to be years rather than months, we would be able to identify and highlight the various challenges and future issues.

In summary, SubOptic exists because it is the one conference event that is run by the industry for the industry.

This time the conference will take place at the Conrad Hotel, Dubai, UAE.

Dubai is strategically located on the Eastern coast of the Arabian Peninsula, in the south west corner of the Arabian Gulf. With year-round sunshine, intriguing deserts, beautiful beaches, luxurious hotels and shopping malls, fascinating heritage attractions and a thriving business community, UAE & Dubai receives millions of leisure and business visitors each year from around the globe.

As the host of SubOptic 2016 event, E-marine looks forward to seeing you all in Dubai, UAE.

WELCOME REMARKS

WELCOME FROM THE PRESIDENT OF THE SUBOPTIC EXECUTIVE COMMITTEE

YVES RUGGERI

The SubOptic conference and convention comes around only once every three years and it is the premier event for the submarine cable industry – an event put on by the industry for the industry. On this occasion on behalf of the SubOptic Executive Committee I welcome you to Dubai for the ninth event in our series, SubOptic 2016, hosted by E-marine PJSC.

This will be the first time that a SubOptic event has been held in the Middle East and it is quite apt that on our 30th anniversary we have ventured into this region, which is a crossroads for different cultures and a critical hub in the global undersea telecommunications network.

SubOptic is the most important conference for the industry and I am sure it will continue to enjoy the success of past years. It is the one event that encourages all people from the industry and community to get together and discuss issues that are critical to our business.

As in previous events we have shaped the programme to provide maximum value to the industry and to encourage attendance to the varied and broad range of presentations. These have been organised by our Programme and Paper Committees, led respectively by Alice Shelton from Alcatel-Lucent Submarine Networks and Mark Andre from Orange, whose structure has followed the pattern initiated at SubOptic 2013.

These committees are formed entirely by volunteers, including nearly 60 abstract reviewers - and it is only by their hard work and dedication that we can maintain the professional and independent nature of the event and make it truly - "For the Industry, by the Industry".

With submarine system based networks being ever more critical to the global economy I look forward to your full participation in an event which will explore the "Emerging Subsea Networks" and really demonstrate that they are "The World's Expanding Treasure".

I look forward to meeting you whilst you are here.

WELCOME REMARKS

INTRODUCTION FROM THE CHAIRMAN OF THE PROGRAMME COMMITTEE

ALICE SHELTON

On behalf of the Programme Committee I'm pleased to welcome you to SubOptic 2016. The Programme Committee Chairman, together with a small group of Strategic Advisors including the Papers Committee Chairman are responsible for formulating the conference programme and we are pleased to present the programme for SubOptic 2016 in the following pages.

Before deciding on the programme structure for SubOptic 2016, a review of all the feedback received after SubOptic 2013, either via the survey or via emails or comments, was done. Looking at the comments, it was clear that there were many people who felt there was too much in parallel and that we should try to avoid three parallel oral sessions, cutting back the total quantity of oral presentations and being more selective in choice of these presentations. It was also felt that the poster session was too crowded in space and that there were too many posters to possibly get round in one session.

Mark Andre, the Papers Chairman and I have addressed these comments and the programme for SubOptic 2016 is based on two parallel sessions for masterclass tutorials and oral presentation sessions. There are six masterclass tutorial sessions planned for Monday afternoon on a very wide range of topics, full details of the masterclass topics are included in the conference programme. I thank all the masterclass tutorial presenters very much; preparing material for a 90 minute session is a substantial task.

Mark and the Papers Committee have selected 65 papers for oral presentation which are organized in 13 oral sessions across the three days. It may still be difficult to choose which sessions to attend, as with only two parallel sessions, we expect the quality of the presentations to be exemplary!

There will be a longer poster session to allow everybody to get round all 40 posters with the chance to discuss with the presenters of the papers in an informal one-to-one way.

We plan also to celebrate 30 years of SubOptic. When the first SubOptic conference was held in Versailles in 1986, optical submarine cables were in their infancy. The World Wide Web was on a drawing board and the driver for submarine systems was purely voice traffic. All systems were regenerator based with a single fibre pair having a capacity of 280Mbit/s.

We have since introduced optically amplified systems, originally based on a single wavelength per fibre pair, now deployed as Dense Wavelength Division Multiplexed (DWDM) systems with in excess of 100 wavelengths per fibre, with individual channel bit rate capacities of 100 Gbit/s and more, an increase in capacity of more than 1,000 times each year.

In preparing for the conference over the last 18 months I have asked for any mementos, memorabilia that people have from the early days of SubOptic. Alas it seems that nobody has kept any shark teeth damaged cable lengths or the cartoon 'The Big Plunge' shown at the first SubOptic, nor that space in cellars and garages is used for old SubOptic gifts or original optical amplifier models.

Nevertheless there will be plenty to celebrate at the 30th anniversary session on the final afternoon, Thursday at 4pm. I greatly look forward to what Elaine Stafford and 'her boys' have pulled together and I would also like to thank Nicole Starosielski and Bronwyn Holloway-Smith for their support in preparing this session. Without divulging more of the content, I urge everybody to attend and enjoy this final session of SubOptic 2016 and the chance to celebrate 30 years of SubOptic in true SubOptic style!

I look forward to meeting you sometime during the conference.

WELCOME REMARKS

INTRODUCTION FROM THE CHAIRMAN OF THE PAPERS COMMITTEE

MARK ANDRE

I feel honoured to have been appointed as SubOptic 2016 Papers Chairman, supporting Alice who leads the Programme Committee and had my role at the previous SubOptic edition. So far so good! We have achieved some critical milestones in the past two months and we are now heading at finalizing the last details of the oral sessions and posters. The "Call for Papers" for SubOptic 2016 was launched in May 2015 and the deadline for submission was extended only once! The Review Committee worked on the abstracts for two months, scrutinizing the descriptions of the papers, making sure they were provided under the right topic area, requesting clarifications to authors, etc. A long process and telling figures: 59 reviewers, 3722 individual scores. A fair selection process too: all reviewers ranked their papers with no indication about the author or the company. In December 2015, the six Vice Chairmen made their recommendations for SubOptic 2016 and notifications were sent to all authors before the Christmas break. I guess that some well-deserved free time was used for the conference…as the deadline for submitting the final version of the paper was 31st of January 2016. Extended only once also! Despite the unexpected number of authors withdrawing their paper, most of the 13 oral sessions now have their papers labelled and their chairpersons identified; a new family of good-will people! The preparation of the poster event is also 99% complete (never say 100% to remain on the safe side).

I would like to thank very much Mohamed, Graham, Peter, Edwin, Stephen and Guillaume for accepting my proposition to lead a review team and bring their experience/knowledge for the benefit of the event. Thank you also for the ongoing support. There will be a drink at Dubai.

All my gratitude to the reviewers too, it's never an easy task to score multi-pages paper based on a few lines. There can't be a drink at Dubai, I'm sure you can understand, but I truly thank you and appreciate your efforts.

Last but not least, a warm welcome to the oral sessions chairpersons for this SubOptic 2016 edition. I'm confident that they will bring their enthusiasm and make these sessions a great place for learning, asking, thinking, challenging the audience and the authors themselves!

KEYNOTE SPEAKERS

DR. EESA MOHAMMED BASTAKI, PH.D.

PRESIDENT, UNIVERSITY OF DUBAI

Former CEO, ICT Fund
Recipient of Emirates for Sciences, Arts & Literature in 2009
Recipient of Middle East "ICT and Knowledge Development CEO Excellence Award".

Dr. Eesa Bastaki is President of the University of Dubai and former CEO of the ICT Fund where he actively led the effort to create an eco-system in the UAE ICT industry, by encouraging entrepreneurship, funding R&D projects and University scholarships and implementing ICT initiatives at the school level.

During his distinguished career he held many senior posts including Director of Education & Technology at the Dubai Silicon Oasis Authority (DSOA), Chairman of the Energy Section at the UAE University (UAEU) and Chairman of the Technology Section at the Technology & Energy Research Center of the UAEU. Dr. Bastaki is one of the founders of DSO and RIT-Dubai, and he is the founder of the IT Center in Al-Ain Municipality.

Dr. Bastaki's current professional activities include Chairman of the Technical Committee for the Emirates Energy Awards, Chairman of the Board of the Emirates Science Club, and Member of the Board of the Cultural & Science Association.

Born in Dubai, Dr. Bastaki is a UAE national scientist and researcher; he studied abroad where he received his B.Sc. and M.Sc. degrees in Electrical Engineering from the University of California, San Diego and Ph.D. from the University of California, Irvine. His research interests are Multiple Access Communications, Coding and Synchronization.

Dr Bastaki is the recipient of Sheikh Rashid's Award for Scientific Excellence. In 2009, he received the UAE's highest award "The Emirates Awards for Science, Arts and Literature" in sciences. In 2014, he received the Middle East "ICT and Knowledge Development CEO Excellence Award".

Dr Bastaki will speak on the UAE initiative to create Smart Cities by the deployment of Smart systems in the Information, Electronics and Communications Technology (IECT) sector. This sector is growing so rapidly that it is difficult to keep up with the speed of its advancements. Three main trends are seen:

- Embedded intelligence through electronic devices
- Improved connectivity through resilient communication systems
- From person-to-person to machine-to-machine

These three trends will lead to Ubiquitous Internet of Things in all services and transactions. In parallel, UAE has worked in knowledge creation to assure the sustainability of the dynamic economy.

KEYNOTE SPEAKERS

GERD LEONHARD
FUTURIST AND CEO THE FUTURES AGENCY

Gerd Leonhard is a widely-known and top-rated futurist, with over 1500 engagements in the past 15 years and a combined audience of over 1 million people. Gerd focuses on near-future, 'nowist' observations and actionable foresights in the sectors of humanity, society, business, media, technology and communications.

Gerd is also an influential author, a sought-after executive 'future trainer' and a trusted strategic advisor. He is the co-author of the best-selling book The Future of Music and the author of 4 other books. Gerd is also the host of the web-TV series The Future Show and the CEO of The Futures Agency, a global network of over 30 leading futurists.

Gerd is considered a leading voice on a wide range of topics including digital transformation and the discovery of digitally-native business models, the opportunities and challenges of an exponential society, a sustainable business and cultural ecology, social media and communications, TV / film, radio and broadcasting futures, mobile content and commerce, innovation, leadership and entrepreneurship, 'hard-future' consumer trends, human-machine futures and AI, the IoT, big data and automation, next-generation advertising, marketing and branding, as well as sustainability and related 'green future' topics. In 2006, The Wall Street Journal called Gerd 'one of the leading Media Futurists in the World', and Wired Magazine listed Gerd as #88 of the top 100 influencers in Europe in 2015.

Gerd's keynotes, speeches and presentations are renowned for their hard-hitting and provocative yet inspiring, often humorous and always personal, motivational style. Gerd is highly regarded as a global influencer and has advised many business leaders and government officials around the globe.

His diverse client list of over 200 companies includes Unilever, Lloyds Bank, WWF, YouTube, Nokia, The Guardian, Google, Sony, Telkom Indonesia, Siemens, RTL, ITV, BBC, France Telecom, Orange, Deutsche Telekom, MTN, The Financial Times, DDB, Ogilvy, Omnicom, the European Commission, Mandarin Oriental Hotel Group, VISA, Volkswagen and many others.

Gerd's background is in the music business; in 1985 he won Berklee College's 'Quincy Jones Award' and subsequently spent 12 years working as a professional guitar player, composer and producer. He then caught the Internet-bug and became a digital music &media entrepreneur, serving as Founder/ CEO of several Internet startups, based in San Francisco. In 2002, following the .com meltdown and the 9/11 crisis, Gerd returned to Europe and discovered his new calling as a futurist.

He now travels around the globe to speak at leading conferences and events, company retreats, seminars and in-house trainings, and offering his unique 'Future Experience' trainings along with his colleagues at The Futures Agency, an international organization that Gerd founded in 2010 to meet client demand for tried-and-tested future-trainers, speakers and personalities.

In this keynote for SubOptic 2016, Gerd will share his 2020 foresights on technology, business and society. Exponential technological change is impacting every facet of our society, from communications and media to commerce, transportation, medical and energy. Increasingly, many things that looked like science fiction only a few years ago have now become science-fact: self-driving cars, virtual reality headsets, human genome editing technologies, automated language translation, AI and cognitive computing and much more.

Connectivity is a key factor in all of what Gerd calls the ''10 ations" i.e. digitization, automation, virtualization, disintermediation and others, and so is security and what Gerd calls 'digital ethics'.

At the same time that technology is changing our world dramatically, humanisation of technology has also become a key topic around the globe: how do we make sure that technology does not overpower us, or take things away that we'd rather keep?
Apart from the challenges, Gerd will focus on the key future opportunities and lead the audience towards an inspiring future vision.

GUEST SPEAKERS

H.E. MAJED AL MESMAR
TELECOMMUNICATIONS REGULATORY AUTHORITY

SubOptic welcomes Majed Almesmar as the conference opening speaker at SubOptic 2016.

Majed Almesmar holds a bachelor degree of science in Electrical Engineering from Northeastern University in Massachusetts - USA, graduated in 1990. Has over 24 years of experience in the field of telecommunications. He held various top level management within Etisalat organization such as Chief Technical Officer (CTO) of Etisalat-Mobily in Saudi Arabia, Chief Operating Officer (COO) in Etisalat-India and Group Senior Vice President – Special Projects in Etisalat-UAE.

In April 2010, Mr. Almesmar joined the Telecommunications Regulatory Authority as Deputy Director General for telecommunications sector.

ALI BIN JARSH
E-MARINE

Ali Bin Jarsh is Chief Operating Officer at E-marine PJSC, For the past three years, he has been managing E-marine's Technical & Marine Operations section.

Ali started his career with Etisalat in early 1991 and worked various departments within Etisalat. He has been involved with the submarine cable industry since 1995 and was part of FLAG, SMW3 and SMW4 technical committee from Etisalat. In 2007 Ali joined CANAR TEL in Sudan as CEO where he have commissioned FALCON landing station in Port Sudan and create whole department. Later in 2011 Ali was appointed as ZANTEL CEO in Tanzania and managed the EASSy landing station, commissioned SEAS landing and established the wholesale department. After successful completion of overseas assignments in 2013 Ali joined E-marine as COO in Dubai, UAE.

Overall Ali has worked in Telecommunications for more than 25 years and taken a wide range of roles such as R&D, submarine networks design, installation and marine services and other management roles. Ali holds BSc Electrical Engineering Degree from Tri University in Indiana, USA.

Ali Bin Jarsh will provide the conference closing speech.

INVITED SPEAKER

STEPHEN B. ALEXANDER
SENIOR VICE PRESIDENT AND CHIEF TECHNOLOGY OFFICER AT CIENA

With more than 20 years of telecom experience, Mr. Alexander is currently serving as Ciena's Senior Vice President and Chief Technology Officer.

Mr. Alexander is an IEEE Fellow and was the recipient of the IEEE Communications Society Industrial Innovation Award in 2012. He is currently an Associate Editor for the IEEE / OSA Journal of Optical Communications and Networking. He has served as a member of the Federal Communications Commission Technological Advisory Council, as an Associate Editor for the Journal of Lightwave Technology, as a member of the IEEE / LEOS Board of Governors, and was a General Chair of the conference on Optical Fiber Communication (OFC) in 1997.

Mr. Alexander received both his B.S. and M.S. degrees in electrical engineering from the Georgia Institute of Technology. He has been granted 18 patents and has authored a text on Optical Communication Receiver Design as well as numerous conference and journal articles.

The Papers and Programme Chairmen requested an Invited Paper on Software Defined Networking, Steve Alexander kindly agreed to present the paper. It will be presented during the last Paper Session TH2B on Thursday 21st April 2pm – 3.30pm.

MASTERCLASS TUTORIALS

1. Extending Capacity and Reach - Demand and Supply

We are pleased to have confirmed a masterclass tutorial session to be provided by Professor Polina Bayvel and researchers from the Optical Networks Group at University College London (UCL), currently engaged in the large EPRSC funded UNLOC project.

UNLOC - UNLocking the capacity of Optical Communications - is a programme funded by the UK Engineering and Physical Sciences Research Council (EPSRC) to research the future of optical communication systems.

It is recognized that global communication systems are rapidly approaching the fundamental information capacity of current optical fibre transmission technologies. To date, growth has been supported by falling cost/bit but by 2020 we may be running out of capacity. Capacity will become a rare commodity. This will have a devastating impact on the economy, causing bandwidth to be rationed or prices to increase: either would be devastating for economic growth.

To set the scene for the presentation of the new approaches to unlock future capacity beyond the limits of current technology and tailored to the nonlinear optical channel, the first part of the session will describe the needed future scaling of submarine networks. Vijay Vusirikala and Valey Kamalov from Google will present on the drivers and trends for traffic growth for large data centre and cloud operators. This first part will also discuss how the business models, traffic growth pattern and diversity requirements are different from traditional subsea network models. They will also outline the value of open subsea cables and continued innovation in wet plant design and deployment.

Dr Robert Maher, Dr Dom Lavery and Professor Polina Bayvel, from UCL's Optical Networks Group, will then discuss a range of promising digital signal processing techniques for unlocking the capacity of optical communications.

The success of next-generation multi-terabit/s optical transmission networks hinges on the development of optical transceiver subsystems that provide a significantly lower cost-per-bit than the extremely successful 100 G predecessors they will be replacing. In addition, this must be achieved within the unique power constraints inherent to submarine optical networks, while simultaneously maintaining or indeed increasing transmission reach. To achieve this objective, significant research focus has been placed on the generation and reception of higher order modulation formats, such as dual polarisation 16QAM and 64QAM, which have already been demonstrated in laboratory based trans-oceanic transmission systems up to 10,000km.

However, as the order of the modulation format increases, a corresponding increase in launch power is required to achieve an acceptable signal-to-noise ratio at the end of the transmission link. Higher powers inevitably result in significant signal distortion arising from fibre nonlinearity, which, if uncompensated, will limit the throughput of future optical transport systems. The masterclass tutorial will review different nonlinearity mitigation techniques that will enable the transmission of higher order modulation formats over submarine systems which can significantly increase reach, capacity and spectral efficiency in submarine optical fibre systems.

Topics that will be covered:

- Scaling Submarine Networks: Datacentre Operator Perspective
- Overcoming and using nonlinearities to maximise system capacity
- Design of transceivers with optimal modulation, coding and DSP

Presenters:

- Valey Kamalov and Vijay Vusirikala (Google)
- Dr Robert Maher, Dr Dom Lavery and Professor Polina Bayvel (University College London)

Moderator: Steve Grubb (Facebook)

2. Legal Innovation & Jurisdiction Creep

Two separate topics will be covered during this 90 minute masterclass session.

A - Legal Innovation

Covering the legal implications of the new market conditions such as sales of spectrum not capacity and updates on many other legal matters for private and consortium cables.

Topics that will be covered:

- Legal implications of new market conditions (sales of spectrum not capacity)
- Sale and leaseback of submarine networks and capacity
- Resale restrictions in capacity contracts etc
- Protecting a purchaser of IRUs on a consortium cable from the insolvency of the seller
- Turning a private cable into a consortium
- Creating a new sales channel for a consortium

Presenter:

- Mike Conradi (DLA Piper)

B – Jurisdiction Creep

A masterclass on marine jurisdictional problems for submarine cables starting with an explanation of the rights of, and claims by, coastal states to the different maritime zones, describing the many problem areas where disputes can occur that can significantly delay and put at risk a submarine cable project, concluding with a practical section focused on remedies.

Topics that will be covered:

- Rights of, and claims by, coastal states to maritime zones
- Territorial sea, contiguous zone, EEZ, continental shelf, high seas, and the Area
- Authorities control beyond the off-shore 12 mile territorial waters – where is it happening?
- Varying requirements for securing landing licences and operational permits in different regions of the world
- What impact does this have to submarine cable projects on permits, timescales, costs etc
- Problem areas covering:
  - Permissible but harmful assertions of jurisdiction
  - Excessive assertions of jurisdiction inconsistent with international law
  - Failure to coordinate marine activities and protect submarine cables
  - Failure to address emerging technologies and industries
  - Failure to plan adequately for future submarine cable development
  - Lack of private right of action under international law
  - Lack of UNCLOS framework for resolving territorial disputes
- Practical solutions

Presenter:

- Kent Bressie (HWG)

Moderator: Carl Osborne (TATA Communications)

MASTERCLASS TUTORIALS

3. Optical Power Budgets – the key to the supply or upgrade of any submarine system?

In April 2015 Tony Frisch from Xtera invited anybody interested to join a Working Group on Optical Power Budgets. Two months later the Working Group had 12 members, all people with a wealth of experience in the industry, representing turnkey and upgrade suppliers, system owners, traditional carriers and OTT players. A demonstration of the willingness of the industry to collaborate on a sensitive topic, the Working Group has been running since June and is ready to present its findings at SubOptic 2016.

Optical power budgets are key to the supply or upgrade of any submarine system, yet they sometimes appear – or are made to appear? – complex and difficult to understand. In reality, the essential principles are not that difficult to understand, even if deriving some of the numbers requires sophisticated tools and experience. The objective of the tutorial is de-mystify the essential processes, explain what the numbers mean and to show when it is necessary to go beyond approximations that are often used.

The masterclass will explain as simply as possible the essentials of how a power budget works and will clarify the essential similarities and differences between the two ITU templates which are used to present them. After this, a number of important refinements which aim to improve the accuracy of the budget will be explained. Finally there will be some discussion of how to compare or check budgets including real measurable parameters and how one might create and validate a budget for an "open system," where the Line is supplied independently of Terminal equipment.

Participating in the Working Group were experts from AJC, Alcatel-Lucent, AT&T, Ciena, Orange, Microsoft, Tata, Telstra, Verizon and Vodafone.

Topics that will be covered:

- Introduction – use in Design, Bidding and Acceptance
- Fundamentals – with a few simplifications
- How it applies to New builds, Upgrades, Unrepeatered Systems
- How to construct a Power Budget
  ITU-T formats Old and New ("for coherent systems")
- How it feeds into Acceptance
- Refinements – removing the simplifications
  – handling ROPA or DRA
- Discussion – how to do comparisons / sanity checks
  – how to handle "open systems"

Presenters:

- Priyanth Mehta (Ciena)
- Jamie Gaudette (Microsoft)

Moderator: Tony Frisch (Xtera)

4. Competition for Seabed Use - The Impact on the Planning, Installing and Maintenance of Submarine Cables

The primary objective of the masterclass is to address the increasing competition for seabed use in an increasingly complex regulatory environment and the impact on submarine telecommunications cables from a planning, survey, installation and maintenance perspective.

Topics that will be covered

- Emerging impacts from renewable energy
- Growing impacts from subsea mining
- Increasing demands from the hydrocarbons industry
- Coastal developments
- Marine parks and Marine Protected Areas
- Increase in protected marine habitats and designated sites of habitat concern
- Future regulation in Areas Beyond National Jurisdiction

Presenters:

- Kent Bressie (HWG)
- Tony Fisk (Pelagian)
- Kate Panayotou (GHD Sydney)
- Kai Schmidt (DTAG)

Moderator: Graham Evans (EGS)

5. MythBusters 2: Revenge of the Cable Myths

Topics that will be covered:

The mythbusters are back with a brand new set of subsea cable myths to explode! After surviving the 2013 Paris SubOptic event with all extremities intact, the team of intrepid pseudo-scientists return to some of the most persistent myths in our industry:

- Internet traffic is doubling every two years.
- Bandwidth prices will eventually have to go back up.
- And the ever-popular: a majority of Internet traffic is "adult content".

In addition to revisiting these myths and testing new ones, the mythbusters will also cast their gaze back further in time, to see which of the industry truisms that guided cable builds 30 years ago are busted … and which hold true.

Presenters:

- Alan Mauldin and Tim Stronge, with special guest star, David Ross

Moderator: David Ross (David Ross Group)

MASTERCLASS TUTORIALS

6. Oil & Gas – Projects & Technologies

Again a two part masterclass covering commercial and technical aspects of Oil and Gas projects and technologies.

