DC/FO TECHNOLOGY

A LEAN & POWERFUL SUBSEA CONTROL INFRASTRUCTURE

ALCATEL-LUCENT SUBMARINE NETWORKS,
Stephen KEENLYSIDE, Ronan MICHEL

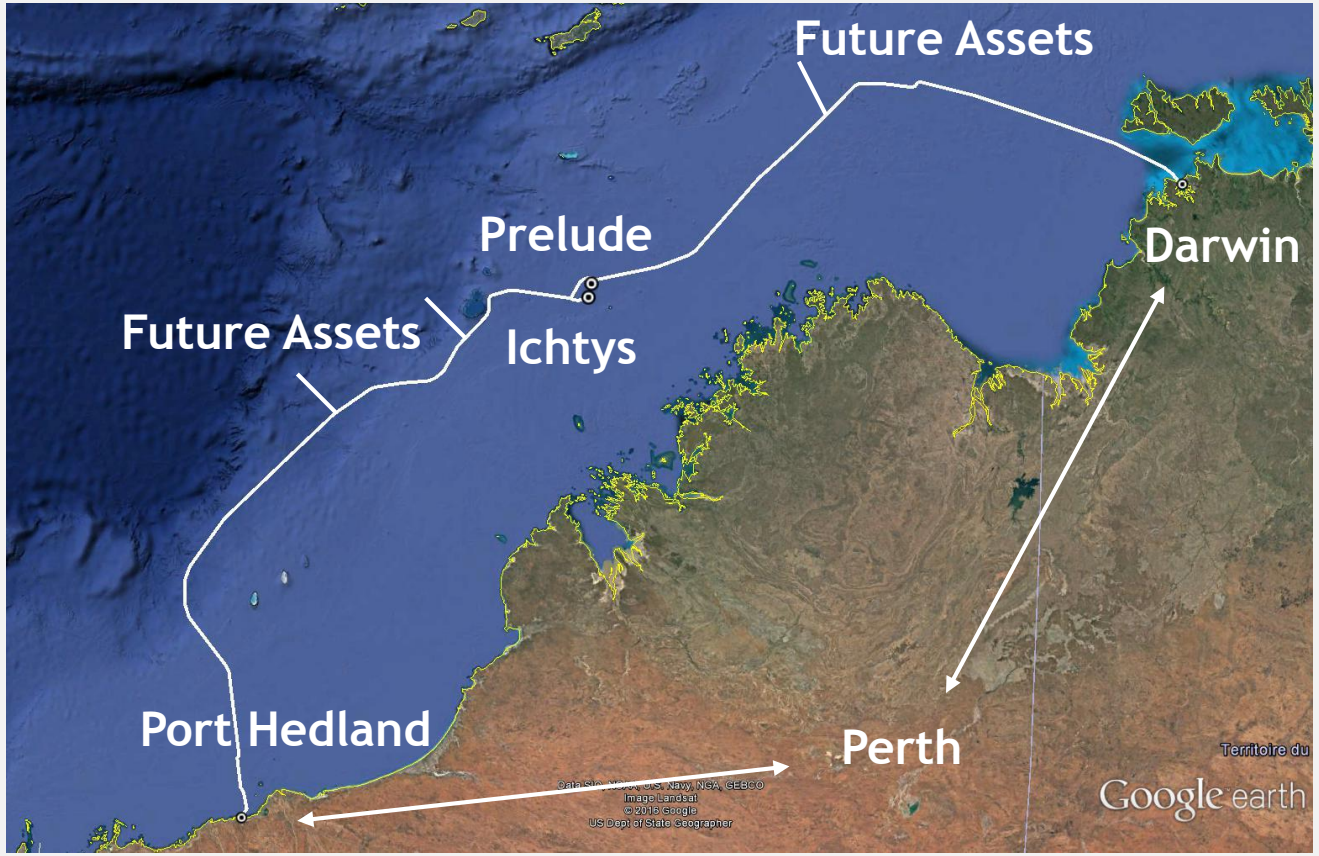
Subsea Control Down Under 2016

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'



