DC/FO TECHNOLOGY
A LEAN & POWERFUL SUBSEA CONTROL INFRASTRUCTURE

ALCATEL-LUCENT SUBMARINE NETWORKS,
Stephen KEENLYSIDE, Ronan MICHEL
Subsea Control Down Under 2016
ASN AT A GLANCE

OVER 550,000KM OF OPTICAL FIBRE SUBMARINE TELECOMMUNICATION SYSTEMS IN SERVICE

PROVEN & STANDARD SUBMARINE TELECOM TECHNOLOGIES TO ACHIEVE COST REDUCTION IN OIL & GAS FIELDS
APPLICATION TO OIL & GAS: NORTH WEST CABLE SYSTEM in AUSTRALIA ‘THE FITZROY PROJECT’

“The subsea cable will give us a highly reliable and stable high-speed voice and data service which is essential for effective and efficient operations at our future offshore facilities. (Shell Prelude Asset Manager)
DC/FO SYSTEM OVERVIEW
ORIGIN OF DC/FO: POWER & COMS FOR SCIENTIFIC APPLICATIONS

NEPTUNE (http://www.oceannetworks.ca/)
- 800 km backbone @10kV DC
- 2700 m water depth
- 5 Subsea Nodes @10 kW + coms offering 4 x (1GbE and 400V DC) interfaces

System in operation since 08/2009
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

Same cross-section
whatever the distance

Power Feed Equipment
Topside/Land cable
Landing joint box
DC/FO submarine cable
Cable End Box
Host Facility

> 300 km

Same cross-section
whatever the distance
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

Power Feed Equipment

Landing Joint box

Host Facility

Cable Joint Box

Fully repairable
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

- Power Feed Equipment
- Landing Joint box
- DC/FO cables
- Y-splice
- Host Facility
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

10 kW converter
4 outputs DC 400V
Optional inverters AC 220V, 400V & 500V

Power Feed Equipment

Landing Joint box

Host Facility

User interfaces
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

10 kW converter
4 outputs DC 400V
Optional inverters AC 220V, 400V & 500V

Power Feed Equipment
Landing joint box
Remote Control Box

Host Facility
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

10 kW converter
4 outputs DC 400V
Optional inverters AC 220V, 400V & 500V

Host Facility

Power Feed Equipment

Landing joint box

Host facility Operation Center

Data fibers

Subsea Node

Subsea Node

Subsea Node

User interfaces
DC/FO SYSTEM OVERVIEW

USE CASE #1: GREEN FIELD and VENDOR AGNOSTIC
DC/FO SYSTEM OVERVIEW

USE CASE #2: BROWN FIELD — REPAIRS

Subsea control line

Flow line
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD — REPAIRS

Subsea control line

Flow line

Shunt fault
Insulation issue
DC/FO SYSTEM OVERVIEW

USE CASE #2: BROWN FIELD — REPAIRS

Subsea control line

Flow line

Shunt fault
Insulation issue

New legacy umbilical
= $$$
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD — REPAIRS
DC/FO SYSTEM OVERVIEW

USE CASE #2: BROWN FIELD — REPAIRS

DC/FO cable tie-back = $

Shunt Fault but tolerant

Subsea control line

Flow line

Shunt fault

Insulation issue

DC/FO
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD — REPAIRS

Subsea control line
Flow line
Shunt fault
Insulation issue
DC/FO cable tie-back = $
DC/FO SYSTEM OVERVIEW

USE CASE #3: BROWN FIELD — EXTENSION
DC/FO SYSTEM OVERVIEW
USE CASE #3: BROWN FIELD – EXTENSION
DC/FO SYSTEM OVERVIEW
USE CASE #3: BROWN FIELD — EXTENSION

Subsea control over legacy

Subsea control + MEG line

Flow line

Marginal prospect

Flow line

Hydraulic + MEG line
DC/FO SYSTEM OVERVIEW
USE CASE #3: BROWN FIELD – EXTENSION
Estimated capex change

Courtesy of Statoil ASA
DC/FO SYSTEM OVERVIEW

Value proposition

Standardized
Open platform
Standard cross section
Any SPS supplier equipment

DC/FO

Extendibility
Large power supply
Lean
Repairability

@Virtually unlimited reach

SYSTEM
Acknowledgment of contributions:

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• Statoil Johan Castberg project team for selecting DC/FO technology in base case and for use of project information

Thank you for your attention!

stephen.keenlyside@alcatel-lucent.com
O&G Commercial Manager, (Sydney)

ronan.michel@alcatel-lucent.com
O&G Product Line Manager
+33 6 72 00 90 21
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DC/FO SYSTEM OVERVIEW
VALUE PROPOSITION

This innovative solution offers a number of advantages inspired from the telecom industry:

• **Standardization** – the same standard cross section can be used regardless of tie back length or power consumption demand

• **Reparability and Extendibility** – The cable and its end terminations can be lifted to surface for repairs or extensions at sea with standardized jointing technology, simplifying the tie-back of new prospects and enabling phased development

• **Open platform** – electrical power and communication interfaces can be connected to any SPS supplier equipment

• **Virtually unlimited reach within Oil and Gas fields** – the system is dimensioned to serve the longest tie backs currently contemplated by the industry

• **Large power supply capability**

• This solution is an enabler for new applications such as AUV recharge or E-Field sensing. On longer term, all-Electric trees can be powered through DCFO System, allowing further downsizing and cost reduction of legacy umbilical cross-section with the removal of hydraulic tubes.