The fibre optic concept for offshore platforms is no longer a new concept, but the industry has been knocked back recently by the significant drop in oil prices. The first part of this masterclass will discuss how we can approach and sometimes re-structure the current opportunities to accommodate a low oil price without impacting the key criteria of safety and reliability.

Topics that will be covered:

- The fibre optic concept for offshore platform has passed the tipping point and it is moving into the main stream for a number of reasons.
- The industry is facing some headwinds in the form of lower oil prices and high costs.
- How can we approach and sometimes re-structure the current opportunities to accommodate a low oil price ?
- Low cost does not mean low quality or lower safety standard
- What are the Cost, risk, threat not to allow these projects to happen ?

This commercial presentation will be complemented by a presentation on technologies covering Cable System Requirements and Technical Solutions for FO Subsea cables for the Oil & Gas Industry

Topics that will be covered:

- Introduction
  - FO in offshore applications
  - Comparison with alternative solutions
- Specifications and Requirements
  - Standards
  - Expectations and requirements specific to the Oil&Gas industry
- Typical Delivery Scope
  - FO cables
  - Accessories, in particular sub-sea terminations, riser solutions and top-side hang-off termination
  - Installation reels
- Challenges
  - Ease of installation
  - Reliability
  - Wet mate connectors (optical, electrical signal and electrical power)
- Example projects

Presenters:

- Pierre Tremblay (OSI)
- Inge Vinermyr (Nexans)

Moderator: Yohann Benard (Alcatel-Lucent Submarine Networks)

MASTERCLASS TUTORIAL BIOGRAPHIES

PROFESSOR POLINA BAYVEL

Polina Bayvel is Head of the Optical Networks Group (ONG), UCL which she also set up in 1994. She was a Principal Systems Engineer with STC Submarine Systems Ltd (Greenwich, UK), and Nortel Networks (Harlow, UK, and Ottawa, Canada), where she was involved in the design and planning of optical fibre transmission networks. She has authored/co-authored more than 300 refereed journal and conference papers in areas of wavelength-routed optical networks, high-speed optical transmission, and the study and mitigation of fibre nonlinearities.

Prof Bayvel is a Fellow of the Royal Academy of Engineering (FREng), IEEE and the Optical Society of America. She was the recipient of 2013 IEEE Photonics Society Engineering Achievement Award, and the 2014 Royal Society Clifford Patterson Prize Lecture and Medal. In 2015 she and 5 members of ONG received the Royal Academy of Engineering Colin Campbell Mitchell Award for their pioneering contributions to optical communications technology.

KENT BRESSIE

Kent Bressie is a partner and head of international practice at Harris, Wiltshire & Grannis LLP in Washington, D.C. Kent specializes in cross-border and national-security regulation of telecommunications networks, investment, and technology and law-of-the-sea issues. He works extensively in the undersea cable sector and has led various industry-wide regulatory-reform and cable-protection initiatives. He has led many licensing and merger review proceedings for undersea cable operators and carriers before the FCC, Team Telecom, and the Committee on Foreign Investment in the United States. He chairs the undersea cable working group of the FCC's Communications Security, Reliability, and Interoperability Council and has long served as counsel to the North American Submarine Cable Association.

MASTERCLASS TUTORIAL BIOGRAPHIES

MIKE CONRADI

Mike is one of the lead partners for telecoms matters at DLA Piper, which is one of the world's largest law firms. He is ranked as one of the leading telecoms lawyers globally by the various legal guides, with Chambers & Partners describing his "ability to grasp complex technical points quickly" and as well as his "skill in navigating through the constraints of a tough regulatory environment".

Mike has particular expertise in the submarine cable sector. He has worked, to varying degrees, on more than 30 different systems and was the only private practice lawyer to sit on the Legal working group for SubOptic, which drafted a template system supply agreement.

In October 2015 a project he led involving the creation of a new sales channel for the ACE consortium cable won the TMT Law Firm of the Year award at the African Legal Awards. Other work just in 2015 includes advising on a new cable planned between in Myanmar and Malaysia, advising on a new Caribbean system and advising a large "anchor tenant" pre-sale customer in connection with a new trans-Pacific cable system.

Mike has delivered a "legal masterclass" to every SubOptic conference since 2004.

GRAHAM EVANS

Graham Evans has been active in the submarine telecommunications community for 25 years - a regular speaker at submarine telecommunications conferences and workshops worldwide. Graham has over 37 years' experience as a marine geoscientist and is a Director of the EGS Survey Group and Managing Director, Global Subsea Cable Business, responsible for the Group's submarine telecommunications business worldwide and has been involved in most submarine cable projects in the Middle East, Asia, the Pacific and South America since 1990. Graham was also a contributing author of Submarine Cables: The Handbook of Law and Policy. In addition to Group responsibilities, Graham is Executive Director of EGS companies in Australia and USA and represents EGS on both ICPC and SubOptic Executive Committees. Graham holds a BSc in Geology and BA in Earth and Environmental Sciences.

TONY FISK

Tony has over 28 years of experience in the subsea cables and telecommunications sectors, encompassing offshore surveying, subsea cable installation, permitting, mobile and terrestrial networks, information security, programme/ project management, business and technical consultancy, with Wimpol, Worldwide Ocean Surveying Limited, Cable & Wireless Marine, Lucent Technologies, Orange and France Telecom Group. Tony is a degree qualified Oceanographer, a FIG/IHO Cat A Hydrographic Surveyor, a Chartered Hydrographic Surveyor (MRICS); and a Member of the Institution of Royal Engineers (MInstRE) as a retired RE(v) officer.

2010 saw Tony join Pelagian Ltd as Commercial Director, covering bids, proposals and providing specialist management consultancy.

Tony currently chairs the Subsea Cables UK Technical & Regulatory Sub Group with strong recent focus on marine spatial planning issues and subsea cable policy proliferation resulting from the rapid onset of devolution in the United Kingdom.

TONY FRISCH

Tony Frisch started at BT's Research labs and then moved to Alcatel Australia, becoming involved in testing submarine systems. A move to Bell Labs gave him experience in terminal design and troubleshooting, after which he went back to Alcatel France, where he worked in Alcatel Submarine Networks' Technical Sales before moving to head Product Marketing.

He is now SVP, Repeaters and Branching Unit for Xtera Communications.

MASTERCLASS TUTORIAL BIOGRAPHIES

JAMIE GAUDETTE

Jamie Gaudette is the Senior Manager of the Transport Technology & Architecture team at Microsoft. Over the past 9 years, Jamie has helped lead the adoption of coherent technology onto undersea cables as an author of the revised ITU performance specifications, and through design and implementation of over 300 Terabits of coherent capacity onto undersea cables with Ciena and Microsoft. As part of great teams, his research produced 4 US patents in the field of undersea telecommunications, the best oral paper at SubOptic in 2013, and has won the Subtel Forums Award for Innovation for Submarine Line Terminating Equipment. Jamie is currently working on Data Center Networking and Open Submarine Cable Systems at Microsoft.

VALEY KAMALOV

Valey Kamalov is a senior staff optical transport engineer at Google since 2007, where he is focused on ensuring a cost-effective, highly scalable network that is easy to grow and operate. Prior to joining Google, he designed optical networks at Nokia Siemens Networks, carried out research and lectured at Moscow University and Russian Academy of Sciences, Institute for Molecular Sciences in Okazaki, Japan, and Georgia Institute of Technology in Atlanta, US. He received B.S. and Ph.D. degrees from Moscow University in quantum electronics, and his Sc.D. degree in chemical physics from the Russian Academy of Sciences. He is author/co-author of 100+ refereed papers in the field of optics.

DR DOMANIC LAVERY

Domaniç Lavery received the MPhys degree in Theoretical Physics from University of Durham, Durham, UK in 2009, and PhD degree in Electronic and Electrical Engineering from UCL (University College London), London, UK in 2013. His doctoral research focused on the use of digital coherent transceivers and their application to spectrally efficient, high capacity passive optical networks. He is currently continuing his work with the Optical Networks Group at UCL as a Research Associate within the EPSRC-funded UNLOC project, investigating digital signal processing techniques for enhancing signal quality in nonlinear optical fibre transmission systems. He is an active contributor to the field of optical communications, having authored or co-authored over 50 papers in this area. He is the recipient of 2013 Marconi Society Paul Baran Young Scholar Award and 2012 IEEE Photonics Society Graduate Research Fellowship Award.

ALAN MAULDIN

Alan Mauldin is a Research Director at TeleGeography. Since joining the company in 2000, Mr. Mauldin has served as a principal analyst in many areas of TeleGeography's research, including international Internet infrastructure, submarine cable systems, and bandwidth demand modeling. Mr. Mauldin heads TeleGeography's Global Bandwidth Forecast and Global Internet Geography research services. He holds a degree from Baylor University.

MASTERCLASS TUTORIAL BIOGRAPHIES

DR ROBERT MAHER

Robert Maher received his BEng and PhD degrees in Electronic Engineering from Dublin City University, Dublin, Ireland, in 2005 and 2009, respectively. He was a Postdoctoral Researcher with the Radio and Optical Communications Lab at Dublin City University, working on optical comb sources for next generation coherent transmission systems. In 2010, he received the prestigious IRC Marie-Curie Fellowship and joined the Optical Networks Group at UCL (University College London). He is a Senior Research Associate at UCL and leads the experimental research work within the £4.8 million EPSRC UNLOC programme (UnLocking the capacity of optical communications). He is Senior Member of IEEE and co-recipient of the Colin Campbell Mitchell Award and Medal from the Royal Academy of Engineering for his pioneering contributions to the field of optical communications. His research is in spectrally efficient, high-capacity long-haul transmission for coherent optical networks, fibre nonlinearity mitigation techniques, dynamic optical networking and optical sources, with over 80 publications in these areas.

PRIYANTH MEHTA

Priyanth Mehta is an optical systems designer for the submarine research and development team at Ciena in Ottawa, Canada. He received his B.Sc. (Hons) (2007) and M.Sc. (Hons) (2009) in Optical Physics from the University of Auckland, New Zealand. He then obtained a PhD in the nonlinear properties of semiconductor optical fibres from the Optoelectronics Research Centre, University of Southampton, in 2013. At Ciena, his primary fields of research are focussed on improving transmission capacity, reach, and user operability through modem and line terminal enhancements. Priyanth also serves as a contributing delegate in standardisation on the International Telecommunication Union (ITU) for Optical Transport and Access.

KATE PANAYOTOU

Kate is a principal environmental scientist with over 15 years' experience. Kate manages the delivery of environmental and social impact assessments (ESIA) for fibre optic submarine cables, including permitting. She has an understanding of government permitting processes, and the legislation relevant to fibre optic submarine cables. In addition, her experience encompasses the preparation of coastal adaptation guideline documentation, coastal geomorphological assessments, environmental risk assessment, environmental monitoring and stakeholder engagement and community consultation.

Kate draws on her experience in the private, government and research sectors for understanding of diverse client needs and the interface between various stakeholders in order to engage and impart technical knowledge into clear, concise and appropriate messages for the client within the fibre optic submarine cable industry. Kate is currently Board Member of PIANC Australia and PIANC YP International Delegate for Australia.

DAVID ROSS

David Ross is President and CEO of The David Ross Group Inc. (DRG), a consultancy dedicated to developing international communications networks. Mr. Ross has served the industry since 1970, holding positions in Bell Laboratories, AT&T, and Tyco Submarine Systems prior to founding DRG in 1999. He holds BSEE and MSEE degrees from the University of Michigan.

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KAI SCHMIDT

Kai Schmidt is Vice President Transport & Technology in Deutsche Telekom AG's Global Network Factory. Kai's responsibilities stretches from the international Leased Lines Business of Deutsche Telekom, international Telehousing and site Management. He is as well responsible for DTAG's sea cable operations as well as the respected sea cable landing stations in Germany. He is as well a member of the MC for SMW3 / TAT14 beside various other sea cables owned by DTAG or where DTAG is part of the consortia. Due to the heavy use of the seabed, particular in the North Sea, Kai's team is in close contact with various other seabed users, e.g. energy companies, oil and gas pipeline providers, regulatory authorities, government body's at EU and National Level's.

TIM STRONGE

Tim Stronge is Vice President of Research at TeleGeography. His areas of expertise include international voice traffic, terrestrial and submarine cable systems, and international bandwidth markets. Since joining TeleGeography in 1996, Tim has served as a principal analyst in most areas of research, including network infrastructure, bandwidth demand modeling, cross-border traffic flows, and telecom services pricing. He holds a Master´s degree in International Economics from Johns Hopkins University and a B.A. from the College of William and Mary.

PIERRE TREMBLAY

Pierre cumulates 25 years of experience in the telecommunications industry. He spent the first 16 years of his career at Alcatel Submarine Networks holding positions in R&D, engineering, project management, and sales of international cable networks.

Using his unique blend of technical, operational, and commercial expertise Pierre has been working with telecom operators and oil and gas companies since 2006 to plan and deliver several submarine cable projects. Pierre is a regular presenter and chair at conferences such as OFC, PTC, Suboptic, SubnetWorld, and OSEA.

In addition to a bachelor of Electrical Engineering, he holds a Master's Degree in Science in the field of Optical Communication and an MBA.

INGE VINTERMYR

Inge Vintermyr graduated from the Norwegian Institute of Technology in 1989 with a Ph.D in Materials Science, and he joined Nexans Norway Norge AS the same year. He has been working with research, development and engineering of fibre optic cables and accessories with special emphasis on offshore applications. Technical Mgr for the Communications Cable Department since 2000.

VIJAY VUSIRIKALA

Vijay Vusirikala currently leads the Optical Transport Architecture and Engineering teams at Google, where he is focused on solutions for scaling and optimizing Google's optical network covering client optics, metro optical, long haul and submarine links. Prior to Google, Vijay was at Infinera, Motorola and Sycamore Networks in senior marketing, business development and architecture roles working on optical networks and systems ranging from backbone core to access networks. Vijay has published extensively, spoken at numerous industry events, and holds several patents in optical devices and systems. He obtained a Ph.D from the University of Maryland, College Park in optoelectronic integration, and a BSEE from IIT, Madras in India.

ROUND TABLES

MARKETS ENVIRONMENT FOR UNDERSEA CABLE NETWORK PROVIDERS: WILL THE EXCITEMENT CONTINUE ?

The subsea cable sector has seen a remarkable resurgence of strategic activity and capital infusion since the last SubOptic conference, with significant new strategic participants, M&A and pronounced new organic demand from converging industry bandwidth consumers and webcentrics.

This executive Roundtable discussion will feature the recent case studies of companies that have accessed the capital markets in a variety of different ways to find means to satisfy their capital requirements.

We will also discuss the strategic winds that are affecting progress for the sector and what the foreshadowing of these executives suggest for the future.

Lastly, we will also explore the prospects for more strategic M&A activity in the arena and how that may vary in different geographies around the world.

Organised and presented by Richard Lukaj (Bank Street), with panelists including Bjarni Thorvardarson (Hibernia Networks), Brian Mass (RTI), Shota Masuda (NEC) and Erick Contag (Globenet).

THE CASE FOR CABLES – PROTECTING AND ENHANCING THE GLOBAL TELECOMS ENVIRONMENT

For too long, the submarine cable industry has assumed that the world knows all about its significant contribution to global economics, environmental and social sustainability, promoting good relations with other seabed users, and critical regulatory matters. In 2015 the ICPC signed an MOU with SubOptic, and in this session – a 'must-attend' for all involved in any of these, we unpack the latest contribution of those in the submarine cable industry to the following areas:

- Other seabed users – how do we meet our objective for reliable telecommunications while achieving harmony with other legitimate seabed users?
- Economics – how do we communicate to stakeholders the value of submarine cable networks?
- Environmental – how do we prove the benign nature of cables?
- Legal and regulatory – what is coming down the track and how do we get ahead of the curve?

In this one hour session we will unpack the issues, inform industry on latest developments, debate the opportunities, and challenges, include time for questions and set out our response. The session will be presented by Dean Veverka (Southern Cross) – Moderator, Graham Evans (EGS), Nigel Irvine (Verizon Business), Keith Schofield (Pioneer Consulting) and Gary Waterworth (Alcatel-Lucent Submarine Networks).

REGIONAL LEADER FORUM – A LOOK INTO THE FUTURE?

Middle East Operators have played a key role in the development of submarine fibre links that connect to the global economies – east and west. As a result, they have positioned the region as a crossroads of the global internet.

In this session, we will explore the impact that this investment is having on the region today. We will hear from Middle East industry leaders on how they see telecoms directly impacting the personal and economic prosperity of the regions citizens, while building a green and sustainable technology foundation which will drive positive change for future generations.

Organised and presented by Ed McCormack (Ciena) and leading Middle East Executives:

- Dr Hessa Al Jaber, Former Minister of Information and Communications Technology in Qatar, Chairwoman of the Board of Directors of E'shailsat and Malomatia
- Saleem Al Balooshi, Executive Vice President, du
- Ghanim Al Falasi, Vice Chairman and Senior Vice President, Corporate Services, Dubai Silicon Oasis Authority
- Dr. Homoud M. Alkussayer, Vice President, Wholesale, Saudi Telecom
- Ali Amiri, Executive Vice President, Carrier And Wholesale Services, Etisalat

WORKSHOPS

THE PROMISE AND REALITY OF OPEN NETWORKS – TO BE (SLTE) OR NOT TO BE? THAT IS THE QUESTION

To buy a new cable with some fibre pairs lit, some dark, or all dark? Cable developers are asking themselves this question more frequently than in the past, yet it remains common practice to purchase the SLTE to light a new undersea network from the system supplier.

- What are the tradeoffs?
- The risks?
- The rewards?

SubOptic has assembled a panel of experts who will share their ideas and experiences on the challenges of contracting, constructing and accepting open (dark) networks.

Organised and presented by Elaine Stafford (DRG), with panelists Mark Enright (TE Subcom), Steve Grubb (Facebook), Vincent Lemaire (ASN), Elizabeth Riviera-Hartling (Ciena), Greg Varisco (Aquacomms) and Joseph Chan (PCCW).

WORKSHOPS

EXTENDING THE LIFE OF SUBMARINE CABLE SYSTEMS – ADDRESSING ISSUES AND CHALLENGES

In 2008, SubOptic launched the first Interim Activity Working Group, an activity ongoing between conferences, aiming to ensure that SubOptic serves the industry in an enduring and supportive manner while at the same time fostering debate in between the three year conference cycle.

The first Interim Activity in 2010 was to develop a framework based on best practice for a **Model Submarine Cable Construction Contract** and associated guidance. For SubOptic 2013, a group of industry experts from various companies led by Elaine Stafford from DRG, developed **The GUIDE**, focussing on the basic fundamentals of planning, constructing, owning and operating an undersea communications network, to fill a void in educational basics for both those who are new to the industry and those niche industry experts who wish to learn more about broad aspects of undersea telecommunications. All The GUIDE presentations are downloadable from the SubOptic website www.suboptic.org.

The current Interim Activity is on **Extending the Life of Submarine Cable Systems**, led by Keith Schofield from Pioneer Consulting. The move from regenerated submarine cable systems to optically amplified systems initiated a technologically dramatic paradigm shift as the dream to upgrade capacity from the landing stations (without touching the submerged cable and repeaters) became a reality. With this, and the advent of coherent technology, came unforeseen economical capacity growth on existing cables already well into their predicted operational life. This unexpected and competitive capacity potential initiated the tantalising prospect of not only continual upgrades, but also of extending the economic, technical and operational life of systems beyond initial design intentions.

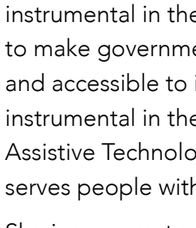
Today, as the early optically amplified systems continue to be upgraded and progress towards their design life, owners, suppliers and customers are developing ways confidently to assess the risks, extend the economic life of systems already in the water, and even to recover, redeploy and re-use systems. In the last two years, this cross-sectoral SubOptic Working Group of industry insiders has grappled with the issues that anyone thinking of upgrading, owning or taking capacity on an extended-life system needs to consider.

At SubOptic 2016 the findings of the Working Group will be presented. The session will cover both Technical and Commercial issues of lifetime extension and will be presented by Keith Schofield (Pioneer Consulting) – Moderator, Francis Charpentier (Orange), José Chesnoy (Independant Technical Consultant), Tony Frisch (Xtera) and Carl Osborne (TATA).

There will be ample chance to quiz our panel to see if they can address what's on your mind. In this vibrant workshop we gather the experts, review the technical and commercial issues, answer your questions, and at the very minimum, our aim is that those who join us will emerge with greater clarity on the issues to be addressed, the challenges to be overcome, and maybe even a few answers!

ROUND TABLE & WORKSHOP BIOGRAPHIES

DR HESSA AL JABER



Dr. Hessa Al Jaber was the former Minister of Information and Communications Technology for the State of Qatar. She is the third woman to assume a ministerial position within the country. During her tenure, Dr. Hessa has overseen the liberalization of Qatar's telecommunications market, ushering in an era of choice and competition. She has spearheaded the modernization of Qatar's ICT infrastructure, including founding the Qatar National Broadband Network, and Qatar Satellite, and founding Malomatia, a leading provider of professional technology services and solutions.

Passionate about ensuring that the benefits of technology reach all sectors, Dr. Hessa has led numerous initiatives to make Qatar a more inclusive society through ICT, and been instrumental in the streamlining of processes to make government more transparent and accessible to its citizens. She has been instrumental in the creation of the Qatar Assistive Technology Center (Mada), which serves people with disabilities in Qatar.

She is an expert on the impact of social media and social networking on society, and on strategies for driving growth and innovation by embracing the digital economy. Currently, she is United Nations ITU Broadband Commissioner for Digital Development, and a member of several boards of directors, including; Qatar University's Board of Trustees, the Board of Governors of the American School of Doha, the Qatar Financial Markets Authority, Eshail, Malomatia and many more.

With wide knowledge of ICT development, Dr. Hessa is a contributor to several working papers, studies, and research at relevant Arab and global conferences and symposiums.
Dr. Hessa holds a Bachelor of Science in Engineering from Kuwait University, and a Master's Degree and Ph.D in Computer Science from George Washington University, Washington, DC.

ROUND TABLE & WORKSHOP BIOGRAPHIES

GHANIM AL FALASI

Ghanim Al Falasi was appointed in 2011 as the Senior Vice-President of Corporate Services of Dubai Silicon Oasis Authority (DSOA). Ghanim brings with him extensive knowledge and know-how in the ICT sector through his previous role as Vice-President of the ICT Unit at Dubai Airports where he provided executive, technological and enterprise administrative leadership employment.

Heading three departments including: People happiness, Innovation& Excellence as well as Logistics; Al Falasi was also mandated to drive innovation strategic planning across the organization.

In 2013, Ghanim was appointed as the Vice Chairman of the Smart City Project Committee at Dubai Silicon Oasis Authority.
In his earlier association with the department of Dubai Airports, Ghanim successfully established an ICT directorate for DCA based on a study conducted to identify the infrastructure and services required for the delivery of outstanding performance. Al Falasi also worked for several governmental organizations including the UAE Ministry of Defence, UAE Armed Forces, and the Central Military Command.

Ghanim holds a BS degree in Computer Science from California State University of Hayward, USA.

DR. HOMOUD M. ALKUSSAYER

Dr. Homoud Alkussayer was appointed in 2011 as Vice President of STC's Wholesale Business Unit. Under his leadership, STC continues to be the leading Wholesaler in the Middle East by offering reliable and innovative telecommunications services to customers within and outside of KSA via a diverse best-in-class national and international network infrastructure. Prior to his current position, Dr. Alkussayer was Vice President of Regulatory Affairs where he successfully steered STC during the initial stages of telecommunications liberalization within KSA, and he was also instrumental in collaborating with key stakeholders to promote the adoption of ICT across the government, health, education and commerce sectors within KSA.

Dr. Alkussayer has more than 30 years of leadership and management experience in the telecommunications sector including Strategy Development, Business and Technology Development, Financial Planning, and Marketing, in addition to his active participation in regional organizations.