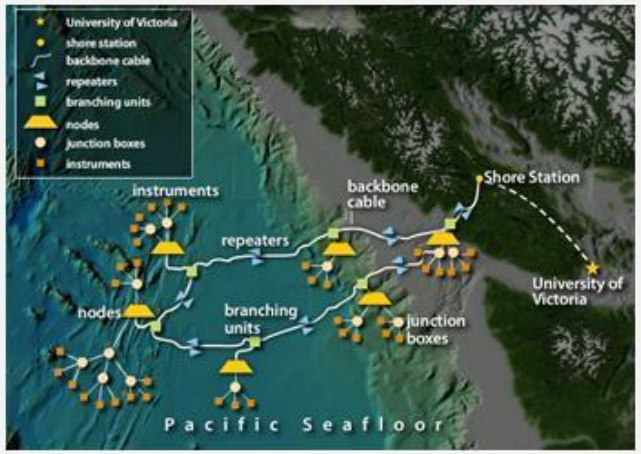
Cable from Darwin to Port Hedland
Connection to Prelude Ichtys, and potentially future other O&G assets in the area.

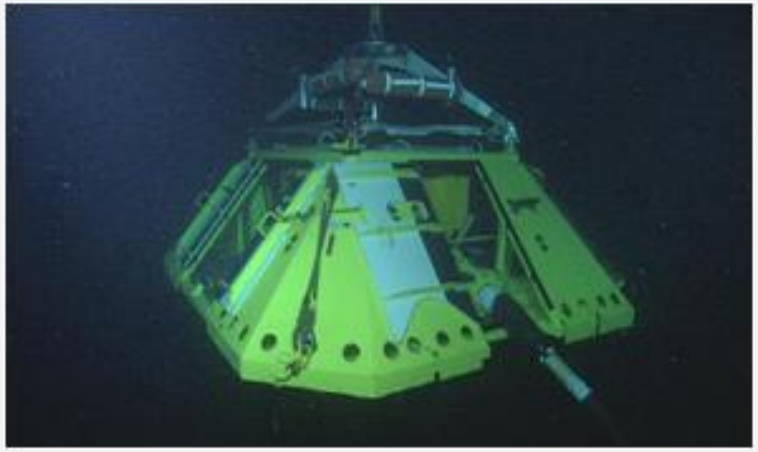
"The subsea cable will give us a highly reliable and stable high-speed voice and data service which is essential for effective and efficient operations at our future offshore facilities. (Shell Prelude Asset Manager)

DC/FO SYSTEM OVERVIEW
ORIGIN OF DC/FO: POWER & COMS FOR SCIENTIFIC APPLICATIONS

NEPTUNE (http://www.oceannetworks.ca/)

