

# **Submarine Networks World 2014, Singapore**

## **Building cables of the future**

*Keynote Closing Address:*

**What does the submarine cable of the future look like? The new business case, innovations and social benefits for climate and disaster sensors**

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### **What does the submarine cable of the future look like?**

For well over a century, submarine cables have been providing voice, image, and data communications and connectivity between nations on most continents, providing an immense service to government, business and society. Progressive innovations in the technology of cable structure and fibres as well as shore facilities and maintenance services have kept pace with innovations in ICT development. This digital revolution has transformed so much of the activities, services and behaviours in society and business. The growth in ICT has been explosive as witnessed, for example, by the evolution and rapid growth of major companies such as Apple, Google, Amazon, Oracle, and Netflix. Leaders in those companies and others consider this revolution to be still in its infancy. As such, it can be expected that the demand for ever-increasing data transmission (volume and rate, images and video) will continue perhaps exponentially for the foreseeable future. Complementary advances in submarine cables and the industry will surely follow. Key factors affecting demand for increased submarine cable capacity include:

*Drivers:* Global population growth, economic development of the BRICs, international trade agreements (Canada-EU, USA-EU, Trans-Pacific Trade Agreement), lower cost of cable data transmission, global financial market trading, global security and privacy concerns.

*Technology:* Ongoing surge in ICT developments, use of Internet, miniaturization of components, increased video services, increased data transmission capacity of fibres, sophistication of hand-held devices, and new breakthrough potentials.

*Geographic connectivity:* Wider geographic cable coverage throughout the oceans (southern hemisphere; around Africa, Australia, South America, India, Canadian/US Arctic) and between island states (Caribbean, Southern Asia, Pacific); the move to offshore routing to avoid permitting issues in densely populated coastal regions).

### **The new innovations: green cable systems**

*Green Cable Systems - Sensors on cables:* The submarine telecommunication industry has progressively installed an extensive network of trans-ocean and regional coastal cables to deliver communications and data between nations and for a wide variety of applications and customers. The potential exists to expand the capabilities and

functionality of this traditional network by adding sensors to the cable system to monitor key environmental data from many set points along the cable routes. Specifically, a limited package of sensors would include those to measure temperature, pressure and acceleration, which would be valuable parameters for refined detection of ocean climate change, tsunamis, and earthquakes. If installed with repeaters or blisters, about every 50-70km, an exceptional new network of environmental sensors would produce long real-time data series for much of the 70% of the planet that lies below the oceans and coastal seas. These sensors would be installed on new or refurbished cable systems at modest cost, receive little or no maintenance, and take advantage of a new generation of small, precise, relatively stable and inexpensive sensors.

### **The social benefits for climate and disaster sensors**

*Climate change – the role of the oceans:* The oceans are the main driver in climate change, holding much of the heat and greenhouse gases, with a complex circulation system. Much analysis has been included in the recent IPCC Fifth Assessment Reports (2013-14), but key data are unavailable or sparse for the deeper parts of the oceans. Installation of green cable systems could help understand and alleviate this central societal problem.

*Disaster mitigation – tsunami monitoring throughout ocean basins and coastal margins:* There have been nearly a dozen major tsunamis over the last decade (notably from major earthquakes in Indonesia, Samoa, Chile, Japan, Haiti, etc.) that have caused loss of life in the hundreds of thousands and destroyed property and infrastructure in the billions of dollars. Green cable systems would generate real-time data over wide ocean and coastal areas and improve early warning systems and mitigate loss of life, damage, and costs.

*Sea-level change:* The precision of the latest generation of pressure sensors allows detailed analysis of changes in sea-level at set points, and hence regionally with green cable systems. Such data are invaluable to integrate with those from coastal tide gauges, satellite altimetry and geodynamic modeling.

### **The new business case**

*Promoting the value of Green Cable Systems:* Given that the technology is now available for green cable systems and given its clear potential to add value to proposed systems, a new business case is developing to advocate and elaborate the commercial and societal benefits and the potential user communities.

*Large-scale systems:* Some proposed trans-ocean cable installations with repeaters would be highly suitable on which to add sensors. One currently being offered is that by the SubPartners' APX East line across the Pacific, with TE SubCom as the supplier and installer. Others emerging with potential to add sensors include those by Arctic Fibre (Tokyo-London via the Canadian Arctic, with many side links) and NEC/Google (FASTER, trans-Pacific, Japan to US).

*Small-scale systems:* Smaller regional networks linking, for example, island and coastal states in the western Pacific, Caribbean, and Mediterranean would mostly use non-repeated cable networks, but with still the capacity to add sensors. An example is the recent call for public-private partnerships to build a new submarine fibre-optic network to connect all Pacific Islands from Papua New Guinea back to Sydney by the Digicel Group.

*Linking cable owners and suppliers with international and national agencies/NGOs responsible for social and economic benefits:* The societal benefits, technology and initial proposals just noted form a basis for optimism that the green cable systems can be deployed in the near future on new and refurbished submarine networks. However, there clearly needs to be strong advocacy to convince the submarine cable owners and suppliers of the value of promoting this capacity, and likewise for the potential users (such as government/NGO hazard agencies and coastal industries/communities) of funding some of the infrastructure or paying for the environmental data stream.

### **Facilitation through the ITU-WMO-UNESCO IOC Joint Task Force (JTF)**

*Establishment and activities of the JTF:* The Joint Task Force (JTF), established in 2012 by the International Telecommunication Union (ITU), the World Meteorological Organization (WMO) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO, is examining novel uses for submarine telecommunication cables. With ITU secretariat support and through recent and upcoming workshops (Paris, September 2012; Madrid, September 2013; Singapore, October 2014; <http://www.itu.int/en/ITU-T/Workshops-and-Seminars/jtf-itu-wmo-unesco-ioc/Pages/default.aspx>), the JTF is developing a strategy and roadmap that could lead to enabling the availability of green submarine cable systems equipped with scientific sensors (such as temperature, pressure and acceleration) for climate monitoring and disaster risk reduction (particularly tsunamis) over much of the world's oceans (<http://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx>).

*Future plans and proposed facilitation by JTF:* The initiative addresses two main issues: a) the need for sustained climate-quality data from the sparsely observed deep oceans; and b) the desire to increase the reliability and integrity of the global tsunami warning networks. Both address issues of profound and urgent societal concern including global warming, hazard mitigation, coastal infrastructure, planning and security. Plans are being developed to launch a wet demonstration project with the active involvement and partnership of cable industry owners and suppliers and ocean observatory researchers to examine the technical challenges and business case opportunities. The new installations of cabled ocean observatories (e.g., Ocean Networks Canada, Ocean Observatories Initiative in US, DONET in Japan, EMSO in Europe, MACHO in China) have successfully established many of the technologies, data management systems, and promoted sensor development. They, or industry facilities, could be used for testing the wet demonstrator project. Membership in JTF is free, open and all interested persons are invited to join and participate ([greenstandard@itu.int](mailto:greenstandard@itu.int)).