Dr. Alkussayer obtained his BSc and Master Degrees in Telecom Engineering from King Saud University – Kingdom of Saudi Arabia – in 1984 and 1992 respectively and his Ph.D. in Telecom Engineering from Bradford University - UK in 1998.

ALI AMIRI

Ali Amiri is Executive Vice President of Etisalat's Carrier & Wholesale Services (C&WS), responsible for all International and National Wholesale Services.
Ali continues to lead the evolution and development of Etisalat's global service portfolio and network. Etisalat C&WS offers the most comprehensive portfolio of Mobile, Data, IP, Voice and Roaming services. Etisalat has been recognized as the Best Middle East Wholesale Operator, every year since 2007.
Ali serves on the Board of Director on a couple of Etisalat's units / subsidiaries and was previously Chairman of the GSM Arab World and as a Member of the GSMA Executive Committee.
Ali is a graduate of Electronic Engineering from Kings College, London University.

JOSEPH CHAN

Joseph has more than 20 years' experience in the Telecommunication Industry. Held positions in engineering, project management, operation and maintenance for a number of subsea cable systems and projects. He currently heads the cable planning team of PCCW Global and is responsible for strategic planning and implementation of all PCCWG's subsea cable interests. Joseph, currently, is MC co-chair of AAE-1.

FRANCIS CHARPENTIER

Francis Charpentier is the Head of Purchasing and Deployment of submarine systems for Orange. He and his team take part actively to the Procurement Groups of many submarine cables (ACE, SMW3, SMW4, SMW5, IMW, SAT3/SAFE, LION1/2/3, TAT14, Americas-2, ECFS, CBUS).

ROUND TABLE & WORKSHOP BIOGRAPHIES

JOSÉ CHESNOY – INDEPENDENT EXPERT

José Chesnoy graduated from Ecole Polytechnique in 1977. After receiving a PhD in 1981 in femto-second laser physics, he entered the French Centre National de la Recherche Scientifique (CNRS). In 1989, José joined Alcatel's research organization and worked in this area of the advent of amplified submarine cables.

Later in 1999 José became head of System Development in the Submarine Business Division, then extended into the Terrestrial Network Division. He then moved successively to development of terminal WDM equipment, submarine product management and technical offers, and became CTO of Alcatel-Lucent Submarine Networks until the end of 2014.

During the course of his technical career, José has been granted more than 50 patents in the field of fiber optics and was nominated a Bell Labs Fellow in 2010. He organized many international workshops, including the chair of the program committee for SubOptic 2004, and was editor of the first edition of the book "Undersea Fiber Communication Systems" in 2002 and with a second edition in 2015.

José Chesnoy is retired from Alcatel, but remains an active expert inside the ecosystem of the submarine cable community. He has been nominated Legal Expert at the Paris court in 2015.

ERICK CONTAG

Erick Contag is the President and Chief Operating Officer for GlobeNet. Mr. Contag brings more than twenty years of sales, marketing, business development, strategy and corporate management expertise to GlobeNet. His responsibilities include strategic management of the company's business operations and expansion into new regions.

Mr. Contag has held executive positions in the U.S. and Latin America including founder, President and CEO of DataViz, a leading systems integration firm, CSO/CTO of Simbacom, a wireless service provider, and VP of Engineering for Protokol Sistemas, a leading network Integration firm. He also has served on the Board of Directors of several companies and organizations. In 2011, Mr. Contag was awarded the Global Telecoms Business Power 100 Award, an honor bestowed upon the most powerful 100 executives in the telecom industry.

Mr. Contag holds a degree in Electrical Engineering from the University of Tulsa, U.S. and an Executive Engineering Management certification from Instituto de Estudio de Superiores de Administración (IESA).

MARK ENRIGHT

Mark Enright has been with TE SubCom for 27 years. During his career he has held positions in Manufacture, Project Management and R&D. Mark's Customer Solutions team is responsible for Product Line Management, System Design and Implementation, System Testing & Training, Network Testing, Technical Customer Support Hotline and Power Feed Equipment. Mark holds a BSEE from Stevens Institute of Technology and a MSEE from Villanova University.

GRAHAM EVANS

Graham Evans has been active in the submarine telecommunications community for 25 years - a regular speaker at submarine telecommunications conferences and workshops worldwide. Graham has over 37 years' experience as a marine geoscientist and is a Director of the EGS Survey Group and Managing Director, Global Subsea Cable Business, responsible for the Group's submarine telecommunications business worldwide and has been involved in most submarine cable projects in the Middle East, Asia, the Pacific and South America since 1990. Graham was also a contributing author of Submarine Cables: The Handbook of Law and Policy. In addition to Group responsibilities, Graham is Executive Director of EGS companies in Australia and USA and represents EGS on both ICPC and SubOptic Executive Committees. Graham holds a BSc in Geology and BA in Earth and Environmental Sciences.

TONY FRISCH

Tony Frisch started at BT's Research labs and then moved to Alcatel Australia, becoming involved in testing submarine systems. A move to Bell Labs gave him experience in terminal design and troubleshooting, after which he went back to Alcatel France, where he worked in Alcatel Submarine Networks' Technical Sales before moving to head Product Marketing.

He is now SVP, Repeaters and Branching Unit for Xtera Communications

ROUND TABLE & WORKSHOP BIOGRAPHIES

DR STEVE GRUBB

Dr. Grubb is currently a Global Optical Architect at Facebook, overseeing the build of several possible new open submarine cable systems. He formerly worked at Infinera, Corvis and AT&T/Lucent Bell Labs where he worked on a variety of optical technologies and network directions.

NIGEL IRVINE

Nigel has some 25 years' experience in the marine and telecommunications industries; firstly working on Cable & Wireless (Marine) cable ships and then in the offshore oil & gas industry. Following an MSc in Marine Resource Management (Heriot-Watt University, Edinburgh, 1993/4) and a period working in the marine environmental sector, Nigel returned to the submarine cable industry firstly in a permitting/regulatory role with GMSL (2000), and then FLAG Telecom (now Global Cloud Exchange) (2004). Nigel joined Verizon in 2007. He is currently Europe India Gateway (EIG) Upgrade Procurement Group (UPG) Co-Chair, is the company's representative on several of its other Atlantic and Mediterranean based consortium and private cable systems and is Verizon's representative on all its Marine Maintenance Agreements. As Verizon representative on the ICPC, Nigel is also on its Executive Committee, and is Chair of its Affiliations Working Group, whilst he also represents his company on SubSea Cables UK (SCUK) and the North American Submarine Cable Association (NASCA).

VINCENT LEMAIRE

Vincent Lemaire is currently VP Technical operation at ASN part of Nokia Group. He owned R&D and Operation management positions in Alcatel Lucent for more than 25 years. In the early 90s he studied coherent detection and Forward Error Codes for submarine transmissions.

RICHARD LUKAJ

Mr. Lukaj has more than 20 years of investment banking experience having originated, structured and executed hundreds of deals totaling over $100 billion of transaction value. Mr. Lukaj is a founder of Bank Street and aspires with his partners to create a premier middle market investment banking franchise focused on growth sectors of the global economy. Mr. Lukaj has executed transactions over the course of his successful investment banking career, ranging in variety from mergers and acquisitions, underwriting of debt, equity and derivative securities, restructurings, exclusive sales, and other financial advisory mandates. During his prior tenure at Bear Stearns, he contributed meaningfully to the development of one of the strongest investment banking franchises on Wall Street. Although heavily weighted towards the Media, Communications and Technology industries, he also has a very broad industry experience in Industrial, Consumer, Retailing, Energy, Aerospace, Specialty Finance, Real Estate and Natural Resources arenas.

BRIAN MASS

Mr. Mass is Director of Finance for RTI, a leading neutral cable owner and develops global telecom infrastructure and large-scale data connectivity in selected markets. Mr. Mass has an extensive background in telecom, media, and technology financing and advisory services. From 2001 to 2012, Mr. Mass was a Director in Citigroup's Global Technology Investment Banking Group, where he specialized in providing corporate finance and advisory services for Global Services and IT Infrastructure companies. During Mr. Mass's tenure with Citigroup, he executed more than $70 billion in transactions.

Previously, from 2000 to 2001, Mr. Mass was an Analyst at Rho Ventures, a venture capital firm with more than $2 billion under management.

Mr. Mass sits on the board of YipTV (live Internet television), and is FINRA Series 7 (General Securities Representative) and Series 63 (Uniform Securities Agent) registered.

ROUND TABLE & WORKSHOP BIOGRAPHIES

SHOTA MASUDA

Mr. Masuda graduated KEIO University with a Bachelors Degree in International Law. He started his career at NEC Corporation in Sales of Terrestrial Telecom Equipment. He moved on to a role creating Project Finance and managing Credit Risks, after which he was brought back to Sales of Submarine Cable Systems. He is now the head of the Sales team for the Submarine Network Division.

CARL OSBORNE

Carl Osborne is Asst. Vice President, International Network Development for Tata Communications. As a member of the management team for the Global Network, Cloud & Data Centre Services line of business, Carl is responsible for establishing and implementing strategies for global network development and investments encompassing both private TGN cable systems and consortium cable systems.

Prior to joining Tata Communications, Carl worked at Cable & Wireless companies in a variety of International Network Planning and Carrier Sales roles. Carl is a graduate of the University of Warwick, with a Bachelors degree in Applied Mathematics and Business Studies.

ELIZABETH RIVERA-HARTLING

Elizabeth Rivera-Hartling has been with Nortel and then Ciena since 2008, when the subsea upgrade vendor market was a new idea to the industry. She was a founding member of the Ciena Submarine R&D engineering team, designing and executing solutions for some of the very first subsea industry 40G and 100G coherent upgrades, as well as co-pioneering the ITU standardization of submarine power budget tables for coherent technologies. Elizabeth is currently a systems engineer in Ciena's global submarine team, overseeing network design activities on new and existing submarine cables around the globe, and responsible for internal training of Ciena's Submarine sales engineering force.

KEITH SCHOFIELD

Keith Schofield has worked in the submarine cable industry since 1981. Initially working in optical cable development, process development and qualification, he moved on to project management at STC Submarine Systems. Later, Keith joined Cable & Wireless Network Services, handling design and implementation of numerous cable systems. In 2007 he joined Pioneer Consulting, advising project developers, manufacturers, cable owners and investors in the development and acquisition of both new and existing submarine cable network infrastructure. At present, Keith is the General Manager of the International Cable Protection Committee (ICPC) performing GM/Secretariat services to its Executive Committee and Members. In this role, Keith continues to develop the ICPC's international profile, represents the organisation at industry workshops and with associations involved in subsea operations, and acts to increase overall membership.

ELAINE STAFFORD

Elaine Stafford is a Managing Partner at The David Ross Group, a consulting firm in the undersea cable industry. She supports cable owners across the globe with planning, developing, designing, procuring and managing the construction of undersea communication networks. Before joining DRG, Elaine worked as part of Tycom, AT&T Submarine Systems and AT&T Bell Laboratories. She has been active in the industry for over 35 years.

BJARNI THORVARDARSON

Mr. Bjarni Thorvardarson is the CEO of Hibernia Networks since January 2005. Mr. Thorvardarson joined CVC, Hibernia's parent company, in 2002 from ISB bank where he launched and managed the publicly traded Talenta-Technology fund which focused on emerging communication and IT opportunities. Prior work experience includes investment banking at FBA bank, management of an MIS department and European Sales Director for Traffic Software. Mr. Thorvardarson holds an M.Sc. degree in Engineering from UW-Madison, an MBA from ISG in Paris and an M.Sc. in Finance from London Business School. Mr. Thorvardarson has also served on the board of various private and public portfolio companies of his fund and that of CVC, serving as Chairman of the publicly traded Vodafone Iceland.

ROUND TABLE & WORKSHOP BIOGRAPHIES

GREG VARISCO

Greg Varisco is the COO of AquaComms Limited. Greg is responsible for market research, strategic business development, system design and implementation, and project management. A senior management executive who has provided professional services to telecommunications and oil and gas industry firms for over three decades, he has led the development and execution of international business initiatives for Fortune 100 and other public and private organizations, from start-ups to companies in turnaround. Greg earned an Associate degree in Industrial Technology from Louisiana Technical College.

DEAN VEVERKA

Dean Veverka is currently the Director Networks & Vice President of Operations of the 30,000km Southern Cross Cable Network, responsible for all Regulatory, Engineering and Operational aspects of the network. Electrical Engineer and Business Management Graduate with over 35 years' experience in Telecommunications covering numerous technical and management roles at the Overseas Telecommunications Corporation (OTC Australia), Telstra and Optus in Australia. Other responsibilities include past Chairman of ICPC, Director and Treasurer of NASCA, member of the Australian Government's Trusted Information Sharing Network - Communications Sector Group and regular speaker and presenter at submarine cable conferences and summits.

GARY WATERWORTH

A Chartered Engineer, born and educated in the UK, Gary started his professional career with STC in 1979, working on the first subsea cable tie back projects in the North Sea. STC provided an exceptional opportunity for experience in many varied areas including, submarine cable installation and repair, cable design and manufacture, jointing, sea trials, special purpose cable handing equipment design, construction, commissioning and project management. Continuing with the creation of ASN, he led the teams developing and manufacturing the first submarine WDM optical amplifiers and associated wet plant. For the last 18 years Gary has been part of ASN's customer-facing team, involving all types of submarine cable project and marine maintenance worldwide.

ORAL PRESENTATION SESSIONS

TUESDAY 19TH APRIL – ORAL SESSIONS TU1A & TU1B 11.00AM – 12.30PM

ORAL SESSION TU1A – THE FIBRE CORNER
Session Chair – Stuart Barnes (Xtera)
TU1A – 1 Reduction in splice loss between fibers with dissimilar effective areas
Sergejs Makovejs (Corning)
TU1A – 2 Ultra-Large Effective Area Fibre Performances in High Fibre Count Cables and Joints. A new Technical Challenge
Florence Palacios (Alcatel-Lucent Submarine Networks)
TU1A – 3 Ultra-low loss Pure-silica-core fiber for capacity expansion
Takemi Hasegawa (Sumitomo Electric Industries)
TU1A – 4 Optical Fibre Fatigue And Submarine Networks Reliability: Why So Good?
David Walters (Independent Consultant)
TU1A – 5 Cable and Splice Performance of 153um2 Ultra Large Area Fiber for Coherent Submarine Links
Ole Levring (OFS)

ORAL SESSION TU1B – CABLES FINANCING AND CONSORTIUM ENVIRONMENT
Session Chair – Mahesh Jaishankar (du)
TU1B – 1 Financing Opportunities and Challenges Facing Submarine Cable Projects
Andrew Lipman (Morgan Lewis)
TU1B – 2 Fixing the Financing Shortfall for Next Generation Submarine Cable System Owners
Brian Mass (RTI Inc)
TU1B – 3 What Future For the Consortium Model?
Joel Saltsman (Orange)
TU1B – 4 Smart Procurement Group, the main pillar for successful consortiums
Faisal Samahi (Etisalat), Rayan Alsaedi (Saudi Telecom Company)

TUESDAY 19TH APRIL – ORAL SESSION TU2A 1.30PM – 3.00PM

ORAL SESSION TU2A – UNREPEATERED APPLICATIONS
Session Chair – Reja Mateen (British Telecom)
TU2A – 1 Evolution of Repeaterless Systems Architectures
Philippe Perrier (Xtera)
TU2A – 2 Transmission over unrepeatered 85dB fiber link using advanced modulation format
Xiaohui Yang (Infinera)
TU2A – 3 More than 30dB Budget Improvement in Unrepeatered 100GHz Links
Serguei Papernyi (MPB Communications Inc.)
TU2A – 4 Amplification technologies supporting upcoming modulation formats in unrepeatered links
Hendrik Besch (Coriant)
TU2A – 5 Enabling fibre and amplifier technologies for submarine transmission systems
Benyuan Zhu (OFS)

ORAL PRESENTATION SESSIONS

TUESDAY 19TH APRIL – ORAL SESSIONS TU3A & TU3B 3.30PM – 5.00PM

ORAL SESSION TU3A – UNDERSEA TECHNOLOGIES
Session Chair – Olivier Courtois (Alcatel-Lucent Submarine Networks)
TU3A – 1 3D Printing Submerged Equipment
Adrian Jarvis (Huawei Marine Networks)
TU3A – 2 Extreme and Fatigue Analyses of a Dynamic Fiber Optic Riser
Muhammed Tedy Asyikin (Nexans)
TU3A – 3 Highly efficient submarine C+L EDFA with serial architecture
Douglas Aguiar (Padtec)
TU3A – 4 Technology for C+L Undersea Systems
Alexei Pilipetskii (TE Subcom)
TU3A – 5 Application and Benefits of Raman-Enhanced Amplification Schemes in Tomorrow's Optical Submarine Systems
Colja Schubert (FhG-HHI)

ORAL SESSION TU3B – THE MARINE CHAIN
Session Chair – Matteo Gumier (Alcatel-Lucent Submarine Networks)
TU3B – 1 Bigger Isn't Always Better: Focusing on Pertinent Desktop Study Content
Nancy Poirier (IT International Telecom)
TU3B – 2 Route Clearance for Hibernia Express and the findings
Alasdair Wilkie (Hibernia Networks)
TU3B – 3 Regulatory Challenges of Project Implementation – India Case Study
Nick Smith (Alcatel-Lucent Submarine Networks)
TU3B – 4 Global Trends in Submarine Cable System Faults
ME Kordahi (TESubcom)
TU3B – 5 The Benefits of Recycling the Right Way
Dec Wallace (BT), Arnaud Louw (Mertech Marine)

WEDNESDAY 20TH APRIL – ORAL SESSIONS WE1A & WE1B 11.30AM – 1.00PM

ORAL SESSION WE1A – MANAGING SYSTEM LIFETIME
Session Chair – Katherine Edwards (Vodafone)
WE1A – 1 Applying the Hugo upgrade model to re-deployed systems
Phil Lancaster (Vodafone)
WE1A – 2 Tracking the End-of-Life of a Submarine Cable
José Chesnoy (Independent Consultant)
WE1A – 3 Fundamentals of Cable Redeployment
Alan Proudfoot (Xtera Communications)
WE1A – 4 Mitigation method of spectrum gain deviation in D+ based long distance submarine cable systems with large bandwidth repeaters
Kohei Nakamura (NEC Corporation)
WE1A – 5 Methods and Limits of Wet Plant Tilt Correction to mitigate wet plant aging
Loren Berg (Ciena)

ORAL PRESENTATION SESSIONS

ORAL SESSION WE1B – MARINE ACTIVITIES
Session Chair – Graham Evans (EGS)
WE1B – 1 Shallow Water Cable Abrasion – Managing the Risk
Gordon Lucas (Alcatel-Lucent Submarine Networks)
WE1B – 2 Installing subsea structures – A Successful Cable End Module Case Study
Paul Deslandes (GMSL)
WE1B – 3 The Future of Marine Survey - Applications for Submarine Cables
Ryan Wopschall (Fugro)
WE1B – 4 Technology developments are enabling the new generation of cable burial ploughs to operate more efficiently with a reduction in operational downtime
Julian Steward (IHC Engineering Business)
WE1B – 5 Big Challenge to Overcome Difference in Bending Radius in Housing Unit Used in Submarine Telecommunication System and Seismic and Tsunami Observation System
Satoki Fujimori (Kokusai Cable Ship Co.)

WEDNESDAY 20TH APRIL – ORAL SESSIONS WE2A & WE2B 2.00PM - 3.30PM

ORAL SESSION WE2A – NETWORK TOPOLOGY
Session Chair – Elizabeth Rivera-Hartling (Ciena)
WE2A – 1 Cost allocation on a shared fiber pair using ROADM Bus
Marc-Richard Fortin (GlobeNet)
WE2A – 2 A Solution For Flexible and Highly Connected Submarine Networks
Arnaud Leroy (Alcatel-Lucent Submarine Networks)
WE2A – 3 Integrated Submarine and Terrestrial Network Architectures for Emerging Subsea Cables
Mohan Rao Lingampalli (Equinix)
WE2A – 4 Open Cables and Integration with Terrestrial Networks
Georg Mohs (TE Subcom)
WE2A – 5 How Resilient is the Global Submarine Cable Network?
Andy Palmer-Felgate (Verizon)

ORAL SESSION WE2B – MARINE ASSETS AND OBSERVATORIES
Session Chair – Kate Panayotou (GHD)
WE2B – 1 A Paradigm Change to Submarine Telecom Marine Assets
Charles Collins (3U Technologies LLC)
WE2B – 2 Marine Maintenance Synergy's – Sharing costs within new market spaces!
Stephen Holden (GMSL)
WE2B – 3 S-net Project, Cabled Observation Network for Earthquakes and Tsunamis
Toshihiko Kanazawa (NIED)
WE2B – 4 Installation of new seafloor cabled seismic and tsunami observation system using ICT to off-Tohoku region, Japan
Masanao Shinohara (The University of Tokyo)
WE2B – 5 Power and data over fiber for sea-floor observatories
Florent Colas (Ifremer)

ORAL PRESENTATION SESSIONS

THURSDAY 21ST APRIL – ORAL SESSIONS TH1A & TH1B 10.00AM – 11.30AM

ORAL SESSION TH1A – LINE DESIGN
Session Chair – Izumi Yokota (Fujitsu)
TH1A – 1 Capacity limits of submarine cables
Edouardo Mateo (NEC Corporation)
TH1A – 2 Impact of frequency separation between orthogonal idlers on system performance
Pierre Mertz (Infinera)
TH1A – 3 Quasi-Single-Mode Fiber Transmission for Submarine Systems
John Downie (Corning)
TH1A – 4 The Challenge of Very High Cable Capacity: PDM-8QAM modulation format, the booster for submarine cable capacity and OSNRWET, the parameter to evaluate cable capabilities
Pascal Pecci (Alcatel-Lucent Submarine Networks)
TH1A – 5 Optical Designs for Greater Power Efficiency
Alexei Pilipetskii (TESubcom)

ORAL SESSION TH1B – PROJECTS AND IMPACTS
Session Chair – Andy Palmer-Felgate (Verizon)
TH1B – 1 Flexible ROADM Networks: New aspects of Commissioning, Operation and Maintenance through project examples
Jean-Pierre Blondel (Alcatel-Lucent Submarine Networks)
TH1B – 2 The challenges of completing an Oil & Gas Cable System order
Jerry Brown (Hengtong Marine Cable Systems)
TH1B – 3 Lighting the Way to Bandwidth Equality: The Role of Submarine Connectivity in Bridging the Bandwidth Divide
Michael Ruddy (Terabit Consulting)
TH1B – 4 Evolution of the Internet of the Middle East
Doug Madory (Dyn)
TH1B – 5 Capturing the Public Imagination: Communicating the cultural significance of submarine internet cables
Bronwyn Holloway-Smith (Massey University)

THURSDAY 21ST APRIL – ORAL SESSIONS TH2A & TH2B 2.00PM – 3.30PM

ORAL SESSION TH2A – WET AND DRY TECHNOLOGIES
Session Chair – Edwin Muth (TE Subcom)
TH2A – 1 Proving And Qualification Of A Sea-Earthing System For A New-Generation Submerged Branching Unit
Ian Watson (Huawei Marine Networks)
TH2A – 2 Improving the Crush Resistance of Submarine Cables
Weiwei Shen (Hengtong Marine Cable Systems)
TH2A – 3 SLTE Modulation Formats for Long-Haul Transmission
Alexei Pilipetskii (TE Subcom)
TH2A – 4 Ultra high capacity transoceanic transmission
Gabriel Charlet (Bell Labs, Nokia)
TH2A – 5 Optimising Design of Dynamic Fiber Optic Riser Cable using Cross Section Analysis
Bjørn Konradsen (Nexans)

ORAL SESSION TH2B – THE LAST SESSION
Session Chair – Mark Andre (Orange) – Papers Chair SubOptic 2016
TH2B – 1 The future of changing liabilities and effective subsea asset management
Benjamin Sims (Vodafone)
TH2B – 2 Government Surveillance, Hacking, and Network Security: What Can Submarine Cable Operators and Their Customers Do?
Kent Bressie (Harris, Wiltshire & Grannis LLP)
TH2B – 3 Regulation of Underwater Sounds
Richard Hale (EGS)
TH2B – 4 Permanent Reservoir Monitoring (PRM) System Installation: The Installer's Perspective
Andrew Lloyd (GMSL)
TH2B – 5 SDN: Still Dumb Networks? (INVITED PAPER)
Steve Alexander (Ciena)

POSTER SESSION

WEDNESDAY 20TH APRIL – POSTER SESSION 3.30PM – 6.00PM

MARKET & PROJECT – TRENDS & CHALLENGES

MP01 The challenges of fibre optic installation in developing markets
Paul Deslandes (GMSL)

MP02 Submarine Optical Cable Market in Africa: Challenge and potential
Ali Ben Abdallah (Tunisie Telecom)

MP03 How media attention can shorten repair times for damaged cable systems
Kristian Nielsen (Submarine Telecoms Forum)

MP04 How EPIC are submarine cable systems?
Mounish Patel (Vodafone)

MARINE SERVICES AND OPERATIONS

MS01 Submarine Cable Spatial Planning Discussion Based on Increasing Marine Activities
Hongli Shi (Huawei Marine Networks)

MS02 Shore End Cable Protection Case Study – Submarine Cliffs
Zhang Xiaolong (Huawei Marine Networks)

MS03 New Subsea Optical Fibre Junction Box for reduced tensile load applications
Craig Beech (GMSL)

MS04 Lessons Learned from Past Cases for Achieving Disaster Resilient Routing and Economically Viable Maintenance Operation
Yukitoshi Ogasawara (Kokusai Cable Ship Co.)