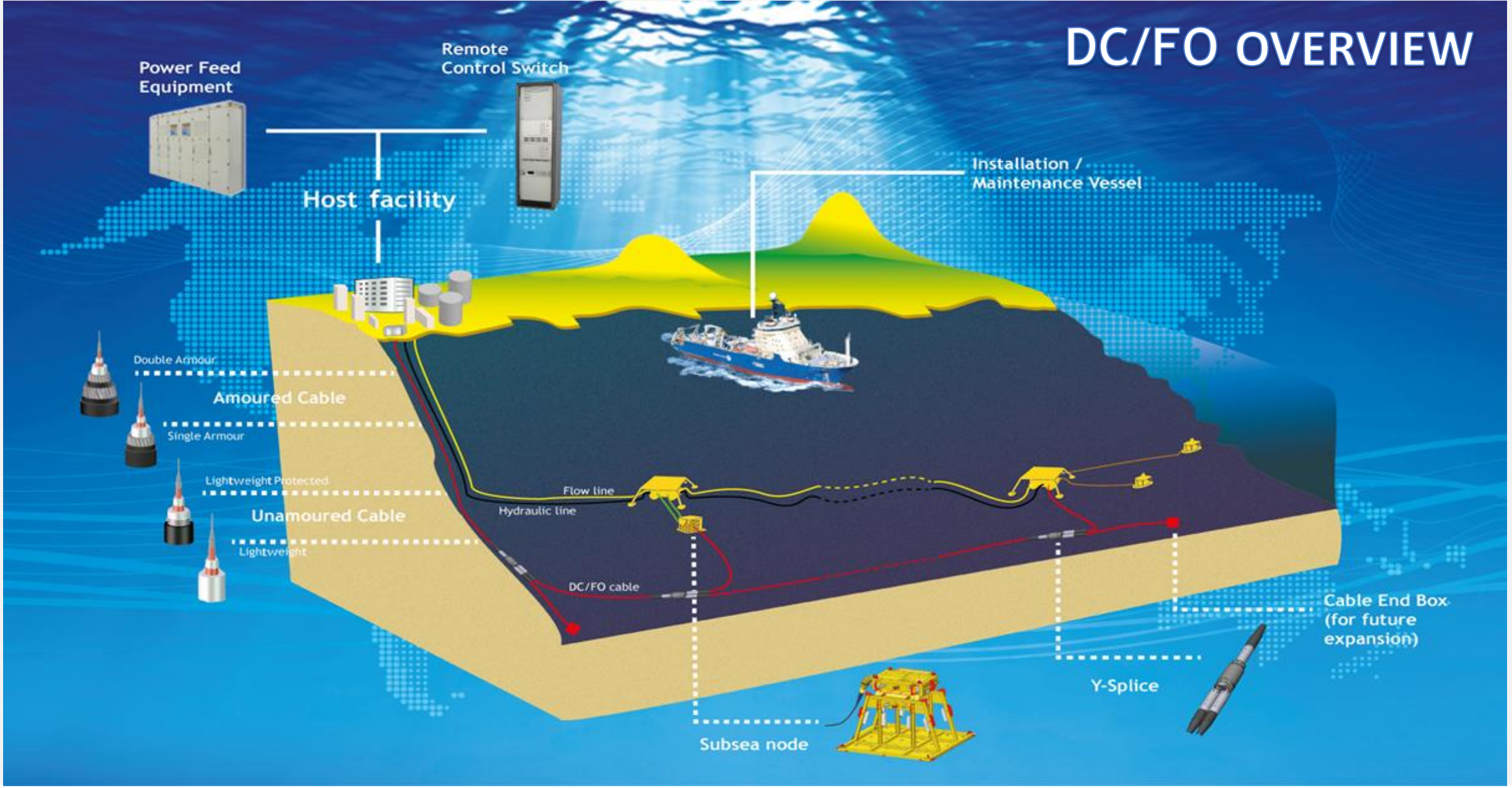
- 800 km backbone @10kV DC
- 2700 m water depth
- 5 Subsea Nodes @10 kW + coms offering 4 x (1GbE and 400V DC) interfaces