MS05 Applied seabed geomorphology in cable route planning, surveying and engineering
Eric Roach (EGS)

MS06 Real-time Correlation of Cable Fault to Vessel Location and the benefit to Cable System Operators
Darwin Evans (Ciena)

MS07 The Global Challenges of Comprehensive Undersea Jointing
Maurice Kordahi (TE Subcom)

NETWORK ARCHITECTURE AND SYSTEM DESIGN

NA01 Power Feeding Solution for Festoon-like Repeatered Submarine Cable System
Li Yuhe (Huawei Marine Networks)

NA02 Spectrum sharing in a multivendor environment
Darwin Evans (Ciena)

NA03 Upgrading on the Longest Legacy Repeatered System with 100G DC-PDM-BPSK
Jianping Li (Huawei Marine Networks)

NA04 Transoceanic Transmission over 11,400km of installed 10G System by Using Commercial Dual-Carrier 100G
Ling Zhao (Huawei Marine Networks)

NA05 Modeling of nonlinear fiber effects in systems using codirectional Raman amplification
Hendrik Besch (Coriant)

NA06 Optimization of Pulse Shaping Scheme and Multiplexing/Demultiplexing Configuration for Ultra-Dense WDM based on mQAM Modulation Format
Inoue Takanori (NEC Corporation)

NA07 Simple method to estimate repeater span by varying the length of a reference digital line section
Francis Charpentier (Orange)

POSTER SESSION

NA08 Resource Savings Using Gridless Submarine Networks based on Filterless Coherent Transmission Technologies
Christine Tremblay (Ecole de technologie supérieure, Université du Québec)

NA09 Benefits of Digital Sub Network Connection Protection for Dual Route Backhaul
Benoit Kowalski (Infinera)

NA10 Innovative Submarine Transmission System using Full-Tunable ROADM Branching Unit
Takehiro Nakano (NEC Corporation)

EQUIPMENT AND COMPONENT TECHNOLOGIES

EC01 The Electrochemical Aspects Of The Use Of Titanium And Steel In Submerged Plant And Cables
Ian Watson (Huawei Marine Networks)

EC02 The Relationship of Carbon Backfill and Metal Corrosion Rate in Submarine Electrode Array System
Kai Sun (Huawei Marine Networks)

EC03 A more reliable pumps redundancy design
Changwu Xu (Huawei Marine Networks)

EC04 A New Cable Failure Quick Isolation Technique of OADM Branching Unit in Submarine Networks
Hongbo Sun (Huawei Marine Networks)

EC05 Evaluation of Nonlinear Impairment from Narrow-band Unpolarized Idlers in Coherent Transmission on Dispersion-managed Submarine Cable Systems
Masashi Binkai (Mitsubishi Electric Corporation)

EC06 Effective Application of KCS Cable Probe for Localizing Submarine Telecommunication and Power Cables
Takaharu Etou (Kokusai Cable Ship Co.)

EC07 Ultra-low loss and large Aeff Pure-silica core fiber advances
Hideki Yamaguchi (Sumitomo Electric Industries)

EC08 Evaluation of Mixed Metal Oxidation For Sea Earth Electrode With High Reliability
Hong-ying Chao (Huawei Marine Networks)

EC09 Ultra-Low Loss Fiber and Advanced Raman Amplification Deliver Record Unrepeatered 100G Transmission
Do-il Chang (Xtera)

EC10 Tool-Kit for Ultra-Long / High-Capacity Repeaterless Systems
Philippe Perrier (Xtera)

NETWORK OPERATIONS AND CARRIER SERVICES

NO01 When do pump failures prevent system re-use or lifetime extension?
Tony Frisch (Xtera)

NO02 Real-Time Wet Plant Health Monitoring and Automation
Darwin Evans (Ciena)

NO03 Capacity optimization of submarine cable through smart spectrum engineering
Vincent Letellier (Alcatel-Lucent Submarine Networks)

POSTER SESSION

OIL & GAS AND SPECIAL MARKETS

OG01 Emerging subsea networks: new market opportunities for, and societal contributions from, SMART cable systems
Christopher Barnes (University of Victoria)

OG02 Design of Fiber Optic Cables and Accessories for Offshore Applications
Inge Vintermyr (Nexans)

OG03 Fibre to Platform Connectivity – Working in the 500m zone
Andrew Lloyd (GMSL)

OG04 Application of QAM signals to Oil & Gas OADM submarine cable systems
Hiroshi Nakamoto (Fujitsu)

OG05 The European Multidisciplinary Seafloor and water-column Observatory - the Development and utilisation of large scale distributed EU cabled marine research infrastructure
Paul Gaughan (Irish Marine Institute)

ABSTRACTS

ORAL SESSION TU1A – THE FIBRE CORNER

TU1A – 1 Reduction in splice loss between fibers with dissimilar effective areas
Sergejs Makovejs (Corning)

We demonstrate that the use of tapering technique to achieve an adiabatic transition from large mode field (Corning® Vascade® EX3000 fiber) to smaller mode field ITU-T G.652-compliant fiber results in a reduction in splice loss, relative to a configuration where a G.652 fiber splice recipe is used. On average, a decrease from 0.29 dB (no tapering) to 0.15-0.17 dB (with tapering) was observed experimentally. Simulations using beampropagation model show the feasibility of further splice loss reduction to 0.043 dB, by optimizing the tapers to deeper and asymmetric shapes. This loss is comparable to typical G.652-G.652 fiber splice loss.

TU1A – 2 Ultra-Large Effective Area Fibre Performances in High Fibre Count Cables and Joints. A new Technical Challenge
Florence Palacios (Alcatel-Lucent Submarine Networks)

Ultra long haul, very high bit rate WDM transmission systems now require the use of optical fibres with extra large effective area and very low attenuation levels (Coherent Submarine Fibres, CSF). This paper presents the comprehensive testing program performed to accurately measure attenuation variations of several CSF fibre types and validate their qualification in ASN cables and joints for full +D system applications. It also presents the good performances reached in high fibre count cables, thanks to the optimization of cable design and well managed cabling processes. Integration in joints and design optimization to guarantee low attenuation is detailed too.

TU1A – 3 Ultra-low loss Pure-silica-core fiber for capacity expansion
Takemi Hasegawa (Sumitomo Electric Industries)

Optical fiber for high capacity submarine transmission will be discussed. In a viewpoint of bandwidth expansion, utilizing of the L-band in addition to the C-band is promising. Bending loss characteristics and fiber figure-of merit of ultra-low loss pure-silica-core fiber with the Aeff of 130micron2 at 1550nm are evaluated, and we confirm that the PSCF has the excellent performance for the L-band transmission.
We will also discuss about the required performance for future enhancement of transmission capacity, and we conclude the possible lowest loss will be the most important.

TU1A – 4 Optical Fibre Fatigue And Submarine Networks Reliability: Why So Good?
David Walters (Independent Consultant)

Classical fracture-mechanics theory, applied to optical fibre in cables and submerged plant, implies that there should occasionally have been some fibre failures during installation, service or recovery. However, none have ever been reported in conforming fibre. An explanation for this is that the graduations in fibre surface crack-depth are limited by the distances between atoms in the silica lattice, so that proof-tested fibre at maximum working strain levels has a zero, and not simply 'Low', probability of fracture. This has very positive implications for allowable working strains and extension of system lifetimes.

TU1A – 5 Cable and Splice Performance of 153um2 Ultra Large Area Fiber for Coherent Submarine Links
Ole Levring (OFS)

Early in the development of coherent transport technology, it was recognized that – in addition to low attenuation – an optical fiber optimized for the new paradigm would have a large effective mode area (Aeff) and large chromatic dispersion (CD). Under the assumptions of the Gaussian Noise model, the noise power due to non-linearity adds to the ASE noise power from the amplifier to limit the effective OSNR. A large Aeff allows higher launch power without increasing the non-linear noise. A large CD suppresses non-linear cross-talk between channels through walk-off effects. Here we show that fibers with effective areas of 153 μm2 have excellent loss and splice performance in submarine cables.

ABSTRACTS

ORAL SESSION TU1B – CABLES FINANCING AND CONSORTIUM ENVIRONMENT

TU1B – 1 Financing Opportunities and Challenges Facing Submarine Cable Projects

Andrew Lipman (Morgan Lewis)

The submarine cable industry has greatly changed over the past few years. Following a multi-year construction drought, new systems are being announced in many regions of the world. This is largely driven by the need to bring large amounts of content closer to the user. Silicon Valley Internet companies and other online content providers have become anchor tenants in multiple systems. More than any other single factor, financing impacts the timing and success of a submarine cable project. This paper describes the possible financing structure options available and the tasks that a sponsor should complete to successfully fund a new submarine cable build. Successfully securing the funding for a submarine cable project will take a significant amount of preparation. To succeed, sponsors will need to identify a market opportunity and prepare a credible business plan. The first ingredient is equity. After some years on the sidelines, private equity funds, venture capitalists and other institutional investors appear to be slowly returning to the submarine cable industry. In addition to securing capacity sales to large Internet companies or content providers, cable sponsors should look at these institutional investors as the most likely source of outside equity for new projects. These equity investors are extremely selective on the projects they back and sponsors need to have realistic assumptions in their business plans. Moreover, virtually no privately-sponsored project can be completed without debt. Commercial banks and multilateral organizations (e.g., IFC, OPIC, regional development banks) continue to be the obvious candidates to provide the debt component for a new system. While interest rates remain at all-time lows, lenders heavily scrutinize business plans and loan conditions tend to be more stringent than before the Great Recession. Performance history, reputation, and effective accountability are prime factors that will differentiate which deals lenders choose to finance. The structuring and negotiation of financing documentation is a delicate balancing act. This paper identifies steps for structuring projects to improve funding options and ways to successfully negotiate financing with multiple funding sources.

TU1B – 2 Fixing the Financing Shortfall for Next Generation Submarine Cable System Owners

Brian Mass (RTI Inc)

The robust demand for greater global fiber capacity and connectivity, and the increasing importance of route diversity, have resulted in a much wider variety of prospective submarine cable system owners. Even with so many new potential investors, many of these projects are unable to raise the required capital to bring their contracts into force. In this paper, we will address why many projects are underfunded, how to sort out the viable projects and what can be done to close this funding gap. We will discuss several finance schemes, starting from (i) traditional ODA and infrastructure financing sources such as private equity and why they present challenges for financing submarine cable projects, (ii) supplier arranged bank loans and the associated challenges, to (iii) introducing an unconventional special purpose vehicle (SPV) scheme to close the funding gap. We will present a workable financial solution to foster further discussion within the Submarine Cable industry and to help close this funding gap.

TU1B – 3 What Future For the Consortium Model?

Joel Saltsman (Orange)

As a commercial model, the submarine cable consortium is proving surprisingly resilient even as telecoms markets have liberalized and demand for broadband has multiplied under the influence of the Internet and other revolutionary technologies. Despite the growing prevalence of incorporated submarine ventures, many telecom companies continue to find decisive advantages in multi-party projects based on contracts alone. At the same time, in managing their cable systems the participants must work to overcome the inherent limitations of the consortium format in a variety of areas, such as governance, finance, dispute settlement and sales to international wholesale markets. The paper examines some of these limitations and looks at ways in which they can be overcome, including through adaptations to the traditional model.

TU1B – 4 Smart Procurement Group, the main pillar for successful consortiums

Faisal Samahi (Etisalat), Rayan Alsaedi (Saudi Telecom Company)

Procurement Group (PG) is arguably the most visible committee within any consortium due to the importance of the expected outcome from this group. This committee faces number of influences, which create challenges, disputes and problems during PG tasks. The failure of controlling these influences might result in either buying worst solution, delay the procurement or at worst case scenario a complete failure. This paper suggests number of solutions to deal with these common issues.

ORAL SESSION TU2A – UNREPEATERED APPLICATIONS

TU2A – 1 Evolution of Repeaterless Systems Architectures

Philippe Perrier (Xtera)

The Cable & Wireless Networks network is a good example of the evolution of repeaterless systems architectures. Recent upgrades performed on a number of C&W Networks infrastructures in the Caribbean have taken thus far disparate unrepeatered systems and integrated them into a unified network, seamlessly bridging North America to South and Central America.

ABSTRACTS

TU2A – 2 Transmission over unrepeatered 85dB fiber link using advanced modulation format
Xiaohui Yang (Infinera)

Unrepeatered transmission of 6 x 50 Gb/s over 85 dB large area core fiber, using co-propagating Raman amplification and a Rx Remote Optically Pumped Amplifier (Rx ROPA) with a 3rd order cascaded pumping, is reported. An advanced modulation format, Matrix-enhanced BPSK (ME-BPSK), has been used in the test and shows more than 1 dB gain on reach over BPSK.

TU2A – 3 More than 30dB Budget Improvement in Unrepeatered 100GHz Links
Serguei Papernyi (MPB Communications Inc.)

A new communications link configuration is presented with co-located Tx and Rx ROPAs inserted in two fibers carrying traffic in opposite directions and sharing pump power from a single pump source. The methodology to be followed to optimize the placement of the joint ROPA enclosure is discussed and a link budget increase up to 32 dB is experimentally demonstrated for 100 G transmission with 3rd order cascaded ROPA pumping. This novel configuration makes it possible for essentially no additional cost to extend reach by ~10 dB compared to a link configuration with Rx ROPA alone.

TU2A – 4 Amplification technologies supporting upcoming modulation formats in unrepeatered links
Hendrik Besch (Coriant)

This paper gives an overview over technologies that enable using higher order modulation formats supporting more than 100 Gbit/s per wavelength in existing unrepeatered systems. The advantages and disadvantages of these technologies are discussed. Placing a second ROPA close to the transmit side is the solution that potentially provides the required performance improvement. Therefore, the impact of important system parameters such as the position of the erbium-doped fiber coil, pump power, and pump wavelength on performance improvement is investigated.

TU2A – 5 Enabling fibre and amplifier technologies for submarine transmission systems
Benyuan Zhu (OFS)

This paper describes the key fibre and amplifier technologies that enable high capacity and long reach for submarine transmission systems. We discuss the optical fibre properties of new ultra-large-area ultra-low-loss fibres and their impacts on the transmission performance for undersea coherent systems. We will then describe a few key amplification techniques for repeatered and repeaterless submarine systems including high performance C+L band Er-doped fibre amplifier (EDFA), remote-optical-pumped amplifier (ROPA), wideband high power Yb-free clad-pumped booster EDFA, and distributed Raman amplifiers using 2nd order Raman pumping.

ORAL SESSION TU3A – UNDERSEA TECHNOLOGIES

TU3A – 1 3D Printing Submerged Equipment
Adrian Jarvis (Huawei Marine Networks)

Similar to the impact of fibre optics over copper in telecommunications, back in the 1980's, 3D printing is providing a revolutionary step change in manufacturing technology. It is beginning to have major influences on how parts, structures and equipment are made, allowing engineers to imagine the impossible and create products previously impossible to build using traditional methods. 3D printing is being used across many Hi-Rel/Hi-Performance industries and disciplines that demand quality, reliability and repeatability commensurate with that expected within subsea telecommunication equipment. This paper will discuss the key design and manufacturing considerations, of both metallic and non-metallic 3D printing and will consider the question: Is a 3D printed Repeater possible?

TU3A – 2 Extreme and Fatigue Analyses of a Dynamic Fiber Optic Riser
Muhammed Tedy Asyikin (Nexans)

This paper presents extreme and fatigue analyses of a newly developed Dynamic Fiber Optic (FO) Riser, which is designed with the aim of long fatigue life even in extreme environments. The riser consists of four layers of steel armor wires and 18 helical stranded steel tubes composing the FO package. The harsh Norwegian Sea environment and the deepwater West African Sea have been chosen as locations for the analyses. The FO riser has been modeled and analyzed based on its dynamic configuration, global loads, vessel's motion characteristic and attached accessories, e.g. bend stiffener, buoyancy module and tether clamp, by using a well-known software Orcaflex. This study shows that the FO riser satisfies the acceptance criteria for both extreme and fatigue.

TU3A – 3 Highly efficient submarine C+L EDFA with serial architecture
Douglas Aguiar (Padtec)

This paper presents the theoretical and experimental results of an ultra-wide band C+L Erbium Doped Fiber Amplifier (EDFA). The EDFA is composed of three Erbium Doped Fiber (EDF) stages assembled in a serial architecture. Between these stages are inserted two Gain Flattening Filters (GFF) in order to achieve a balance between the control of the gain tilt and the gain bandwidth. With this strategy 70 nm of amplified bandwidth was obtained with only two pump lasers per amplifier each operating below 300 mW. The proposed architecture requires only the use of a limited number of high reliability commercially available components.

ABSTRACTS

TU3A – 4 Technology for C+L Undersea Systems
Alexei Pilipetskii (TE Subcom)

C+L technology makes possible undersea systems with higher total capacity and lower cost per Tb/s than C-only systems. C+L transmission experiments have demonstrated 9100 km transmission of 49.3 Tb/s per fiber using C+L amplifiers. Practical system designs can support 24 Tb/s per fiber pair over 12,500 km and higher capacities on shorter systems. All supporting technologies have been or soon will be qualified for use in wet plant equipment and in the required terminal equipment. This paper reviews system architecture, transmission results, and progress in developing the system elements and system designs using C+L technology in undersea systems.

TU3A – 5 Application and Benefits of Raman-Enhanced Amplification Schemes in Tomorrow's Optical Submarine Systems
Colja Schubert (FhG-HHI)

In this paper we investigate the benefit of commercially available hybrid Raman + EDFA amplifiers (HRA) for new-build optical submarine systems. We use analytical approximation tools, based on the Gaussian Noise model, to compare HRA systems against systems using only EDFA amplification as well as looking at the influence of certain system parameters in HRA. We found that HRA systems can offer significant benefits compared to EDFA-only systems, in particular in terms of increasing the permissible span length for a given system capacity and length.

ORAL SESSION TU3B
THE MARINE CHAIN

TU3B – 1 Bigger Isn't Always Better: Focusing on Pertinent Desktop Study Content
Nancy Poirier (IT International Telecom)

With the quantity of information now available on the internet, data gathering for Desktop Study can easily lead into the trap of just adding more content to make the report look more "scientific". Some DTS reports have hundreds of pages with detailed discussion about the Precambrian rock formation overlain by Phanerozoic sedimentary rocks underlying the sediment cover from Pleistocene times' glacial deposits origin...What value does this have for planning a submarine cable project? This paper reviews the different topics covered in a standard DTS and assesses the types of information that have a real potential impact on our projects.

TU3B – 2 Route Clearance for Hibernia Express and the findings
Alasdair Wilkie (Hibernia Networks)

During the route clearance of Hibernia Express, a cable which has taken an old route across the Atlantic, but a route that hasn't been used for almost 100 years, more than fifty different cables were recovered. The oldest cable recovered was from the early 1880s and the latest from the 1970s so there is the best part of one hundred years of cable history in one route clearance. As part if the route clearance samples of all the recovered cables were kept, researched and where possible, positively identified. The positively identified samples show an interesting change in cable design over the years. This paper traces the history of these recovered cables and speculates on the use of some of the unidentified cables.

TU3B – 3 Regulatory Challenges of Project Implementation – India Case Study
Nick Smith (Alcatel-Lucent Submarine Networks)

Governments worldwide impose regulations and approval regimes to control the development of submarine cable projects. Network operators, system suppliers and maintenance authorities work in accordance with these requirements and factor them into project implementation plans. However this exercise becomes very difficult in situations where either regulatory requirements are ambiguous or there is a variableness/ inconsistency as to how they will be interpreted and enforced. This paper uses the experience of a number of projects implemented in India over recent years as a case study to illustrate the impact that regulatory frameworks can have on system implementation.

TU3B – 4 Global Trends in Submarine Cable System Faults
Maurice Kordahi (TE Subcom)

This paper is written on behalf of the Submarine Cable Improvement Group (SCIG). Fault data from undersea systems continues to be collected by several organizations. The SCIG attempts to analyze and present the data in order to provide a basis for improving the cable protection and overall undersea telecom network reliability. This analysis highlights recent system faults with focus on data from the last six (6) years and provides a continuation of previous global trend studies which were presented in 2010, 2007, 2004, 2001, and 1997.

TU3B – 5 The Benefits of Recycling the Right Way
Dec Wallace (BT), Arnaud Louw (Mertech Marine)

Mertech Marine and BT have collaborated with one another to effect the removal of a number of Trans-Atlantic and Domestic Out of service cables.

BT will estimate the benefits of such removals in terms of removing Third Party Legal Liability, reductions in permitting and associated ownership fees and the freeing up of the route to reuse.

Mertech will discuss the benefits of lifting and recycling these specific cables in an environmentally friendly way and how this balances against the manufacturing of the same set of raw materials.

ABSTRACTS

ORAL SESSION WE1A – MANAGING SYSTEM LIFETIME

WE1A – 1 Applying the Hugo upgrade model to re-deployed systems

Phil Lancaster (Vodafone)

Until recently Hugo was an unrepeatered system constructed from cable recovered from Gemini. Knocks from fishing nets and anchors had created losses which had reduced the potential capacity of the cable to an unacceptable level. This paper describes how cable repair and wet-plant upgrades were considered and why the final choice was the unusual step of adding repeaters, rather than ROPAs. The final outcome of this decision was a fast and efficient solution which yielded a huge capacity increase and may serve as a model for other systems.

WE1A – 2 Tracking the End-of-Life of a Submarine Cable

José Chesnoy (Independent Consultant)

Many submarine cables are around 15 years old, and exhibit a remarkable health. FIT rates are low, since these cables are in their middle life. However, as submerged equipment is qualified for a 25-year lifetime, an increase of FIT rate possibly linked to wear out may be observed as it approaches 25 years.
As an early warning for cable ageing would be extremely useful, we describe how a regular analysis of the wet plant parameters could detect early minor changes before any transmission quality degradation.
This paper is supported by the Suboptic working group on the extension of the system lifetime.

WE1A – 3 Fundamentals of Cable Redeployment

Alan Proudfoot (Xtera Communications)

Re-configuration of an existing system (cable and/or repeaters) has been done in different ways to date, either performing this operation on a cable laying vessel, or by taking the recovered cable system, to a suitable depot for reconfiguration on land. The former may save time (particularly where the recovered span lengths can be used in the new application as this minimises any cable transfers between tanks) but requires a cable ship with sufficient cable storage capacity and jointing resources, whereas the latter needs more transits and loading to the lay vessel. On the other hand this approach offers more flexibility in handling, adjustment of cable lengths/ types and subsequent system testing. We discuss practical aspects and advantages of these methods, and also consider hybrid and alternative approaches.