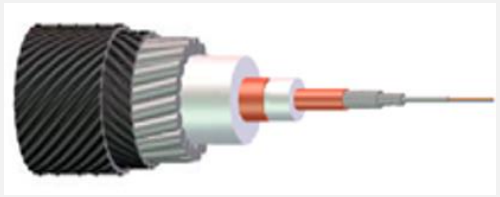
System in operation since 08/2009

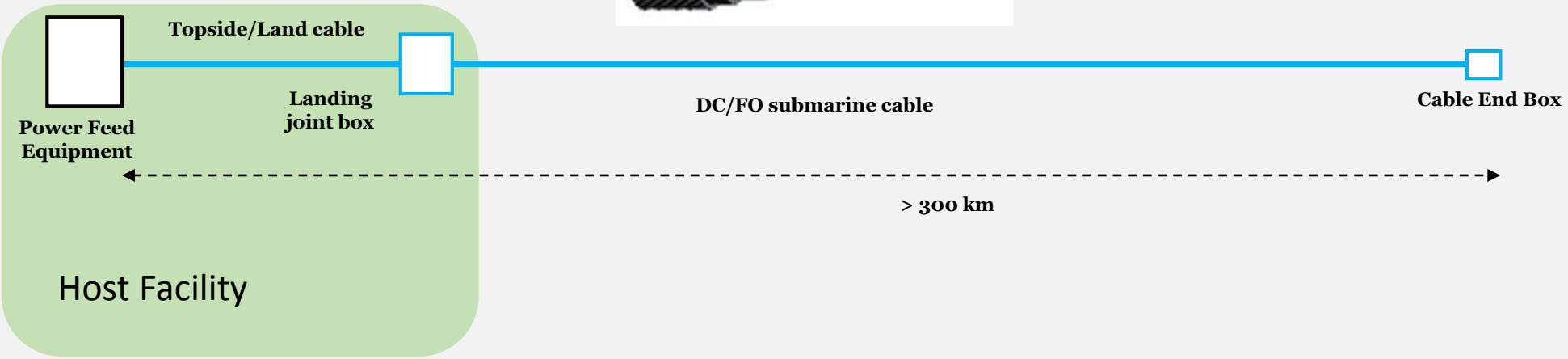
DC/FO OVERVIEW



DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

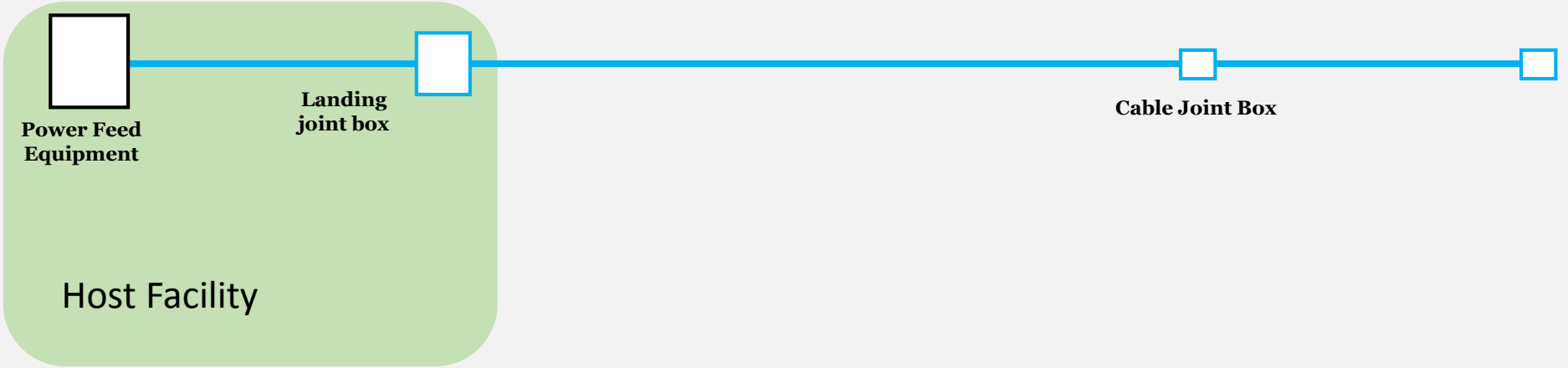
Same cross-section
whatever the distance



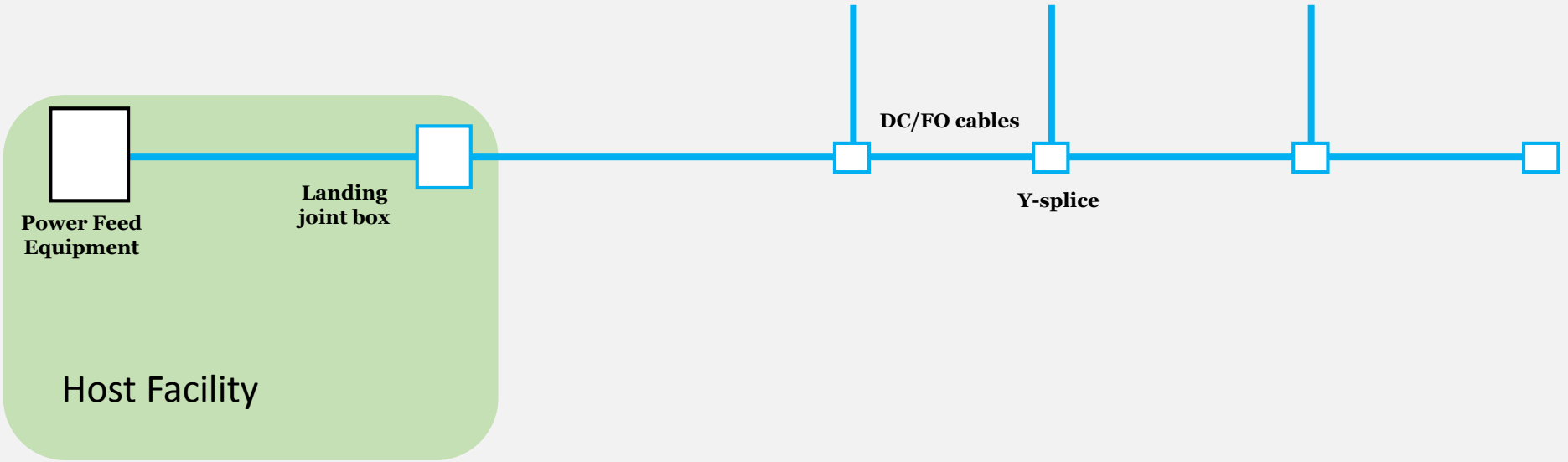


DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

Fully repairable