WE1A – 4 Mitigation method of spectrum gain deviation in D+ based long distance submarine cable systems with large bandwidth repeaters

Kohei Nakamura (NEC Corporation)

This paper describes our study result about the impact of Spectrum gain deviation for long-distance submarine cable system. Three mitigation methods for spectrum gain tilt are experimentally compared through D+ fiber-based long distance transmission test-bed with large bandwidth repeaters.

WE1A – 5 Methods and Limits of Wet Plant Tilt Correction to mitigate wet plant aging

Loren Berg (Ciena)

Submarine wet plants represent a significant long-term investment, and any extension of useful life, or correction to factors that may threaten the expected economic lifetime, can be very valuable to cable owners. One factor that can threaten the optical performance of a submarine cable is the accumulation of tilt along the repeater chain. Tilt is often caused by the addition of loss due to repairs and can cause not only degradation of system OSNR, but higher than average launch powers throughout, leading to significant non-linear propagation penalties, particularly on dispersion managed cables. In this paper, we present laboratory measurements where varying degrees of tilt are induced in a submarine line system via excess losses, representing submarine cable repairs. The extent of correction via pre-emphasis and other tilt management techniques at the terminal (SLTE) is investigated.

ORAL SESSION WE1B – MARINE ACTIVITIES

WE1B – 1 Shallow Water Cable Abrasion – Managing the Risk

Gordon Lucas (Alcatel-Lucent Submarine Networks)

Until fairly recently, cable abrasion has mostly been associated with faults in deep water where cables have been installed across, or near to, seabed features. The classic solution available to combat this threat is to increase the level of cable protection by utilising Lightweight Protected (LWP) instead of Lightweight (LW) cable. This additional protection can be planned for because the seabed features are visible from the marine route survey data.

However, today, we are increasingly seeing abrasion related cable faults in shallow water where maximum protection (Double Armour – DA) has already been specified. Unlike the deep water faults, some of the environmental factors that lead to abrasion in shallow water are not obvious and are not measured as part of the marine route survey. Furthermore, as the world's ocean floor becomes ever more crowded with submarine cables, routing away from areas where adverse factors exist is becoming much harder to achieve.
The goal of this paper is to raise the awareness within the Submarine Cable Community of shallow water cable abrasion, its causes and steps that can be taken to mitigate the risk.

WE1B – 2 Installing subsea structures – A Successful Cable End Module Case Study

Paul Deslandes (GMSL)

There is a growing trend towards the installation of Cable End Modules (CEMs), which allow subsea rather than on-platform termination of fibre optic cables. However, installing these subsea structures is not without its challenges. This paper addresses the potential issues an installer may face and additionally demonstrates how a CEM in practice may be installed through a case study example from a recent North Sea installation.

ABSTRACTS

WE1B – 3 The Future of Marine Survey - Applications for Submarine Cables
Ryan Wopschall (Fugro)

New advances in survey capabilities have been and are being developed for use in various global industries. While some of these technologies have been explored for use in the submarine cable industry, the development, advancement and adoption of other technologies have yet to be fully explored or implemented.
This paper gives a brief overview of the evolution of marine survey technologies. The paper will then explore modern survey technologies and their possible applications for the survey of submarine cables. These technologies include airborne LiDAR (Light Detection And Ranging), AUVs (Autonomous Underwater Vehicles), MBES (Multibeam Echo Sounder) backscatter, deep-tow SAS systems (synthetic aperture sonar), and drones / unmanned aerial vehicles (UAVs) with orthophoto or mounted laser capabilities.

WE1B – 4 Technology developments are enabling the new generation of cable burial ploughs to operate more efficiently with a reduction in operational downtime
Julian Steward (IHC Engineering Business)

Plough development peaked during the early 2000's; since that period there have been limited advances. There is a renewed focus on the installation of telecom cables and new developments have followed. Dynamic Simulation and, FEA are used to optimise mechanical structures, resulting in better construction and improved fatigue life. The latest control systems include distributed control architectures and intelligent condition monitoring feedback. Equipment can now be interrogated from the beach enabling fast fault correction. Subsea configurable jetting allows optimum ploughing right up to ultra-shallow waters. All of these developments culminate in the production of stronger and more efficient systems which can stay operational in the water longer with less operational downtime.

WE1B – 5 Big Challenge to Overcome Difference in Bending Radius in Housing Unit Used in Submarine Telecommunication System and Seismic and Tsunami Observation System
Satoki Fujimori (Kokusai Cable Ship Co.)

KCS expanded our challenge to implement the network composed of cabled seismographs and tsunami units. The cable used for the network was exactly the same as the one used for submarine telecommunication system. On the other hand, the housing of the seismograph and tsunami unit was far larger and heavier than a housing used in telecommunication system. This paper describes how we achieved to lay and bury the system by covering the following points;
1) Design and modification to adopt the difference in a bending radius
2) Key points to be considered
3) Safety issue

ORAL SESSION WE2A NETWORK TOPOLOGY

WE2A – 1 Cost allocation on a shared fiber pair using ROADM BUs
Marc-Richard Fortin (GlobeNet)

The purpose of this paper is to present a cost model for sharing spectrum across a fiber pair on a subsea system equipped with ROADM BUs and using nm.km as cost unit.

WE2A – 2 A Solution For Flexible and Highly Connected Submarine Networks
Arnaud Leroy (Alcatel-Lucent Submarine Networks)

The profusion of different bit rates in a node - corresponding to the connectivity to different fibers or within the same fiber but with different destinations thanks to wavelength routing capability from the wet plant - should be routed cost-effectively and yet respecting OTN standard for proper network management. Solving this complex matching problem (e.g. 16-QAM 400G recoloring into 8-QAM 300G and/or QPSK 200G) while keeping webscale capacity switching and highly connected topologies at the node level will be described. Additionally, we will study the impact of trading margin against capacity which can be easily made available with new software defined transceivers.

WE2A – 3 Integrated Submarine and Terrestrial Network Architectures for Emerging Subsea Cables
Mohan Rao Lingampalli (Equinix)

This paper discusses front-haul network architectures integrating emerging subsea cables and terrestrial fiber networks. Integrating cable landing stations (CLS) and submarine line terminating equipment (SLTE) in a neutral urban point of presence (POP) optimizes costs while providing access to customers of subsea cable capacity. This paper presents various front-haul network architectures and benefits for extending the SLTE termination for subsea cables from remote landing points to inland POPs in urban areas. This is accomplished through use of terrestrial dark fibers, reconfigurable optical modules, and latest optical transport technologies to extend the reach from the traditional coastal CLS.

WE2A – 4 Open Cables and Integration with Terrestrial Networks
Georg Mohs (TE Subcom)

Today's undersea cable systems are increasingly complex and part of a much larger network topology that spans the continents. Operational efficiency can be significantly enhanced by integrating the undersea paths seamlessly into the overall network architecture. This implies that it is desirable to have one control plane for both the terrestrial and undersea parts of the network, one network management layer and similar transmission equipment. It is therefore not surprising that there is a tendency in the market to continue upgrading undersea cable systems with transmission equipment from the same supplier. This does not present a technical challenge as long as the undersea cable system is in operation and can be tested by prospective upgrade suppliers to ensure that capacity and system margin requirements can be met.

ABSTRACTS

WE2A - 4 continued
However, a significant technical challenge exists if the cable is not yet in operation. In that case the cable is not available for testing and capacity and system margin must be predicted from specifications guaranteed by the cable supplier. A generally accepted performance metric for the undersea cable is the available optical signal to noise ratio (OSNR), which is a necessary but not sufficient parameter to characterize transmission performance. OSNR does not capture nonlinear transmission impairments and system designs with the same OSNR but very different transmission performance do exist.

In this paper, we explore the two important cable implications of open cables: control plane requirements, and criteria for wet plant acceptance. We propose to use effective optical signal to noise ratio, which reflects a combination of linear and nonlinear transmission effects, to describe and guarantee cable performance for ultra-long haul and dispersion uncompensated transmission links.

WE2A – 5 How Resilient is the Global Submarine Cable Network?
Andy Palmer-Felgate (Verizon)

An understanding of marine-based risk can influence many decisions affecting the profitability of submarine cable investments. Yet reliability information is rarely made available in a way that can be quantified and understood in a regional or global context. This paper takes data from more than 1,000 worldwide marine cable faults spanning a seven-year period as inputs to a numerical model that allows estimation of resilience and availability for existing cables, planned cables, and mesh networks.
While there always will be cables that do not fit the model, this paper illustrates the vast regional differences in network resilience as a consequence of marine faults and available redundant paths. The findings presented should enable smarter investment decisions for new system builds, improved budgeting of network operating costs and greater understanding of network resilience (and conversely, vulnerability) by stakeholders at many levels.

ORAL SESSION WE2B – MARINE ASSETS AND OBSERVATORIES

WE2B – 1 A Paradigm Change to Submarine Telecom Marine Assets
Charles Collins (3U Technologies LLC)

Maritime assets utilized by the Submarine Telecommunications Industry have experienced significant changes since SubOptic 2001. Vessels were removed from service, redeployed to other markets with few vessels added. In 2007 opinion was that purpose-built, highly equipped cable ships were the only suitable platforms for cable installation or cable repair. The niche utilization of converted Oilfield Support Vessels (OSV's) was limited. However, today's oilfield Multi-Purpose Service Vessels (MPSV's) are significantly different from those of 2007. MPSV's are larger and configured to facilitate mobilization and demobilization for a broad range of payloads/accommodations/missions. Based upon a recent cost evaluation of a project in the pacific, the mobilization and operation of an oilfield PSV proved uneconomical when compared to utilization of a conventional cable ship. The current MPSV's move the Submarine Telecommunications Industry closer to the oilfield model of lift-on/lift-off capabilities but more work needs to be done. The vessels are ready and capable. However, until the cable laying equipment becomes more readily available, the industry will be tied to existing vessels with already installed cable laying spreads.

WE2B – 2 Marine Maintenance Synergy's – Sharing costs within new market spaces!
Stephen Holden (GMSL)

A paper that sets out to explore if merging markets for submarine repair services e.g. telecom, power, O&G etc. offers a chance for the industry to replace the worlds aging cable repair fleet as well as retain the core marine skills necessary to achieve effective and timely cable repairs. As part of the analysis the paper will examine potential maintenance synergies within the fast developing European wind industry to see if they offer a viable solution to other area's targeted for increased offshore renewable development as well as discuss and evaluate other potential inter industry maintenance models and solutions.

WE2B – 3 S-net Project, Cabled Observation Network for Earthquakes and Tsunamis
Toshihiko Kanazawa (NIED)

The S-net project is an undertaking to construct a large-scale ocean floor network of cabled 150 observatories around the Japan Trench. The S-net covers a wide region of 1000 km x 300 km off the Japan's Pacific coast at a station spacing of 30-50 km with using an optic cable of 5,800km in length. NIED (National Research Institute for Earth Science and Disaster Prevention) takes in charge of the project which is supported by MEXT (the Ministry of Education, Culture, Sports, Science and Technology) financially. The purpose of the S-net is to provide the in-situ and real-time earthquake and tsunami data which will be used for disaster prevention.

WE2B – 4 Installation of new seafloor cabled seismic and tsunami observation system using ICT to off-Tohoku region, Japan
Masanao Shinohara (The University of Tokyo)

We have developed the new compact Ocean Bottom Cabled Seismic and Tsunami (OBCST) observation system using Information and Communication Technology (ICT) since 2005. Our system is characterized by securement of reliability by using TCP/IP technology and a software-based observation node using up-to-date electronics technology. In 2015 September, we installed the system off Sanriku, northeastern Japan to obtain exact seismic activity related to plate subduction such as the 2011 Tohoku earthquake and to observe tsunami on seafloor using two cable observation systems. The observation had been performed just after the deployment of the system.

ABSTRACTS

WE2B – 5 Power and data over fiber for sea-floor observatories
Florent Colas (Ifremer)

For the last decades, transmission of data and power over one single fiber has been investigated in different configurations for seafloor observatories. Recently, this technology was studied for long links up to 10 km. This quasi-all-optical link was demonstrated capable of transmitting data at 5 Mbits/s while providing an electrical power of 120 mW to the sensor. In this presentation, we will first present the developed technology and how the different parts of this link were optimized. Then we will expose its use for acoustic applications.

ORAL SESSION TH1A
LINE DESIGN

TH1A – 1 Capacity limits of submarine cables
Edouardo Mateo (NEC Corporation)

Submarine cables play a fundamental role in global telecommunications. In recent years, the internet traffic is experiencing a remarkable growth due to the large number of resource hungry applications which often require large traffic between data centers. In parallel with this traffic growth, optical transmission technologies have experienced a remarkable transformation providing large improvements in terms of transmission rates, spectral efficiency or OSNR tolerance.

TH1A – 2 Impact of frequency separation between orthogonal idlers on system performance
Pierre Mertz (Infinera)

Continuous-wave (CW) idlers are widely used in submarine links to control channel power to optimize transmission performance. The use of two orthogonally polarized CW lasers as a single idler, instead of a single free-running laser source, has been proved to reduce polarization dependence fluctuation in channels close to it. The frequency difference between the two CW lasers must be carefully controlled, otherwise the system may suffer significant penalty.

TH1A – 3 Quasi-Single-Mode Fiber Transmission for Submarine Systems
John Downie (Corning)
We investigate single-mode transmission over a few-mode optical fiber for submarine systems. The motivation is to achieve a larger effective area fiber with acceptable macrobend loss performance. While nonlinear impairments are lessened by larger fiber effective area, multi-path interference (MPI) becomes a new transmission issue that must be addressed. We model the growth of MPI in quasi-single-mode (QSM) transmission, measure MPI in spans of QSM fiber via different techniques, and present transmission results of high spectral efficiency systems over QSM fiber on link lengths representative of transoceanic distances.

TH1A – 4 The Challenge of Very High Cable Capacity: PDM-8QAM modulation format, the booster for submarine cable capacity and OSNRWET, the parameter to evaluate cable capabilities
Pascal Pecci (Alcatel-Lucent Submarine Networks)

In this paper we review the parameters which allow the capacity of a cable to be increased. Advanced coherent modulation formats bring higher capacity per channel but require a high OSNR. As there are many ways to obtain this high OSNR in the cable, how can one solution be differentiated from another? An OSNRWET parameter is proposed to help in this technical decision. A case study of a 6 600 km link is used to illustrate the capacity dilemma both experimentally and by simulations.

TH1A – 5 Optical Designs for Greater Power Efficiency
Alexei Pilipetskii (TESubcom)

One of the significant limitations in the long-haul undersea systems is the ability to deliver power to the optical amplifiers due to the power feeding from the shore ends thus capping the achievable optical power. The expected growth in undersea capacity requires new solutions for powering problem. The paper will examine approaches that include SDM to optimize the use of available optical power and discuss experimental capacity results.

ORAL SESSION TH1B
PROJECTS AND IMPACTS

TH1B – 1 Flexible ROADM Networks: New aspects of Commissioning, Operation and Maintenance through project examples
Jean-Pierre Blondel (Alcatel-Lucent Submarine Networks)

Subsea flexible networks are now becoming operational with the implementation and commissioning of the first flexible networks based on reconfigurable submerged units such are Reconfigurable Optical Add/Drop Multiplexers (ROADM). This paper reviews how Operation & Maintenance benefit from the new characteristics of such flexible networks and also discusses the practical optimization of the commissioning for systems with multiple possible configurations.

TH1B – 2 The challenges of completing an Oil & Gas Cable System order
Jerry Brown (Hengtong Marine Cable Systems)

This paper details some of the opportunities & challenges Hengtong Marine Cable Systems (HMCS) encountered when working with a client from the oil & gas industry. The equipment design, solutions and documentation requirements are discussed and lessons learned presented. The project budget created many opportunities for novel innovative solutions for the cable accessories supplied. The end client however required only field proven equipment, which could not always be supplied due to existing restrictions and so a number of technical concessions were granted. Some examples are provided to show how all parties worked together to ensure products were delivered on time.

ABSTRACTS

TH1B – 3 Lighting the Way to Bandwidth Equality: The Role of Submarine Connectivity in Bridging the Bandwidth Divide
Michael Ruddy (Terabit Consulting)

Over the last 15 years, international fiber optic bandwidth has expanded to dozens of countries and territories that had previously been served only by satellite links. The submarine communications industry has been the primary enabler of this expansion, providing backbone interregional fiber optic capacity to unserved markets in Africa, Asia, the Caribbean, Latin America, and the South Pacific. As a result, millions of individuals have benefited from faster, more reliable, and significantly less expensive connectivity. Yet despite this significant progress, the promise of next-generation connectivity has still eluded the majority of the planet's inhabitants, and the divergence of nations into groups of "bandwidth haves" and "bandwidth have-nots" has served to impede international development and cooperation, while deepening global economic inequality. By acknowledging the urgent challenges of this "bandwidth divide," proven multilateral solutions can be implemented that offer strong opportunities for public-sector developmental growth and private-sector profitability.

TH1B – 4 Evolution of the Internet of the Middle East
Doug Madory (Dyn)

The Internet of the Middle East is heavily dependent on submarine cable connectivity and thus cable breaks and activations can have dramatic impacts on traffic patterns. However, in recent years, submarine cables aren't the only factors contributing to the development of the Internet of the Middle East. In this brief paper, I describe the some regional impacts of submarine cable cuts in 2008, 2013 and 2015 as well as look at the growth rates of local markets over the past several years by tracking the number of entities routing traffic in each country.

TH1B – 5 Capturing the Public Imagination: Communicating the cultural significance of submarine internet cables
Bronwyn Holloway-Smith (Massey University)

Popular terms such as "wireless", "the cloud", and "cyberspace" have misled public perceptions of internet infrastructure, belying its physical and geographically-bound reality. This can cause problems for the submarine cable industry, particularly when explaining the infrastructure of the internet to uninformed potential investors, regulators, and the public in general. As an independent forum art can be a useful mediator in these situations, enabling shifts in these perceptions of the internet. This paper discusses a range of artworks that present new perspectives on submarine internet cables from outside the industry.

ORAL SESSION TH2A
WET AND DRY TECHNOLOGIES

TH2A – 1 Proving And Qualification Of A Sea-Earthing System For A New-Generation Submerged Branching Unit
Ian Watson (Huawei Marine Networks)

A series of trials has been carried out at 150m water depth over a period of 4 years to evaluate and qualify the long-term performance of the sea-earthing arrangement of a branching unit which incorporates the latest design of submerged plant with titanium housings linked to steel couplings and armour wires. Hydrogen build-up in key areas has been accurately measured and modelled, and the earthing system has been demonstrated to be suitable for indefinite operation with either positive or negative DC powering with no adverse effect on system performance or long-term reliability.

TH2A – 2 Improving the Crush Resistance of Submarine Cables
Weiwei Shen (Hengtong Marine Cable Systems)

Many submarine cable faults are caused by external forces which deform and crush the cable. This paper investigates improvements in cable crush resistance through different Fiber in Metal Tube (FIMT) designs, based on Light Weight (LW) cable and Double Armoured (DA) cable. Finite element models have predicted cable deformations, and these results are compared and analyzed. To verify the finite element models, crush tests have been performed on different FIMT, LW and DA cable structures. Results are presented which show the relative crush resistance improvements and conclusions are made which can be useful to future designs of submarine cable.

TH2A – 3 SLTE Modulation Formats for Long-Haul Transmission
Alexei Pilipetskii (TE Subcom)

The invention of new modulation formats and advanced FEC algorithms has enabled data transmission over transoceanic distances with improved spectral efficiency, receiver sensitivity, and tolerance to transmission distortion effects. Coded modulation and time-hybrid modulation offer the capability to implement variable spectral efficiency, which can be used to optimize the overall cable capacity by taking advantage of variations in OSNR versus wavelength. In this paper, we discuss recent experiments using these next generation modulation formats and FEC algorithms, and the resulting implementation issues.

TH2A – 4 Ultra high capacity transoceanic transmission
Gabriel Charlet (Bell Labs, Nokia)

Since the demonstration of 100Gb/s coherent for transoceanic systems in 2009, the capacity reported in record experiments continue to rise. Spectrum shaping, complex modulation formats such as 16QAM and advanced soft decision FEC have been used for several years in record experiments as well as in modern undersea systems. High capacity experiments combining large spectral efficiency and wide band amplification will be presented, as well as transponder optimization for 400Gb/s per wavelength undersea transmission.

TH2A – 5 Optimising Design of Dynamic Fiber Optic Riser Cable using Cross Section Analysis
Bjørn Konradsen (Nexans)

There is a growth in utilizing fiber optics for offshore infrastructure for both telecom and permanent reservoir monitoring (PRM) systems used for seismic data acquisition. In case the application requires a large number of fibers (PRM), or no fibers are available in the existing infrastructure, it is relevant to install a separate fiber optic riser cable. This paper presents how computer tools used for cross section analysis, combined with analytical and empirical knowledge, was used to improve the mechanical properties of a new fiber optic riser cable.

ABSTRACTS

ORAL SESSION TH2B
THE LAST SESSION

TH2B – 1 The future of changing liabilities and effective subsea asset management
Benjamin Sims (Vodafone)

Deepwater seabed mining is set to become a commercial reality and other established offshore industries are pushing into deep water. Countering this, the scale of environmentally protected areas is rapidly increasing. As a result the liabilities associated with both in-service and out-of-service subsea telecommunication assets is becoming increasingly complex and wide ranging. With this in mind enhanced management and tracking of subsea cable assets should be considered critically important for both system owners and the cable industry as a whole.

TH2B – 2 Government Surveillance, Hacking, and Network Security: What Can Submarine Cable Operators and Their Customers Do?
Kent Bressie (Harris, Wiltshire & Grannis LLP)

Tensions between network security, cybersecurity, and privacy on one hand and surveillance undertaken in the name of national security and law enforcement have only grown more acute since September 11, 2001. Telecommunications providers remain caught in the middle, as uneasy partners in surveillance activities typically mandated by law and also as targets for spying. Government surveillance and access requirements can weaken security and undermine customer confidence. While some measures, such as encryption and robust network security protections can help to protect operators and their customers, others such as bypass infrastructure remain mostly for show.

TH2B – 3 Regulation of Underwater Sounds
Richard Hale (EGS)

Government-appointed regulators have an important role in safeguarding the health of the marine environment. In recent years, they have increased their scrutiny of submarine cable operations. A recently-introduced aspect of environmental regulation, that is unfamiliar across much of the submarine cable industry, is the regulators' scrutiny of underwater sounds. This paper reviews underwater sounds made by cable engineering operations; and how these sounds affect marine wildlife. Regulators' requirements in different jurisdictions will be described, based on recent experience of permit applications.

TH2B – 4 Permanent Reservoir Monitoring (PRM) System Installation: The Installer's Perspective
Andrew Lloyd (GMSL)

This paper shares Global Marine's main considerations when designing and delivering long lasting Permanent Reservoir Monitoring (PRM) installation solutions that reap rewards for those oil majors carefully assessing the opportunity cost of same.
By its very nature the capital investment in PRM is significant thus making it critical to consider all aspects of system planning, installation and maintenance; this includes all aspects of cable engineering from desk top study through to installation and associated burial options.

TH2B – 5 SDN: Still Dumb Networks? (INVITED PAPER)
Steve Alexander (Ciena)

The advent of a Software Defined Network (SDN) is the hot topic of discussion to those who design and operate terrestrial networks from access to core, and is now being targeted at submarine networks as well to enable a globally orchestrated network, both overland and undersea. The presentation will cover why SDN is such a hot topic by reviewing the associated technology and business benefits that are made available to network operators that will change how they build, manage, and monetize their networks. Also covered will be how SDN marketing hype is being translated into a real-world use case with a major network operator.