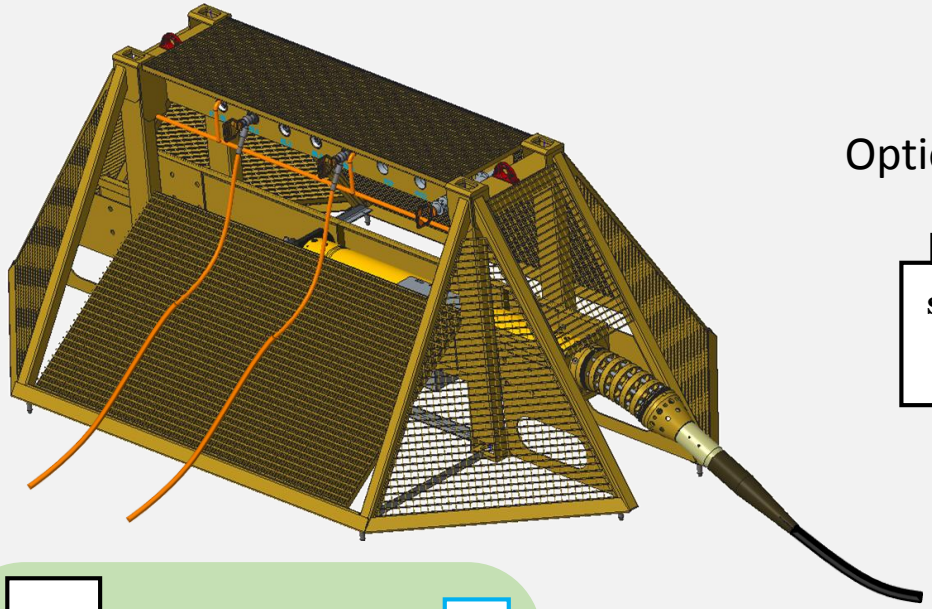


DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS



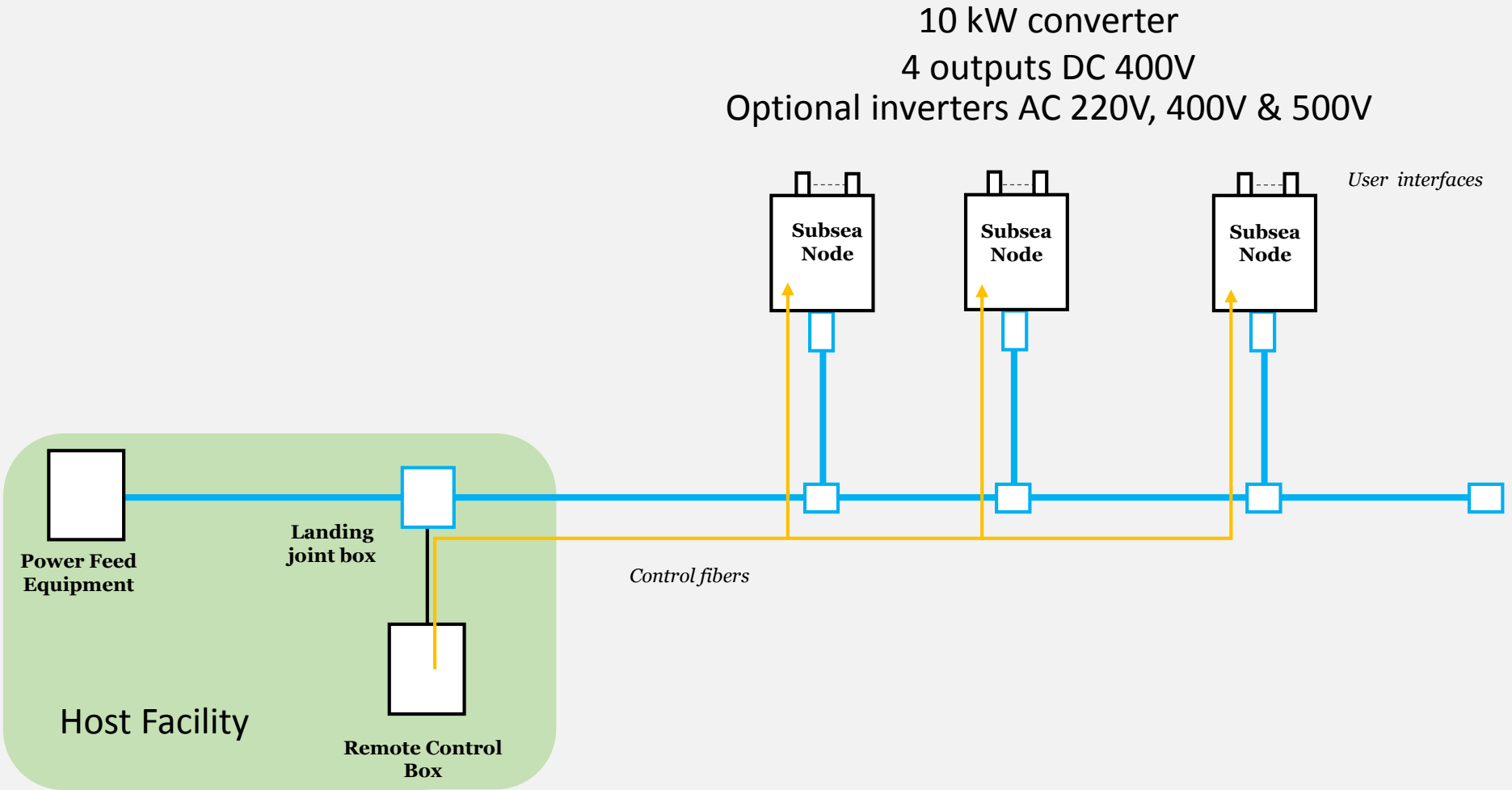