POSTER SESSION ABSTRACTS

MARKET & PROJECT TRENDS & CHALLENGES

MP01 The challenges of fibre optic installation in developing markets
Paul Deslandes (GMSL)

The demand for greater connectivity with emerging markets presents significant commercial opportunities for those involved in delivering new technology. Counterbalancing this, however, is a variety of operational challenges. Subsea fibre optic cables are becoming the primary method for telecommunications for such countries nonetheless, as markets they are often characterised by limited infrastructure, a different business culture and in some cases serious hazards both natural and manmade. So what exactly are the pitfalls and how do you manage these challenges to ensure the successful delivery of the project? This paper identifies the common factors and outlines a proven plan of action.

POSTER SESSION ABSTRACTS

MP02 Submarine Optical Cable Market in Africa: Challenge and potential
Ali Ben Abdallah (Tunisie Telecom)

In Africa during the past decade, ICTs have experienced considerable growth. The popularity of African countries for these technologies is real. The evolution of the bandwidth and the connections to the Internet is impressive. All evidence suggests that this trend is going to continue, as the availability expands and the cost of access continues to decline.

This is even more real than after decades of stagnation, Africa's economy is growing. Over this period, the continental GDP has grown at an average annual increase 5 % making Africa one of the most dynamic areas in the world.

MP03 How media attention can shorten repair times for damaged cable systems
Kristian Nielsen (Submarine Telecoms Forum)

Lately, the news coming from the submarine fiber industry has fallen into two categories: what's new and what's damaged. With new systems seemingly popping up in every time zone, existing and aging systems fight for headline space when a fault occurs and service is interrupted. Over the past three years, SubTel Forum has noted that a handful of systems in separate regions have been experiencing regular fault – be that accidental or otherwise. In this time, we've observed that there are plenty of other systems that suffer faults, but these few make the most press about the incident. The question that presents itself is "Does the media have any impact on the actual downtime a cable can see before a repair is accomplished?" Examining the three different modes of news transmission – paid subscription, free news feed and social media – we will perform an analysis of news coverage regarding cable faults that have occurred since 2010. Each news post will be subjected to a metric that will determine its effectiveness on impacting response time to a fault in a given region. And further, the method of news will also be analyzed, determining which method of news distribution has been the most effective for our industry.

MP04 How EPIC are submarine cable systems?
Mounish Patel (Vodafone)

Engineering, Procurement, Installation and Commissioning (EPIC) of submarine cable systems is commonly carried out on a "turnkey" basis. The engineering, construction and implementation of a new submarine cable system is extremely costly and involves a great deal of complexity. An example of complexity studied in this paper is submarine cable permitting requirements and its corresponding timescales. Management of this activity is vital as it is frequently observed to become a critical path activity. This is one of many reasons why purchaser involvement is essential. This paper also considers why turnkey projects cannot be solely managed by the supplier, and how in reality this concept/model has been not proven to be applicable to all new-build projects.

MARINE SERVICES AND OPERATIONS

MS01 Submarine Cable Spatial Planning Discussion Based on Increasing Marine Activities
Hongli Shi (Huawei Marine Networks)

With global social and economic development, the demands of seabed space are increasing rapidly. The security and reliability of submarine cable systems during its long term design life is more and more critical. Reliable cable route planning can highly mitigate suffering from the increasing external risks and achieve a long term life. This paper discusses the constraints and influences on the planning of submarine cable systems based on past cable faults. The constraints and influences in nearshore areas (0-50m water depth) from offshore areas (50-200m water depth) are discussed.

MS02 Shore End Cable Protection Case Study – Submarine Cliffs
Xiaolong Zhang (Huawei Marine Networks)

A recent project involved the planning and installation of a submarine cable between isolated oceanic islands of volcanic origin. One of many project challenges was the complexity of the cable landings. In the approach to the landing sites, the cable had to ascend vertical submarine cliffs with heights in excess of 20.0 m – a zone influenced by strong swell and corrosive seawater. During the planning phase, with directional drilling and rock cutting considered impractical, a decision was made to pin the cable encased in articulated pipe to the cliff face. The difficulties in achieving this, and the subsequent impact of a storm with magnitude in excess of The Perfect Storm, are discussed.

MS03 New Subsea Optical Fibre Junction Box for reduced tensile load applications
Craig Beech (GMSL)

Composite cables have at least one fibre optic cable used for monitoring, control and maintenance of the system. These fibre optic cables are normally of a simple construction; fibres contained within a hermetically sealed pressure 'fibre tube' with an extruded insulating layer. In many applications field and repair joints the re-instated optical fibre joint housing is contained within a larger housing where the optical cable is not required to support the cable weight during deployment nor does it require additional protection. This paper describes one such tailored solution utilising expertise gathered from the very first subsea fibre optic telecoms systems.

MS04 Lessons Learned from Past Cases for Achieving Disaster Resilient Routing and Economically Viable Maintenance Operation
Yukitoshi Ogasawara (Kokusai Cable Ship Co.)

This paper will look into and analyze cable faults occurred near Japan over the past decade and describe effective countermeasures for realizing disaster resilient routing as well as economically viable maintenance operation by identifying the trends of cause geographically. Finally, above lessons will contribute to the development of the submarine cable industry.

POSTER SESSION ABSTRACTS

MS05 Applied seabed geomorphology in cable route planning, surveying and engineering
Eric Roach (EGS)

Geomorphological mapping is a fundamental requirement in cable route planning, surveying and engineering. It comprises several constituents that require sophisticated equipment to collect and build. Efforts are being made by industrial and academic institutions to provide harmonized standards to render geomorphological maps to be scientifically holistic. Compilation of geomorphological maps in most cases is assigned to laymen and the maps are designated to be read by laymen. Thus, a new approach has been developed in EGS to maintain geomorphological information precision and easy information transfer for cable route surveying and engineering. Applied geomorphology will allow a cost effective design of a survivable cable network, optimizing the shapes of the submarine cables taking into consideration of the seabed topology.

MS06 Real-time Correlation of Cable Fault to Vessel Location and the benefit to Cable System Operators
Darwin Evans (Ciena)

Vessel activity in shallow waters is a real concern for submarine cable operators because of the potential for damage to cables from fishing and anchoring. Cable faults caused by vessels have an estimated direct cost of US$50 million per year, in addition to the possible impact to global communications, which can run into the hundreds of millions of dollars.

Detailed knowledge of the physical location of submarine cables combined with real-time knowledge of vessel location in relation to those cables, can help to prevent damage and so minimise costs as well as increasing end-user satisfaction by avoiding outages.

In the event of a cable fault occurring, knowing vessel locations at the time of the fault can also help determine possible causes and provide detailed information on any vessel(s) that may be responsible. In addition, with an improved understanding of the threats vessels can cause, cable owners can undertake targeted cable awareness programmes.

This paper outlines a wetplant-vendor-agnostic method using standard REST API programmable interfaces and SDN orchestration, to correlate vessel location and cable geographic location data with relevant fault data available from SLTE supervision, COTDR and PFE. This solution can be applied to any cable network to proactively reduce operations costs, increase uptime by preventing avoidable breaks and reduce downtime through automated collection of the key inputs the responsible marine operators require before repair activities occur.

MS07 The Global Challenges of Comprehensive Undersea Jointing
Maurice Kordahi (TE Subcom)

Undersea systems are made up of cable and amplifiers, the joints that connect them together, and terminal equipment that link the systems to terrestrial networks. Leading suppliers have developed and refined their various jointing platforms to meet similar

needs worldwide. In this paper, we consider the challenges of developing and deploying a new global jointing platform in the current market climate. Furthermore, we examine the costs that suppliers face in pursuing the rewards associated with successfully developing the next generation of connecting hardware that breaks away from the pack. We offer a simple tool for comparing costs of introducing a new global platform vis-à-vis continuing with the existing jointing technologies and advancing via incremental improvements. Finally, we discuss the road ahead and the philosophy for driving forward.

NETWORK ARCHITECTURE AND SYSTEM DESIGN

NA01 Power Feeding Solution for Festoon-like Repeatered Submarine Cable System
Yuhe Li (Huawei Marine Networks)

Power feeding equipment and return earth systems are key components of a repeatered submarine cable system, which provide power to the submersible equipment and enable the system's operation. Double-end feeding design with single-end feeding capability is usually adopted to improve the reliability of a power feeding system for a point-to-point repeatered segment.

This paper describes a new design of power feeding solution for a festoon-like repeatered submarine cable system. It is more cost-effective than a traditional design but with equal reliability. The power circuit reconfiguration and fault isolation can be easily achieved by using a high voltage power switch during system operation and maintenance. The features and benefits of the power feeding design are detailed in respect of system reliability, safety, cost effectiveness and the flexibility of operation.

NA02 Spectrum sharing in a multivendor environment
Darwin Evans (Ciena)

With an increase in the number of submarine terminal upgrade vendors providing transmission technology, cable owners now require the ability to support overlaying additional vendor equipment on cables with existing incumbent vendor channels. In addition, the concept of selling spectrum on a cable instead of switched electrical capacity requires the cable owner to have a method of safely and securely providing access to the spectrum to a number of end customers. A method is required ensure the spectrum, either filled with multiple vendors' equipment or sold to different end users, is partitioned and managed correctly. The management solution must be capable of avoiding conflicts and minimizing impacts of actions of one spectrum owner on another in a fixed-power environment. To minimize the impact of change a way of orchestrating changes and responding to fault events is required. This paper outlines a proposed architecture using open APIs and toolsets to perform this orchestration while providing flexibility and security to all end users of the spectrum.

POSTER SESSION ABSTRACTS

NA03 Upgrading on the Longest Legacy Repeatered System with 100G DC-PDM-BPSK
Jianping Li (Huawei Marine Networks)

The largest West Africa submarine cable system cross connects 14 countries along Europe, West Africa and South Africa, was successfully upgraded to 100G systems recently by HMN (Huawei Marine Network). This paper describes how to lay down the solution by field trial and the delivery details on the longest legacy 11450km segment between Portugal and South Africa.

NA04 Transoceanic Transmission over 11,400km of installed 10G System by Using Commercial Dual-Carrier 100G
Ling Zhao (Huawei Marine Networks)

We demonstrate the transmission of 100Gbps DC-PDM-BPSK over deployed 11,450km transoceanic dispersion-managed link with EDFA amplification. The mixed transmission of 10G/100G traffic is mandatory. All upgraded channels can meet the final acceptance standard with robust stability. In addition, we show that simulation plays an essential role in the process of system capacity prediction and upgrade. The differences in Q-factor after transmission between simulation and test are within 0.4 dB. This is a successful demonstration of upgrade from 10G to 100G over one of the longest transoceanic networks.

NA05 Modeling of nonlinear fiber effects in systems using codirectional Raman amplification
Hendrik Besch (Coriant)

This paper proposes a new technique for determining the impact of nonlinear fiber effects on signal propagation in unrepeatered transmission systems when using codirectional Raman amplification. The proposed concept is based on pre-calculated nonlinear penalties for a set of power profiles by making use of accurate but computation-intensive techniques. Once the performance of a specific link needs to be determined, an accurate estimate of the nonlinear penalty is derived from the entries of the generated database almost instantly. The composition of the database and the method to derive the nonlinear penalties from the entries are explained.

NA06 Optimization of Pulse Shaping Scheme and Multiplexing/Demultiplexing Configuration for Ultra-Dense WDM based on mQAM Modulation Format
Inoue Takanori (NEC Corporation)

In this paper, we discuss the optimization of the spectrum shaping technology and multiplexing/demultiplexing configuration considering linear and nonlinear penalty based on the QAM modulation format. Q performance of DP-8QAM and DP-16QAM signal with 37.5 GHz or 33.3GHz channel spacing under back-to-back and transmission condition are analyzed through several simulations. Finally, we experimentally evaluate the transmission performance of DP-16QAM using the straight transmission line with the optimized spectrum shaping and multiplexing/demultiplexing configuration

NA07 Simple method to estimate repeater span by varying the length of a reference digital line section
Francis Charpentier (Orange)

In this paper, we review a simple heuristic method to estimate the required repeater span of a new cable system from the knowledge of the span, overall length and fibre attenuation of a system already deployed in the field, and we analyse its range of validity by comparing it to an accurate simulation model. We show that by taking appropriate care, the estimation error can be kept low enough to be used for the investment opportunity studies needed to drive new cable system deployments.

NA08 Resource Savings Using Gridless Submarine Networks based on Filterless Coherent Transmission Technologies
Christine Tremblay (Ecole de technologie supérieure, Université du Québec)

Flexible and scalable networking solutions are required to offer more efficient bandwidth allocation and increased connectivity in submarine networks. In this regard, filterless optical networks based on agile edge nodes equipped with coherent transceivers and passive broadcast-and-select nodes are promising cost-effective options which allow for more flexible capacity allocation and resource optimization in the optical layer. In this paper, we evaluate possible resource and cost savings in a filterless submarine network architecture.

NA09 Digital Protection versus Optical Protection in Real Network Implementations
Benoit Kowalski (Infinera)

Two main protection solutions are available when protecting traffic from a cable landing station to a point of presence through a dual route backhaul. The first solution is based on optical switching, often referred to as OPTICAL sub network connection protection (O-SNCP). The second solution is based on digital switching, referred to as DIGITAL sub network connection protection (D-SNCP). Both protection solutions are designed to restore commercial services in less than 50ms. While O-SNCP is often the lowest cost implementation since it requires only a single line module or transponder at each end of the link, it suffers from operational limitations compared to the D-SCNP implementation. D-SNCP requires two line modules or transponders at each of the protection link and reacts protects much more complex failure scenarios beyond the basic Loss of Signal (LOS) that O-SNCP only supports. This paper discusses D-SNCP versus O-SNCP based on real deployments and operational experiences on commercial networks where D-SNCP eventually replaced O-SNCP deployment in order to counter traffic outages experiences with the previously-implemented O-SNCP solution.

POSTER SESSION ABSTRACTS

NA10 Innovative Submarine Transmission System using Full-Tunable ROADM Branching Unit
Takehiro Nakano (NEC Corporation)

This paper describes the flexible connectivity of advanced submarine cable systems using fully-tunable ROADM branching units. Key features of fully-tunable submarine ROADM systems are discussed and compared with conventional and terrestrial ROADM systems. The transmission performance of a fully-tunable submarine ROADM system is demonstrated using a prototype ROADM branching unit and long distance straight line test-bed.

EQUIPMENT AND COMPONENT TECHNOLOGIES

EC01 The Electrochemical Aspects of the use of Titanium and Steel In Submerged Plant and Cables
Ian Watson (Huawei Marine Networks)

A series of laboratory tests, and trials at 150m water depth, have been carried out to investigate thoroughly the electrochemical effects resulting from the use of titanium repeater and BU housings, with titanium bend-limiters, in close proximity to steel couplings and armour wires. The titanium oxidises preferentially but at a rate slow enough to be negligible well beyond the system lifetime. Additionally, the presence of titanium actually inhibits the natural corrosion of steel that would otherwise occur, resulting in a very effective design of submerged plant which easily meets the reliability criteria for submarine networks.

EC02 The Relationship of Carbon Backfill and Metal Corrosion Rate in Submarine Electrode Array System
Kai Sun (Huawei Marine Networks)

Carbon backfill is an effective way to reduce corrosions rate by converting the ionic conduction of metal material into the electron conduction. This paper will demonstrate the precise effects of the carbon backfill towards the material's corrosion rate obtained during field trials. Moreover, the relationship between the amount of backfill material used and electrode corrosion rated is also calculated and presented in this paper according to trial results. Based on the outcome, the minimum amount of carbon backfill can be selected to simplify the installation process and reduce any associated engineering cost.

EC03 A more reliable pumps redundancy design
Changwu Xu (Huawei Marine Networks)

This paper describes the benefits and practicalities of a more reliable repeater pump redundancy design by utilizing four pump lasers backup within a two fiber-pairs system. The test result shows that this sort of redundancy provides submarine systems more reliability and thus sturdier to tolerance of up to three pump lasers failure, which ultimately can be detected by COTDR equipment.

EC04 A New Cable Failure Quick Isolation Technique of OADM Branching Unit in Submarine Networks
Hongbo Sun (Huawei Marine Networks)

When cable faults occur in an undersea fibre communication system with an OADM function, performance of survival traffic maybe degraded or even interrupted. A new fault isolation scheme that induces zero penalty on survival traffic is discussed in this paper. Experiments detailed below shows that this scheme is safe to a submarine cable line with no risk of optical power transient during fault isolation operation and has no impact on transmission.

EC05 Evaluation of Nonlinear Impairment from Narrow-band Unpolarized Idlers in Coherent Transmission on Dispersion-managed Submarine Cable Systems
Masashi Binkai (Mitsubishi Electric Corporation)

We evaluated numerically and experimentally the effect of the cross phase modulation (XPM) from narrow-band unpolarized idlers on neighboring 100 Gbps PM-QPSK signals in submarine cable systems. We investigated the effect of XPM from an ASE idler whose bandwidth was set from 25 to 75 GHz. Experimental results showed a maximum XPM penalty of 1.0 dB at 25 GHz bandwidth, which agreed with the simulation. The narrower the ASE idler bandwidth, the more severe the nonlinear penalty was. Also, a modulated idler reduced the nonlinear penalty by 0.9 dB compared to the ASE idler.

EC06 Effective Application of KCS Cable Probe for Localizing Submarine Telecommunication and Power Cables
Takaharu Etou (Kokusai Cable Ship Co.)

The KCS Cable Probe made high accuracy localization possible with easy operation by a diver and simultaneously measuring the burial depth of a buried cable on the beach or inshore area. It detects a low frequency magnetic field generated around a cable and localizes a buried cable position by measuring the distribution of the magnetic field which is generated by the electroding. This development has enabled detection of the existing cables without excavation work and eliminating most of the risks at the same time. The Cable Probe can be used to locate submarine telecommunication and power cables.

EC07 Ultra-low loss and large Aeff Pure-silica core fiber advances
Hideki Yamaguchi (Sumitomo Electric Industries)

Fiber loss of 0.152 dB/km at 1550 nm on a mass production basis is realized, which will be the lowest among commercially available optical fibers, by decreasing Rayleigh scattering on a pure-silica-core fiber having enlarged Aeff of 130 μm2. By virtue of the ultralow loss, this pure-silica-core fiber will have the highest fiber figure-of-merit and be the most suitable for ultra-high capacity transoceanic communication systems.

POSTER SESSION ABSTRACTS

EC08 Evaluation of Mixed Metal Oxidation For Sea Earth Electrode With High Reliability
Hong-ying Chao (Huawei Marine Networks)

The sea-earth electrode is a key component for any submarine network with one or more branching units with three powered legs. It needs to have excellent electrical conductivity, corrosion resistance and a long service life, which depend on both its metal substrate and coating compositions. Various precious mixed metal oxide (MMO) coated electrodes with a titanium matrix were developed and investigated for this application. This paper describes the accelerated ageing and other tests carried out to confirm the performance of the chosen design.

EC09 Ultra-Low Loss Fiber and Advanced Raman Amplification Deliver Record Unrepeatered 100G Transmission
Do-il Chang (Xtera)

We report the longest 100G unrepeatered transmission without any in-line active elements. The unrepeatered transmission is achieved by using a commercial distributed Raman system with coherent 100G transceivers (PM-QPSK) and ultra-low loss fiber with large effective area to support handling of high optical power levels. An enhanced ROPA configuration which utilizes additional pumping fibers is used to extend reach. A single 100G channel is transmitted over a record 626.8 km distance with a span loss in excess of 100 dB.

EC10 Tool-Kit for Ultra-Long / High-Capacity Repeaterless Systems
Philippe Perrier (Xtera)

The various technologies that make ultra-long, high-capacity repearterless transmission possible are first reviewed. The respective contributions of some of these technologies – specifically, Raman amplification and remote amplification – to the reach extension are then analyzed in a specific example. In conclusion, examples of deployments and of laboratory demonstrations exploiting some of these technologies are presented.

NETWORK OPERATIONS AND CARRIER SERVICES

NO01 When do pump failures prevent system re-use or lifetime extension?
Tony Frisch (Xtera)

Re-using or extending the life of existing submarine systems can offer significant economic benefits, but raises obvious questions about reliability. This paper focuses on lasers and explores what lifetime is likely to be achieved and the way in which a system might eventually fail. Where good practice has been employed it seems likely that laser reliability will allow systems to operate beyond 25 years, providing that there are no other blocks, such as lack of operating margin. Thanks to laser redundancy, system failure should be relatively gradual, with several years between the first laser failure and the time when an amplifier-pair fails.

NO02 Real-Time Wet Plant Health Monitoring and Automation
Darwin Evans (Ciena)

Coherent technology, powered by advanced Digital Signal Processing (DSP) provides access to a rich set of detailed information about not only the performance of optical channels, but other key parameters that can provide indication of the state of the infrastructure over which the channels operate. Active supervisory systems and C-OTDR based passive monitoring systems also provide varying levels of information about the operating state of the wet plant. These datasets, when regularly collected and analyzed, particularly in an automated, software controllable fashion, can provide cable owners with performance insights into their assets that were previously not accessible on a large scale.

In this paper, we discuss how network operations can be simplified via automating the collection and analysis of the datasets via interfaces such as REST based APIs and how using SDN functionally can provide real-time insight into the health of a submarine wet plant through long term collection of such information to analyze performance trends and potentially enabling the forecast of future maintenance requirements.

It can also assist in estimating the remaining system life and the technical viability of a system beyond its design life, by analyzing the datasets in order to determine the submersible plant reliability to date and its ageing trend.

NO03 Capacity optimization of submarine cable through smart spectrum engineering
Vincent Letellier (Alcatel-Lucent Submarine Networks)

New generation flexible and coherent transponders offering multiple, selectable or tunable parameters such as modulation schemes and channel wavelength tuning are now being deployed in line terminal equipment. Spectrum engineering consists of selecting the optimum transponder parameters to match each channel format to line performance within the system bandwidth to optimize the submarine cable capacity to the required transmission performance.

OIL & GAS AND SPECIAL MARKETS

OG01 Emerging subsea networks: new market opportunities for, and societal contributions from, SMART cable systems
Christopher Barnes (University of Victoria)

The subsea telecommunications cable industry has the opportunity to enter a new era with the emergence of game-changing dual-purpose cable systems. These SMART cables will incorporate small external sensor packages to transmit real-time environmental data without any impact on commercial traffic. The sensors will precisely measure temperature, pressure and three-axis acceleration across the world's ocean floor on a sustained basis in response to an increasing international need to monitor and mitigate climate and sea-level change and radically improve tsunami hazard warnings. SMART cable systems will provide new market opportunities, engage non-traditional users, and make profound societal contributions.

POSTER SESSION ABSTRACTS

OG02 Design of Fiber Optic Cables and Accessories for Offshore Applications
Inge Vintermyr (Nexans)

Utilizing fiber optics in offshore infrastructure introduces additional requirements and needs for special engineering, compared to traditional telecommunication subsea deployments.

In particular, dynamic riser sections and associated components for dynamic applications configuration call for extended engineering, analysis and qualification testing. Furthermore, the subsea applications commonly require wet-mate connectors.

The reliability requirements are high, due to stringent demands to operability and the cost and risk related to repair campaigns.

This paper describes the various challenges in design, installation and shipment of cable designs and accessories for FO offshore systems.

OG03 Fibre to Platform Connectivity – Working in the 500m zone
Andrew Lloyd (GMSL)

The process of connecting oil and gas platforms with fibre optic telecommunications cables is not without its challenges. Overcoming the specific and sometimes considerable issues that lie in wait demands both expertise and experience from the marine installer, particularly in the 500m zone. This paper identifies the major areas that need consideration from concept through to decommissioning.

OG04 Application of QAM signals to Oil & Gas OADM submarine cable systems
Hiroshi Nakamoto (Fujitsu)

In the monitoring systems of the OIL & GAS sector, it is necessary to select the fiber configuration and modulation format. The digital coherent format is effective in the coexistence of the monitoring signal and a normal communication service.