DC/FO TECHNOLOGY OVERVIEW

BUILDING BLOCKS

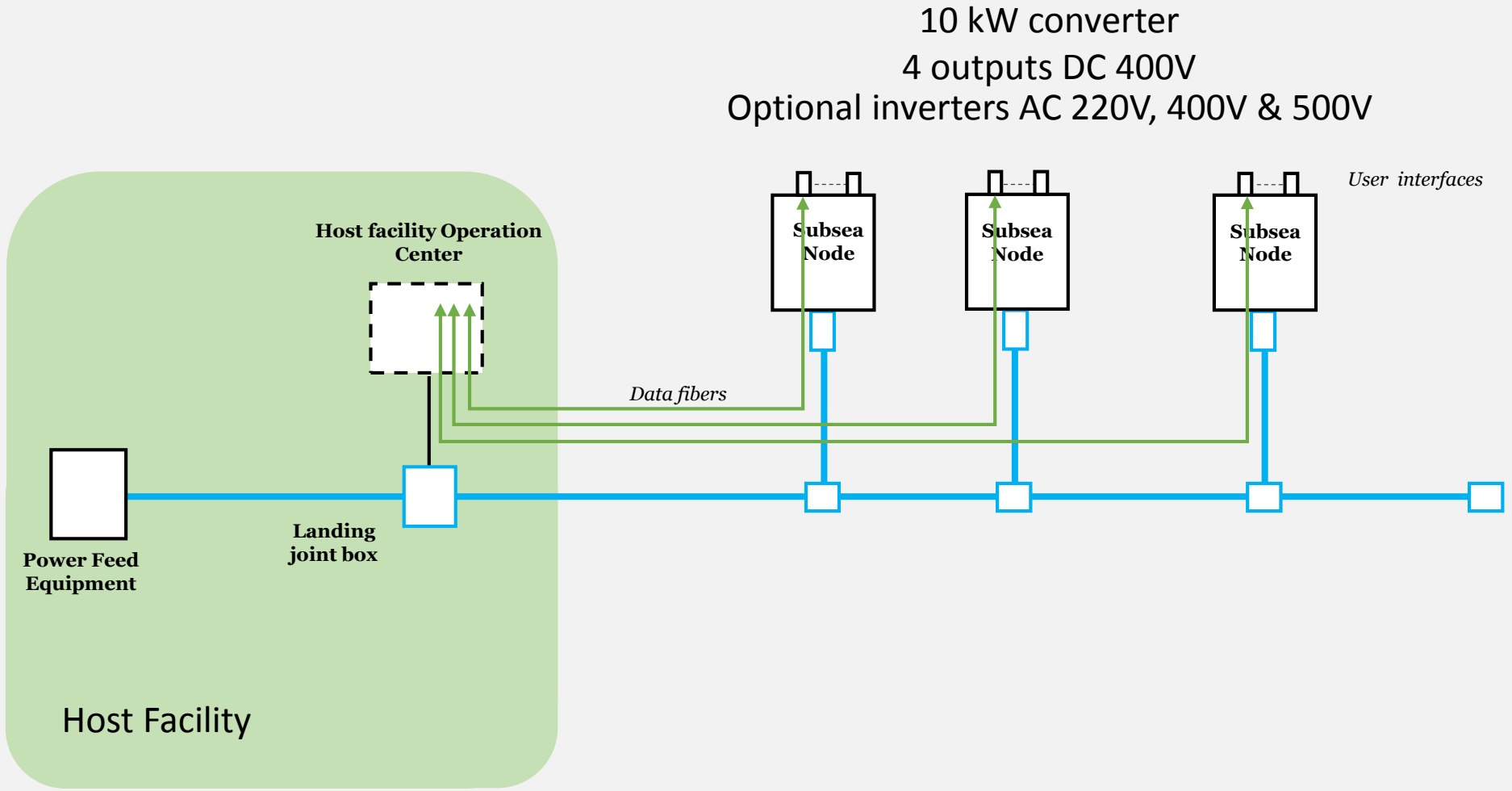


10 kW converter
4 outputs DC 400V