OG05 The European Multidisciplinary Seafloor and water-column Observatory - the Development and utilisation of large scale distributed EU cabled marine research infrastructure
Paul Gaughan (Irish Marine Institute)

EMSO (European Multidisciplinary Seafloor and water-column Observatory; http://www.emso-eu.org) is a large-scale European Research Infrastructure (RI) composed of fixed-point, seafloor and water-column subsea networks and observatories with the scientific objective of near- and real-time, long-term monitoring of environmental processes related to the interaction between the geosphere, biosphere, and hydrosphere. EMSO infrastructure is distributed in European waters, from the Arctic, through the Atlantic and Mediterranean Sea to the Black Sea. EMSO will be the sub-sea segment of the COPERNICUS initiative and will significantly enhance the observational capabilities of European Member States. The EMSO User Strategy is closely aligned with Blue Growth -the long term strategy of the European Union to support sustainable growth in the marine and maritime sectors. The strategy includes a vision of the EMSO infrastructure as the heart of a powerful, new European high-tech marine science and technology Innovation Platform.

PAPERS COMMITTEE

The Papers Committee was comprised of the Papers Committee Chair and six Vice Chairmen, one for each of the nominated topic areas, plus an expert panel of reviewers in each of the topic areas, who together with the Vice Chairmen were responsible for the peer reviews of all submitted Executive Summaries.

PAPERS VICE CHAIRMEN

The Vice Chairmen allocated to the six topic areas were:
Market & Project – Trends & Challenges - Mohamed Nasr (PCCW Global)
Marine Services and Operations – Graham Evans (EGS)
Network Architecture and System Design – Peter Booi (Verizon)
Equipment and Component Technologies – Edwin Muth (TE Subcom)
Network Operations and Carrier Services – Stephen Dawe (Vodafone)
Oil & Gas and Special Markets – Guillaume Huchet (Alcatel-Lucent Submarine Networks)

Under each Vice Chairman a review committee of 8 or more industry experts, specialists in the topic area, were nominated to reflect as broad a cross-section of the industry as possible, geographically and in terms of company affiliation.

VICE CHAIRMEN BIOGRAPHIES

MOHAMED NASR
MARKET & PROJECT TRENDS & CHALLENGES

Mohamed Nasr is AVP – EMEA Cable Development at PCCW Global, with more than 14 years' experience in Telecom field, including O&M, Project Management, Business Development, Marketing and Sales. Mohamed has been involved in Submarine Cable Business since 2008, and used to be the head of International Business Unit at Telecom Egypt until early 2016.
Mohamed participated in the introduction of different successful cable systems, he was one of the Co-Founders of Asia-Africa-Europe-1 "AAE-1" Submarine Cable System and he used to be the Co-Chair of the Investment and Agreement Subcommittee "I&ASC" for AAE-1 until Feb' 2016. Mohamed has a bachelor degree in Telecom Engineering and a Master in Business Administration.

GRAHAM EVANS
MARINE SERVICES AND OPERATIONS

Graham Evans has more than 37 years experience as a marine geoscientist and is a Director of the EGS Survey Group serving as Executive Director of EGS companies in Australia and the United States. Graham's involvement in the submarine cable industry began in 1990 after being encouraged to adapt geoscience procedures developed for marine engineering applications to submarine cable burial assessment.
Graham represents EGS on both the SubOptic and ICPC Executive Committees and was a Program Committee Vice Chair for SubOptic 2010. Graham is a contributing author (Chapter 4) of Submarine Cables: The Handbook of Law and Policy. Graham holds a BSc in Geology and BA in Earth and Environmental Sciences

PETER BOOI
NETWORK ARCHITECTURE AND SYSTEM DESIGN

Peter Booi has been with WorldCom and subsequently Verizon since 1998, where his work focused on development of Verizon's global network, and in particular submarine cable networks. Mr. Booi has been engaged in numerous new submarine-cable builds as well as capacity upgrades.
Mr. Booi has holds a MSc and PhD degree in Applied Physics from the University of Twente in the Netherlands, and previous work experience included research at NIST, IRAM and KPN Research.

EDWIN MUTH
EQUIPMENT AND COMPONENT TECHNOLOGIES

Edwin Muth is Director of Product Line Management at TE connectivity SubCom, responsible for planning of the dry and wet plant products. He joined TE Subcom in 2011 after a short time defining LinkWireless' strategy and supporting wireless companies in need of management consulting.
Prior to this he was a Senior Director at Infineon Technologies, LSI, Agere Systems and Lucent managing a wireless ICs and DSP Systems On a Chip business. Prior to that he held various Engineering Director, Manager, and Systems Engineering positions in wireless consumer products terminal hardware and satellite communications systems at AT&T/Lucent.

STEPHEN DAWE
NETWORK OPERATIONS AND CARRIER SERVICES

Stephen Dawe is Engineering & Business Development Manager at Vodafone Group Services Ltd with 32 years of experience in the submarine systems industry and an extensive background in engineering, system development, management and business development.
Recent career highlights include serving Cable & Wireless Communications as Director of Submarine Systems Engineering for CWC Wholesale Solutions.
His expertise includes international connectivity and carrier commercial arrangements for submarine cables. He was the Network Manager for the Japan-US Cable and has managed a wide range of diverse submarine systems, Stephen is a regular contributor to the SubOptic, Executive Committee Member of Subsea Cables UK and represents Vodafone on a number of cross industry committees.

GUILLAUME HUCHET
OIL & GAS AND SPECIAL MARKETS

Guillaume Huchet received his Master's degree in Optics from Ecole Supérieure d'Optique in 2000. He joined Alcatel Submarine Networks in 2001 and since played several operational roles ranging from system engineering to contract management, involved in the engineering and construction phases of a variety of submarine networks, including Scientific and Oil & Gas systems.
Guillaume now heads the technical department of ASN Oil & Gas division, in charge of Oil & Gas products portfolio and technical proposals.

ABSTRACT REVIEW TEAMS

MARKET & PROJECT – TRENDS & CHALLENGES

Adrian Moss	Reliance Jio Infocomm UK Ltd
Bernard Logan	Delta+ Ltd
Charles Jarvie	MBIE
Colin Anderson	Ciena
Dieter Sieber	T-Systems Singapore
Kent Bressie	HARRIS, WILTSHIRE & GRANNIS LLP
Laurie Doyle	Alcatel-Lucent Submarine Networks
Rab Paramothayan	Gibtelecom

MARINE SERVICES AND OPERATIONS

David Willoughby	Ocean Specialists Inc.
Gordon Lucas	Alcatel-Lucent Submarine Networks
James Coble	TE SubCom
Alasdair Wilkie	Hibernia Networks
Tom Schmitz	NSW
Nigel Irvine	Verizon
Ryan Wopschall	Fugro Pelagos
Stuart Wright	Huawei Submarine Networks
Tsutomu Ohta	NEC
Masakuni Kuwazuru	KDDI
Catherine Creese	US Navy

NETWORK ARCHITECTURE AND SYSTEM DESIGN

Nicolas Brochier	Orange Labs
Jose Chesnoy	Independent
Jamie Gaudette	Microsoft
Valey Kamalov	Google
Takaati Ogata	NEC
Masahiro Soma	RAM Telecom Intl.
Daniel Welt	Tata Communications
Izumi Yokota	Fujitsu
Olivier Courtois	Alcatel-Lucent Submarine Networks
Takahiko Shibata	NTT Com Asia Ltd

EQUIPMENT AND COMPONENT TECHNOLOGIES

Ramakrishna Pratapa	Global Cloud Xchange
Robert Lingle	OFS
Yoshihisa Inada	NEC
Gameel Sharaf	Huawei Submarine Networks
Steve Grubb	Facebook
Herve Fevrier	Xtera
Francis Audet	EXFO
Carine Laval	Alcatel-Lucent Submarine Networks
Tim Stuch	Microsoft
Atsuhiko Utsumi	Fujitsu
William Wood	Corning
Michael Cuddington	BT

NETWORK OPERATIONS AND CARRIER SERVICES

Josephine Conroy	Level3
Carlos Pazmino	Telconet
Iwan Saputra	Telin
Chris Mott	Telstra
Chang Weiguo	China Telecom
Don Schuett	Telx
Maxim Kuschnerov	Coriant
Jol Paling	Subsea Networks
Anderson White	Lime

OIL & GAS AND SPECIAL MARKETS

Gavin Tully	TE SubCom
Simon Webster	NEC
Stephen Keenlyside	Alcatel-Lucent Submarine Networks
Jean-François Rolin	Ifremer
Eric Carbonnelle	Axiom
Peter Phibbs	Marlin Consultant
Pierre Tremblay	OSI
Phil Martell	Nextgen
Joel Ogren	Ocean Networks

PROGRAMME STRATEGIC ADVISORS

The Programme Committee is responsible for formulating the overall conference programme, including the oral presentations, poster presentations, masterclass/tutorials, keynote speakers, and special sessions.

The Programme Committee comprised the Programme Chairman and five strategic advisors, chosen for their special experience and interest in SubOptic:
Elaine Stafford
Carl Osborne
Maja Summers
Keith Schofield
Mahesh Jaishankar

John Horne, the secretary of the SubOptic Executive Committee, also sits on the Programme Committee bringing his wealth of knowledge and experience from the past conferences.

The members of the Programme Committee together with the Papers Committee have many years of experience in the submarine networks industry. The Programme Chair is very grateful to all in the team who have helped shape the SubOptic 2016 programme we have today.

Extra special thanks must go to Elaine Stafford for her tireless enthusiasm and continuous flow of ideas and welcome advice throughout the conference build-up.

SUBOPTIC MOBILE APP

For the first time SubOptic has introduced an Event APP that registrants may use during the forthcoming SubOptic 2016 event.

The APP can be downloaded from all four stores; Apple, Android, Blackberry and Windows under the name "**SubOptic16**".

It gives attendees visibility of the whole programme, day by day and allows individuals to plan their own calendar.

A summary of each of the presentations is provided and at the end of each day, the presentations themselves will be uploaded onto the APP.

A messaging facility to allow contact between attendees is also included, avoiding the need to share email addresses.

These are just a highlight of the available features and a Quick Guide to all of them will be included within your Welcome Pack.

SubOptic
www.suboptic.org 2016

SOCIAL & NETWORKING PROGRAMME

Welcome Reception
Monday 18th April, 6:00 – 8:00 pm
Level 4, Exhibition Floor, The Conrad Hotel

The Welcome reception will take place after the official opening of the Exhibition. This will be a first opportunity to meet Exhibitors, old friends and colleagues, with drinks and hors d'oeuvres served.

Sponsored by Seacom

Poster Session Reception
Wednesday 20 April, 3:30 – 6.00 PM
Level 4, Exhibition Floor, The Conrad Hotel

The 'hub' event of the Conference, the Poster Session will bring all SubOptic attendees together for an interactive presentation of the Poster papers. Drinks and refreshments will be served as attendees are free to browse over 40 poster papers, meet authors, and discuss the papers in detail.

Sponsored by Corning

Gala Dinner
Thursday 21 April, 7:00 – 10:30 PM
The Armani Terrace, Armani Hotel

SubOptic's traditional finale will take place in a unique setting of the Armani Centre which resides at the base of the impressive Burg Khalifa, currently the world's tallest building. The venue is located nearby in downtown Dubai and private coaches will be provided for transportation to and from the Gala Dinner.

Sponsored by

Lunch & Coffee breaks

A buffet lunch will be available on Level 2 for those who wish to be seated, whilst a more informal stand up arrangement will be organised for the buffet lunch on level 4, immediately in front of the Exhibition Hall. Areas for the coffee breaks will be arranged on both Level 2 and Level 4 of the venue. For the first day of the event, April 18th, more limited facilities will be provided and the coffee break will only be available in the afternoon.

Sponsored by

ACCOMPANYING PERSONS PROGRAMME

Traditional Dubai City tour

Be fascinated by Dubai's rich history and tradition
Days of operation: Twice daily – morning and afternoon. Friday – afternoon only
Cost: US$ 45.00 per person

New Dubai City Tour

Explore the iconic landmarks that make up the city's futuristic skyline.

Days of operation: Daily (half day; morning) except Wed, Friday (half day; evening)
Cost: US$ 62.00 per person
Cost: US$ 96.00 per person including At the top

Abu Dhabi Tour

Explore the sights and landmarks of Abu Dhabi, the capital of the United Arab Emirates with a lunch stop at the Marina Mall.

Days of operation: Monday, Tuesday Wednesday & Saturday (full day tour)
Cost: US$ 70.00 per person

City Sightseeing tour

With City Sightseeing, Dubai's hop-on, hop-off tours, you can discover the city at your own pace in a convenient, flexible way with an informative tour giving you the best perspective of Dubai. Join at any of the stops, or at The Dubai Mall.

Days of operation: Daily
Cost: 24 hours pass – US$ 66.00 per person & 48 hours pass – US$ 82.00 per person

Sundowner Dune Desert Safari

The mysterious desert is the ideal venue for a magical and memorable evening. Watch the sun go down as you drive on to our traditional Bedouin style camp where a delicious dinner awaits.

Days of operation: Daily (late afternoon until evening)
Cost: US$ 105.00 per person

Desert Dune Buggies

Try a truly exhilarating adventure driving across the dunes in the latest, fully automatic, four-seater, off-road dune buggy.

Days of operation: Daily (half day – morning/ afternoon)
Cost: US$ 190.00 per person sharing a buggy with 30 minutes driving time

At the top, Burj Khalifa

At 828 metres (2,716 feet), the Burj Khalifa is the tallest building in the world. Visit the main observation deck and outdoor terrace on level 124 offering 360-degree views of the city; or visit the exclusive level 148 - the Burj Sky.

Days of operation: Daily

Contact the hospitality desk when you are on site in Dubai for bookings

GENERAL INFORMATION

BADGES

All participants are asked to wear their name badge at all times during the conference. Name badges will be checked at the entrance to the Session Halls and Social Events.

ORGANISERS' OFFICE

The SubOptic Organisers' office is located in the YAS meeting room located on Level 4. This will be accessible throughout the conference period.

REGISTRATION DESK

The Registration desk will be open on Level 2 during the following hours:

Monday 18 April	**8:00 am ~ 6:00 pm**
Tuesday 19 April	**8:00 am ~ 5:00 pm**
Wednesday 20 April	**8:00 am ~ 5:00 pm**
Thursday 21April	**8:00 am ~ 12:00 midday**

LOST AND FOUND

Enquiries concerning lost property can be made at the Registration desk Level 2 or SubOptic Organisers' office Level 4

DRESS CODE

Dress code for the whole period of conference is "Business Casual". This includes the Gala Dinner.

SPEAKER-READY ROOMS

There are two Speaker-Ready rooms located on Level 2 just outside the main conference area, **Arzannah** and **Lafaeya**.

These two rooms are used for the Speaker Breakfasts, for review of presentation slides and any last minute uploads that may be required and as the meeting place prior to Oral Sessions.

Both rooms are open and manned from 8:00 am to 7:00 pm, Sunday 17th April – Thursday 21st April 2016.

Speaker Breakfasts

All speakers are invited to breakfast in the Speaker-Ready rooms at 8:00 – 9:00am on the day of their presentation. Breakfasts are also attended by Session Chairs so that the logistics of session can be finalized.

Presentation Review

Late updates to presentations may be submitted by authors for upload, but no later than 24 hours before your presentation is scheduled to begin. SubOptic cannot guarantee that any updates provided later than this will be included in the main presentation set. Any such file updates should be provided on USB key.

There will also be the possibility to download a copy of your presentation, but there will not be any facilities in this room for any editing.

Oral Sessions

Oral Presenters are asked to arrive at the Speaker-Ready Rooms no later than 30 minutes before the start of the oral session to receive instructions on the PowerPoint slide controls, microphones, and general stage directions.

SPONSORS

MAJOR SPONSORS

Diamond: e-marine

Platinum: Alcatel·Lucent, HUAWEI MARINE NETWORKS

Gold: ciena, FUJITSU, NEC

Silver: EQUINIX, EGS Earth Sciences & Surveying, Global Marine Systems, infinera (what THE NETWORK will be)

OTHER SPONSORS

ACE, CORNING, DELTA+, etisalat, Orange Marine, Pioneer Consulting (Inspire Guide Deliver), SEACOM, TE connectivity SUBCOM, tex

MEDIA PARTNERS

capacity magazine, COMMSUPDATE, Ocean News & Technology, offshoresource, SCN, submarine networks FORUM 15 YEARS

SubOptic
www.suboptic.org 2016

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Exhibitor / Stand 29-32

EGS
Exhibitor Stand 3-4

EKINOPS
Exhibitor Stand 57

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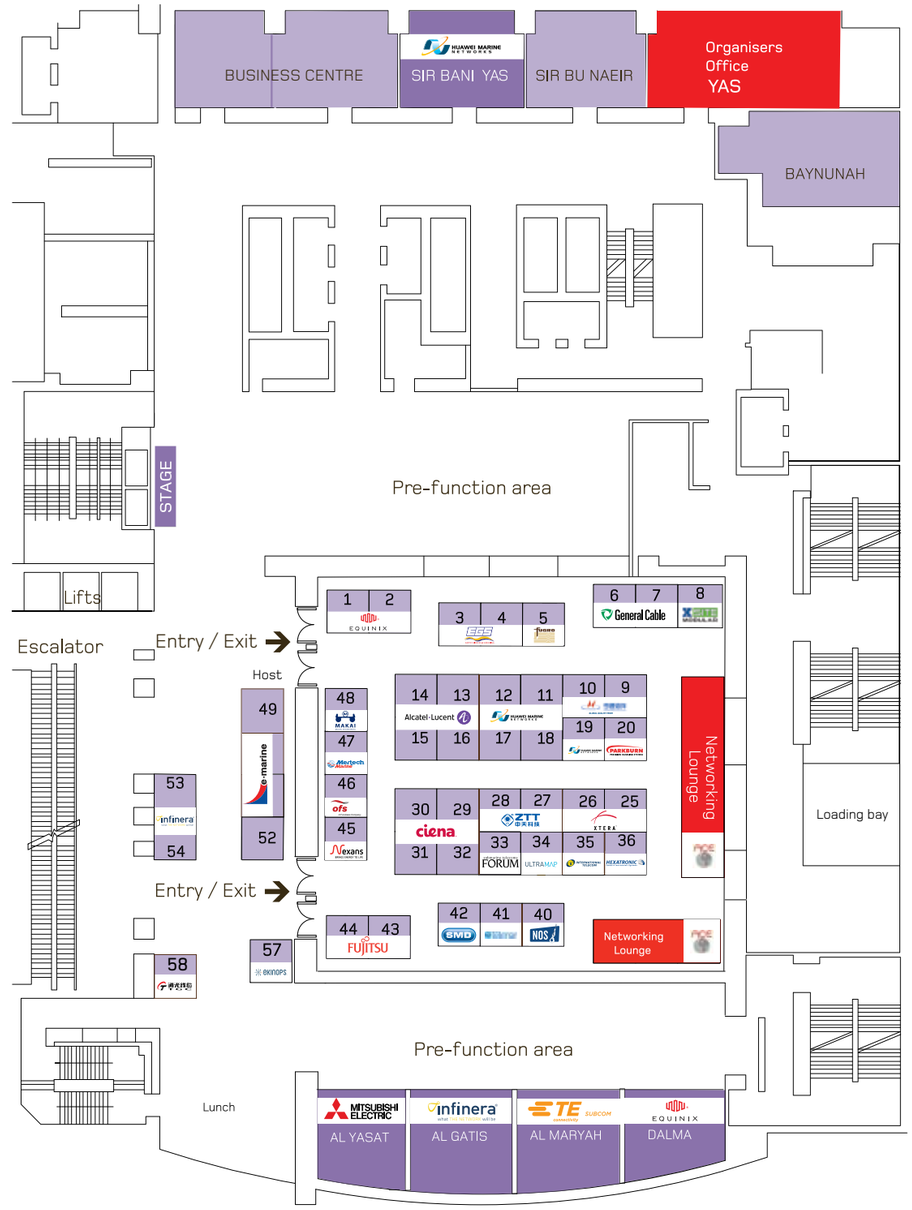
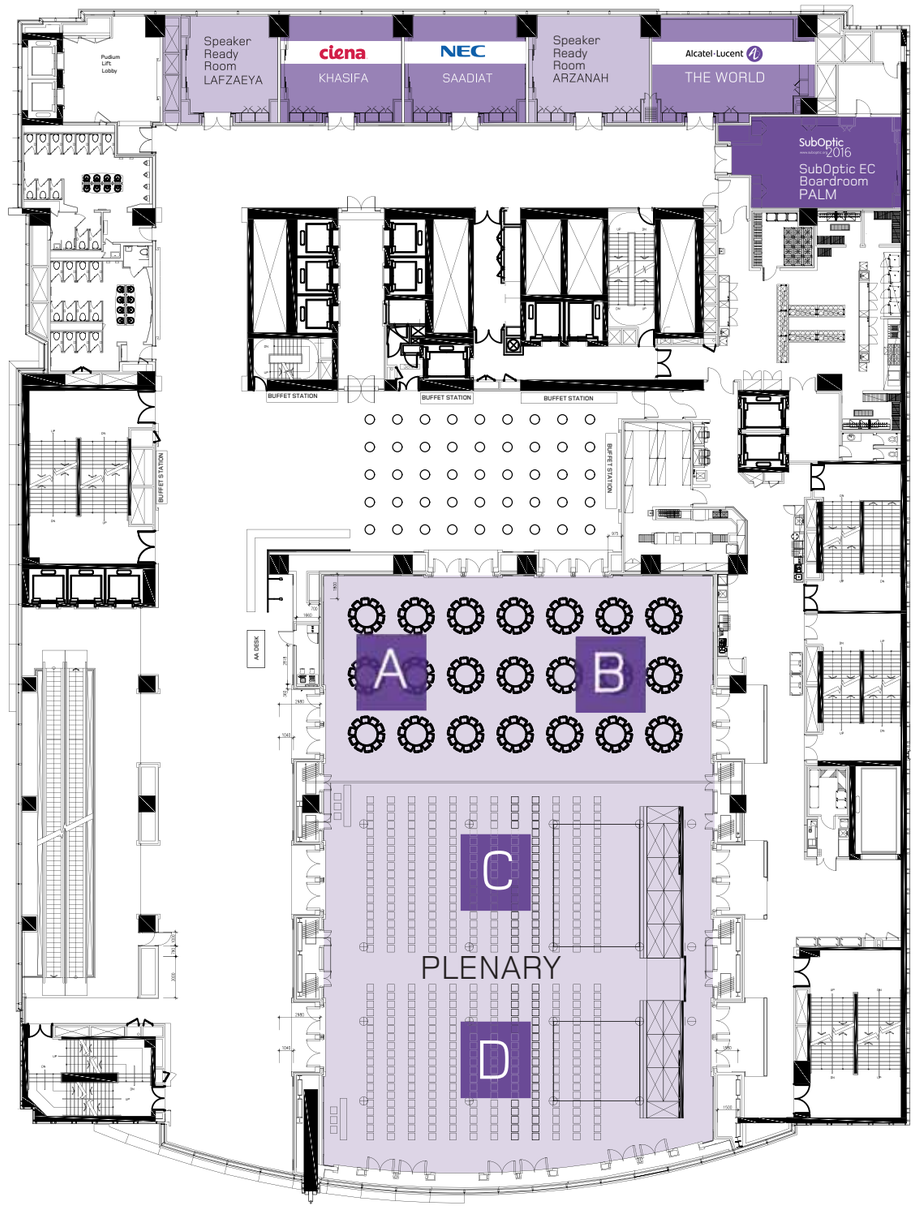


CONFERENCE FLOOR PLAN 2ND FLOOR



ABOUT SUBOPTIC

SubOptic is a non-profit, non-incorporated international organization, steered and sponsored by leading members of the telecommunications industry. It is best known for the conference it organizes, widely considered as 'the Olympics' of the submarine cable community.

The SubOptic Executive Committee (EC) was formed in 1998 as a non-incorporated, mutual, non-profit making organization with a membership that has varied since then from between 14 to 19 member companies, representing the various strands of our community. The membership changes between each conference cycle, reflecting the changing composition of our community. The definition of our community has been very broadly defined and includes, but is not limited to:

- Purchasers of systems and system capacity
- Suppliers of systems
- Suppliers of network management services
- Maintainers of systems
- Suppliers of cable protection
- Non-carrier investors
- Academic, professional and research institutions in the field
- Relevant international standards and regulatory bodies

The primary purpose of the EC is to ensure that the conference promotes the interests of our community by enabling ideas and information to be exchanged, fostering debate and educating the industry. It performs this role by acting as the Strategic Governance Board for the individual conferences that it has organized, which are implemented by a Host organization, which is a nominated member of the EC. As part of that role the EC ensures that the conferences maintain a high level of professional and academic integrity and are not to the individual advantage of any one EC Member or to one segment of the community.

Apart from the conferences, the EC is always looking at ways that SubOptic can provide more value to our community. A number of activities have been undertaken, including the development of a guideline for standard contracts to supply and construct a submarine cable system, the GUIDE, a set of presentations providing an educational overview of a wide range of submarine cable system features and requirements.

SubOptic is currently undergoing a major re-organisation to make it a more open structure to which any organisation within the industry can join, subject to meeting some simple criteria. This is a radical step and will take us some time to implement.

Our President is expecting to provide further details concerning the proposed new organisation at the Closing Session of SubOptic 2016 and we hope that by the time of PTC17, which will be held in January 2017 in Hawaii, to be able launch our new organisation and confirm the venue for our next event, SubOptic 2019.

SUBOPTIC EXECUTIVE COMMITTEE FOR 2016 CYCLE

President:
Yves Ruggeri

Secretary:
John Horne

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MEMBERS:

- Alcatel – Lucent Submarine Networks
- Australia Japan Cable
- Apollo Submarine Cable System Ltd
- Deutsche Telecom AG
- EGS (Asia) Ltd (representing the EGS Survey Group)
- E-marine PJSC
- Fujitsu Ltd
- GlobeNet
- Global Marine Systems Ltd
- Google Inc
- NEC Corporation
- Orange
- Southern Cross Cable Network
- TATA Communications
- TE SubCom
- Telecom Egypt
- Verizon
- Vodafone

PROFILES

ACE COMPANY PROFILE - Networking Lounge Sponsor

ACE is a consortium of telecom operators from Africa and Europe. The Consortium has recently launched segments one, two and three of the ACE submarine cable for commercial service since 19th December, 2012. These segments being the first phase stretched from France to Sao Tome connecting 15 coastal countries and 2 landlocked countries, namely, Mali and Niger.

The supply contract for the second phase, which will complete the 17,000 km cable distance to South Africa, has been signed and the construction is underway. This plans to provide landing stations in Congo Brazzaville, Democratic Republic of Congo, Angola, Namibia and South Africa, with the desire to further connect landlocked countries along the way. In the end, 23 countries will be connected to the ACE submarine system.

The ACE system that will be upgraded to the 100G technology by September, 2016, will increase its design capacity from 5.12 Tbps to 12.8 Tbps. The system is supported by wavelength division multiplexing (WDM) technology that would accommodate tomorrow's ultra-broadband networks.

The ACE submarine system has positioned itself as a key driver of Africa's social and economic growth. The 19 members of the ACE Consortium are Benin, Cable Consortium of Liberia, Canalink, Cote d'Ivoire Telecom, Dolphin, Orange France, Gambia Submarine Cable Company, GUILAB, International Mauritania Telecom, Republic of Cameroun, Orange Mali, Orange Niger, MEO, MTN, Republic of Equatorial Guinea, Republic of Gabon, Sierra Leone Cable (SALCAB) Limited, Sonatel and STP CABO ". The consortium is pleased to announce the formal launching into operations of the Benin, Lagos and Tenerife branches by June 2015.

ALCATEL-LUCENT SUBMARINE NETWORKS - Platinum Sponsor
Exhibitor Stand 13-16

Alcatel-Lucent Submarine Networks, now part of Nokia, leads the industry in terms of capacity and installed base with more than 575,000 km of optical submarine cables/systems deployed worldwide. From traditional telecom to new Oil & Gas applications, ASN provides every part of a global undersea transmission network, all tailored to the customer's needs. An extensive service portfolio completes its comprehensive offering for the submarine business, including project management, installation and commissioning and marine operations and maintenance performed by its fleet of seven cable ships.

PROFILES

CIENA - Gold Sponsor - Exhibitor Stand 29-32

Ciena (NYSE: CIEN) is the network specialist. We collaborate with customers worldwide to unlock the strategic potential of their networks and fundamentally change the way they perform and compete. Ciena leverages its deep expertise in packet and optical networking and distributed software automation to deliver solutions in alignment with its OPn architecture for next-generation networks. We enable a high-scale, programmable infrastructure that can be controlled and adapted by network-level applications, and provide open interfaces to coordinate computing, storage and network resources in a unified, virtualized environment. For updates on Ciena news, follow us on Twitter@Ciena or on LinkedIn http://www.linkedin.com/company/ciena. Investors are encouraged to review the Investors section of our website at www.ciena.com/investors, where we routinely post press releases, SEC filings, recent news, financial results, and other announcements. From time to time we exclusively post material information to this website along with other disclosure channels that we use.

CORNING - Poster Sponsor

Corning is one of the world's leading innovators in materials science. For more than 160 years, we have applied our unparalleled expertise in specialty glass, ceramics, and optical physics to develop products that have created new industries and transformed people's lives. Within the telecommunications industry, our optical fiber, wireless technologies, and connectivity solutions enable high-speed communications networks. With global demand for bandwidth exploding, we are leading the way connecting businesses, buildings, homes and people at the speed of light.

DELTA + Sponsor

Delta+ Limited is in its tenth year of operation as Technical and Commercial consultants to the subsea industry. Bernard Logan CEO Delta+ has thirty years subsea experience and has either designed managed implemented or helped fund 14 subsea systems (HonTai 2; SeaMeWe 3 and 4; Tat12/13; Pencan 5; Telic Phil; Jakarta Surabaya; Yellow; TWA1; Esat; Hugo; Farice; Main One). Bernard Logan also holds the positon of shareholder and Chief Commercial Officer of Main One Cable System and is a Vice President of Mertech Marine the largest subsea cable recycling company in the world.

EGS - Silver Sponsor / Exhibitor Stand 3-4

EGS is the leading independent provider of submarine cable route planning, survey services to the Submarine Telecommunications Industry worldwide. The EGS Group has offices in the UK, North and South America, Australia, and throughout South East Asia from its regional hub in Hong Kong. EGS provides a global one stop shop suite of specialist multi-disciplinary services from feasibility studies, desktop studies; and marine route surveys from a platform of 6 dedicated survey vessels strategically located around the globe. In 2014 EGS celebrated 40 years of survey services and completed in excess of 400,000 route kilometers of submarine cable route survey during 2015.

EKINOPS - Exhibitor Stand 57

Ekinops is a leading supplier of next generation optical transport equipment for telecommunications service providers. The Ekinops 360 addresses Metro, Regional, and Long-Haul applications with a single, highly-integrated platform. Ekinops is a market-leading innovator in 100G transport with a coherent line of products that truly optimizes optical networks and comes in 1RU, 2RU or 7RU chassis. The Ekinops 360 relies on the highly-programmable Ekinops T-Chip® (Transport-on-a-Chip) architecture that enables fast, flexible and cost-effective delivery of new services for high-speed, high-capacity transport. Using the Ekinops 360 carrier-grade system, operators can simply increase capacity of their networks – CWDM, DWDM, Ethernet, ESCON, Fibre Channel, SONET/SDH, and uncompressed video (HD-SDI, SD-SDI, ASI). Ekinops is headquartered in Lannion, France, and Ekinops Corp., a wholly-owned subsidiary, is incorporated in the USA. For more information, visit www.ekinops.net

EQUINIX - Silver Sponsor / Exhibitor Stand 1-2

Equinix, Inc. (Nasdaq: EQIX) connects the world's leading businesses to their customers, employees and partners inside the most interconnected data centers. In 33 markets across five continents, Equinix is where companies come together to realize new opportunities and accelerate their business, IT and cloud strategies. In a digital economy where enterprise business models are increasingly interdependent, interconnection is essential to success. Equinix operates the only global interconnection platform, sparking new opportunities that are only possible when companies come together. Equinix.com

PROFILES

E-MARINE - Diamond Sponsor Host & Exhibitor Stand 49-52

E-marine PJSC, an ISO certified Company, is one of the market leaders in Submarine Cable Installation, Maintenance, and Repair Services. E-marine offers its services in the field of Marine Project Management, Consultancy, Marine Route Survey, Cable Freight Management & Storage, and Charting. Besides Telecommunication field, E-marine provides complete range of solutions to the Offshore Energy sector.

E-marine's beginning was in early 1984, and now over 30 years of track record, it has successfully completed various projects of national and international importance.

E-marine has a highly qualified and motivated technical team to provide customized solutions locally, regionally, and globally to our valued customers. E-marine owns four Cable Ships and one Special Purpose Cable laying support vessel which are fully equipped with state-of-the-art equipments. CS Etisalat is a medium sized cable ship which is designed to operate on shallow areas. CS Niwa (DP II), CS Maram (DP II) and CS Umm Al Anber are Ocean going ships with extended endurance in the sea. All our vessels are fitted with working class ROV's. "SPV WASEL" is designed to perform work such as shore end diving support & Survey activities and cable laying & Repair on depth of half a meter.

E-marine's Cable Depots (Port of Salalah, Oman & Hamriyah Free Zone, Sharjah, UAE.) provide sophisticated storage facilities for submarine cables and accessories in a controlled environment in accordance with highest international standards. The depots are equipped with testing and jointing facilities operated by highly qualified professionals. E-marine's storage facilities meet the high industrial standards.

E-marine's total commitment for quality is evidenced with the obtainment of an integrated quality, Health, Safety, and Environment Management System. It is certified to ISM code, ISO 9001-2000, ISO 14001:2004, and OHSAS 18001:1999. The strategic location of E-marine's facilities as well as its customized solutions and highly competent professionals makes E-marine the leader in the region for submarine cable related services.

ETISALAT - Coffee and Lunch Sponsor

Etisalat is the UAE's leading telecommunications operator and one of the largest corporations in the GCC. Headquartered in Abu Dhabi, UAE, Etisalat serves 11.6 million customers in the UAE and more than 170 million customers across its 18 operations globally.

Etisalat's Carrier & Wholesale Services Division (C&WS) is dedicated to delivering a comprehensive portfolio of high quality wholesale services. SmartHub, established in 2012, is the region's largest capacity, content, Internet, messaging and data hub. Etisalat's upcoming SmartHub IX (Internet Exchange) in Fujairah, UAE, will further extend the reach of SmartHub content. Etisalat's most extensive international network, with an extensive international mobile network in over 200 countries that reaches over 735 destinations also support its success.

FUGRO - Exhibitor Stand 5

Fugro delivers earth and engineering data services to support the design and implementation of infrastructure projects across the world's oceans. We have specialized in the submarine cable industry for over 30 years, operating globally with a presence in over 70 countries. Our expertise is in providing our clients with planning, desktop studies, site visits, route selection, route survey and installation support, as well as environmental impact studies, burial assessment surveys and archaeological surveys for new submarine telecom systems around the world.

FUJITSU - Gold Sponsor & Exhibitor Stand 43-44

Fujitsu is the leading Japanese information and communication technology (ICT) company, offering a full range of technology products, solutions and services. Approximately 159,000 Fujitsu employees support customers in more than 100 countries. We use our experience and the power of ICT to shape the future of society with our customers. Fujitsu Limited (TSE: 6702) reported consolidated revenues of 4.8 trillion yen (US$40 billion) for the fiscal year ended March 31,2015. For more information, please see http://www.fujitsu.com.

PROFILES

GMSL - Silver Sponsor

Global Marine Systems Limited is a marine engineering company with an extensive track record of installing and maintaining complex subsea cable projects. The company has a legacy of 165 years in deep and shallow water operations worldwide, and is a recognised market leader with expertise in telecommunications, oil & gas, offshore renewables and scientific research.

With two longstanding joint ventures in China, S.B. Submarine Systems and Huawei Marine Networks, and the recently acquired majority interest in offshore renewables specialist CWind, Global Marine is committed to delivering exemplary subsea engineering services globally.

HENGTONG MARINE CABLE SYSTEMS - Exhibitor Stand 9-10

Hengtong Marine Cable Systems, located in Changshu city, China and close to the Yangtz River estuary, is a submarine cable R&D and manufacturing base.

Hengtong Marine aims to provide oceanic optical and electrical transmission systems solutions including submarine power & optical fiber cable systems, accessories, cable engineering service and etc.

HEXATRONIC - Exhibitor Stand 36

Hexatronic Cables & Interconnect Systems offers a wide selection of system solutions and products for transport, metro, access and submarine networks. We strive to strengthen our position as the leading player in the work of connecting people to the global digital infrastructure, by continuous development of our system solutions and products.
Hexatronic Cables & Interconnect Systems is a part of The Hexatronic Group which is an innovative Swedish technology group, specializing in fiber communications. The Group provides products and solutions for the fiber optic network and together, the independent, entrepreneurial companies offer a full range of passive infrastructure.
For more information about Hexatronic Group please visit:
www.hexatronicpartners.se

HUAWEI MARINE - Platinum Sponsor & Exhibitor Stand 11-12 & 17-19

Huawei Marine Networks Co., Limited (Huawei Marine) is a joint venture established by Huawei Technologies Co., Ltd. and Global Marine Systems Limited. Bringing together the substantial expertise of the two parent companies, Huawei Marine integrates the state-of-the-art technologies in telecommunications and 160 years of marine operations experience with a strong commitment to the development of submarine cable communication networks throughout the globe. Huawei Marine provides highly reliable, cost-effective turnkey submarine cable system solutions incorporating system design, integration and installation services with an on-going focus and commitment to customer support for network operators.
For more information, please visit www.huaweimarine.com

INFINERA - Silver Sponsor & Exhibitor Stand 53-54

Infinera empowers network operators to quickly deliver differentiated services by enabling an infinite pool of intelligent bandwidth. With the recent completion of its offer for the shares of Transmode, Infinera now offers an end-to-end packet-optical portfolio to fully address the WDM networking market including long-haul, subsea, Cloud and metro. Deployed across the globe, Infinera Intelligent Transport Networks™ enable carriers, Cloud operators, governments and enterprises to accelerate service innovation and simplify optical network operations.

IT INTERNATIONAL TELECOM, INC. - Exhibitor Stand 35

“IT is an ISO-certified, full turnkey provider of desktop study, marine route survey, engineering design, installation and maintenance services for submarine cable systems worldwide. Independent of any manufacturer, IT is in the unique position to collaborate with our customers, providing them with cost-effective and ideal technical solutions for each project.”

MAKAI - Exhibitor Stand 48

“Makai offers sophisticated products that work together to greatly improve the accuracy and reliability with which submarine cables are laid. Makai provides software to:

- Plan cable installations.
- Monitor and control in real-time the installation of a cable or cable system.
- Analyze in detail the installation of a submarine cable.”

MERTECH MARINE - Exhibitor Stand 47

Mertech Marine (established 1998) has been pioneering and innovating turnkey solutions to the submarine telecommunication industry since 2004. Mertech Marine recovers out of service cables using its own marine fleet, dismantles and recycles cables in our own factories. Mertech Marine also offers freighting, route survey, relay and related submarine services according ICPC and International recommendations.

Mitsubishi Electric - Al Yasat Hospitality Room

Mitsubishi Electric is one of the world's leading names in the manufacture and sales of electrical and electronic products and systems used in a broad range of fields and applications. As a global, leading green company, we 're applying our technologies to contribute to society and daily life around the world.
For more information, please visit www.mitsubishielectric.com.

NEC - Gold Sponsor

NEC is a leader in integration of IT and network technologies that benefit businesses and people around the world. Providing a combination of products and solutions that cross-utilize the company's experience and global resources, NEC's advanced technologies meet the complex and ever-changing needs of its customers. NEC brings more than 100 years of expertise in technological innovation to empower people, businesses and society. Furthermore, its 40 year plus experience in submarine networks, NEC has built a reputation for delivering submarine cables of the highest quality, with more than 50,000km supplied, puts it at the forefront of the industry. http://www.nec.com/submarine/

NEXANS NORWAY - Exhibitor Stand 45

Nexans Norway AS is a leading supplier of power, telecommunications, installations and heating cables in Norway, and is among the world's leading manufacturers of offshore control cables and high-voltage submarine cables. The company's head office is in Oslo, and it has manufacturing plants at Rognan, Namsos, Langhus, Karmøy and Halden. The company has nearly 1,600 employees and organized into three product areas: Market Lines, Hybrid Underwater Cables and Submarine High Voltage. More information on www.nexans.no.

NOS - Exhibitor Stand 40

Nos A/S have more than W15 years of experience of supplying the Sub Sea cable laying companies with a wide range of products, wthin Grapnel Ropes, Grapnells, Load Cells, Saddle Backs, Lifting Gear, LCE Tyres, Stoppers, as well as related goods.

NSW - Exhibitor Stand 6-7

NSW, a wholly-owned subsidiary of General Cable since 2007, has been one of the world's leading companies in the field of submarine telecom-munication cables for over 115 years. NSW today offers the complete range of services from design over production and installation for repeatered and repeaterless fiber-optical submarine cable systems.

OFS - Exhibitor Stand 46

OFS is a world-leading designer, manufacturer and provider of optical fiber, fiber optic cable, connectivity, and fiber-to-the-subscriber (FTTX) products. We rovide reliable, cost-effective solutions for a broad range of applications including telecommunications, medicine, industrial automation, sensing, government, aerospace and defense. These products help our customers meet the needs of consumers and businesses, both today and into the future.

ORANGE MARINE - Sponsor

"Orange Marine is specialized in the field of subsea telecommunications, from the design and engineering phase up to the installation of intercontinental connections and maintenance of existing cables.
With the delivery of C/S Pierre de Fermat, in November 2014, Orange Marine now operates six cable ships from its marine bases in Brest and La Seyne sur Mer (France), Catania (Italy) and Cape Town (South Africa).
The company designs, manufactures and operates submarine vehicles (ROV, plough, trencher, crawler) through its subsidiary SIMEC.
Orange Marine has developed its service offer on strategic growth markets such as offshore activities and renewable energies."

PROFILES

PARKBURN PRECISION HANDLING SYSTEMS LTD - Exhibitor Stand 20

Parkburn Precision Handling Systems Ltd (PPHS) is the world's most experienced provider of specialist telecoms submarine cable handling systems. Since 1969, PPHS has designed, manufactured and supported systems and equipment for over 75 cableships and depots world-wide, providing the world's leading operators, unrivalled back deck performance and reliability.

PIONEER CONSULTING - Sponsor

Serving customers spanning five continents, Pioneer Consulting provides professional, trusted and independent submarine cable advisory and consultancy services globally, offering a comprehensive suite of services for the submarine fiber optic telecommunication system industry including due diligence, engineering and implementation, market and technical studies, maintenance planning and operational support, as well as related advisory services. For further information about Pioneer Consulting visit: www.pioneerconsulting.com or send an e-mail to: info@pioneerconsulting.com.

SEACOM - Welcome Reception Sponsor

SEACOM launched Africa's first broadband submarine cable system along the eastern and southern coastlines in 2009, bringing with it a vast supply of high quality and affordable Internet bandwidth.
Since then, SEACOM has moved beyond being a cable operator to become a major pan-African service provider, offering a full suite of resilient and scalable data services that allow Africa's growing ICT community to develop and evolve.
SEACOM is the preferred partner for African network carriers and service providers. Through its ownership of Africa's most extensive ICT data infrastructure - including multiple subsea cables and a resilient, continent-wide IP-MPLS network – SEACOM provides flexible, scalable and high-quality communications services that enable the growth of the continent's economy.
For more information, visit http://seacom.mu/

SMD - Exhibitor Stand 42

Soil Machine Dynamics Ltd (SMD) is one of the world's leading manufacturers of remote intervention equipment, operating in hazardous environments worldwide. SMD is the market leader supplying subsea vehicles to support submarine telecom cable burial, maintenance and survey operations.

SUBTEL FORUM - Exhibitor Stand 33

SubTel Forum is an independent commercial publication, serving as a freely accessible forum for professionals in industries connected with submarine optical fiber technologies and techniques. We are published by Submarine Telecoms Forum, Inc., an independent industry-specific digital and print publishing company, with the assistance of a boatload of industry experts as a free forum for the expression of technical, financial and business ideas.

TEKMAR - Exhibitor / Stand 41

Tekmar Energy is a market leading provider of protection systems for subsea cables, umbilicals and flexible pipes. Operating in Renewables, Oil & Gas and Interconnector markets, Tekmar offers innovative and cost effective, engineered solutions for connecting and protecting assets subsea.

TE - Sponsor

Telecom Egypt is a leading global operator that offers a complete range of Telecom Services including Voice,Data,Managed Bandwidth,IP Transit,MPLS, Colocation & tailored data solutions.

With a unique geographic location spanning about 1000 Km on the Red Sea and 1000 Km on the Mediterranean, TE connecting more than 10 Cable Systems from the East with more than 11 Cable Systems from the West through 7 diversified routes across Egypt., which positions TE as a partner of choice for Euro-Asia and Africa transit traffic of 15+ Tbps lit capacity.

Telecom Egypt is the cofounder of AAE-1 and the provider of the terrestrial capacity across Egypt for the upcoming and advanced state-of-the-art cable systems AAE-1 and Sea-Me-We-5.
For more information, please contact: icn@te.eg

TE SUBCOM - Sponsor

TE SubCom, a TE Connectivity Ltd. company, is an industry pioneer in undersea communications technology and marine services, and a leading global supplier for today's undersea communications requirements. SubCom designs, manufactures, deploys, and maintains the industry's most reliable fiber optic cable systems. Its solutions include long-haul and regional systems, repeaterless networks, capacity upgrades, offshore oil and gas, and scientific research applications. SubCom brings end-to-end network knowledge and global experience to support on-time delivery and the needs of customers worldwide. The company has deployed more than 100 cable systems and enough subsea communication cable to circle the Earth more than 15 times. www.SubCom.com.

PROFILES

JIANGSU TONGGUANG OPTICAL FIBER CABLE CO - Exhibitor Stand 58
Jiangsu Tongguang Optical Fiber Cable Co., Ltd. is a wholly owned subsidiary of TG Cable (SZSE Code: 300265), Specializing in the line of Submarine Optical Fiber Cable and cable solutions.
Visit TG Cable, contact your cable partner in China.

ULTRAMAP - Exhibitor Stand 34
UltraMAP are demonstrating their 24/7 AssetMonitor service that protects cables by monitoring vessels near to them. AssetMonitor places protection zones and rules around cables, detecting damage causing vessel behavior. When cables are at risk, AssetMonitor shows and sounds alarms to the operator and sends emails and texts to those offline.

XSITE MODULAR - Exhibitor Stand 8
XSite Modular is a design-builder of Modular Cable Landing Stations (MCLS) built in the US and shipped all over the world. Our cable landing station projects include ECLink, CFX-1, SEACOM, Matrix, Fibralink, TGN Pacific S5, and SEABRAS-1. XSite also provides PFE shelters, datacenters and all types of terrestrial telecommunications buildings.

XTERA COMMUNICATIONS - Exhibitor Stand 25-26
Xtera Communications, Inc. (NASDAQ: XCOM) is a leading provider of high-capacity, cost-effective optical transport solutions, supporting the high growth in global demand for bandwidth. Xtera offers innovative turnkey solutions for building new subsea infrastructure, upgrading existing submarine cable assets, or recovering and re-laying existing cable assets. More info at www.xtera.com.

ZTT SUBMARINE CABLE - Exhibitor Stand 27-28
ZTT SUBMARINE CABLE is the most experienced subsea cable manufacturer from China, focusing on manufacturing UJ and UQJ qualified submarine fiber optical cables for clients over the world. ZTT submarine cables have been widely used in USA, Saudi Arabia, Qatar, Kuwait, Turkey, Malaysia, Indonesia, Singapore, Sweden, etc.

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