Optional inverters AC 220V, 400V & 500V

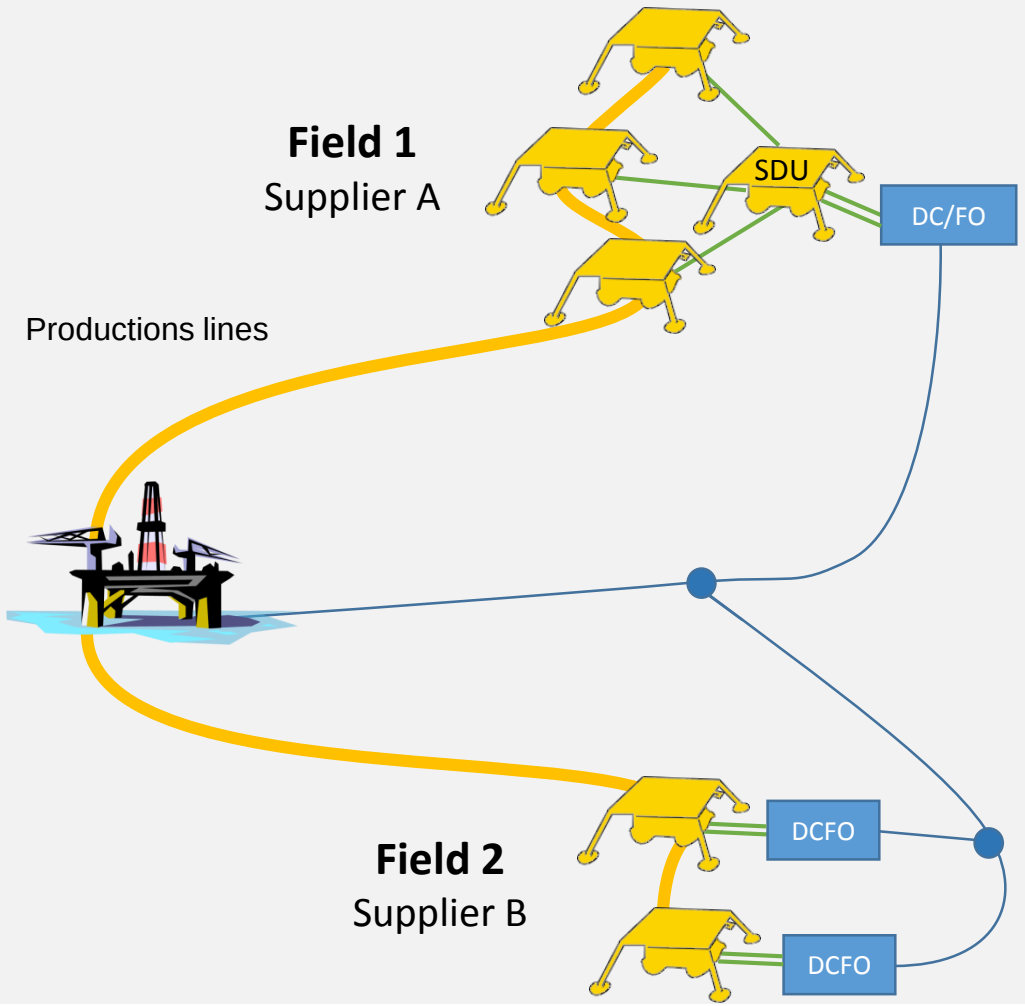
DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

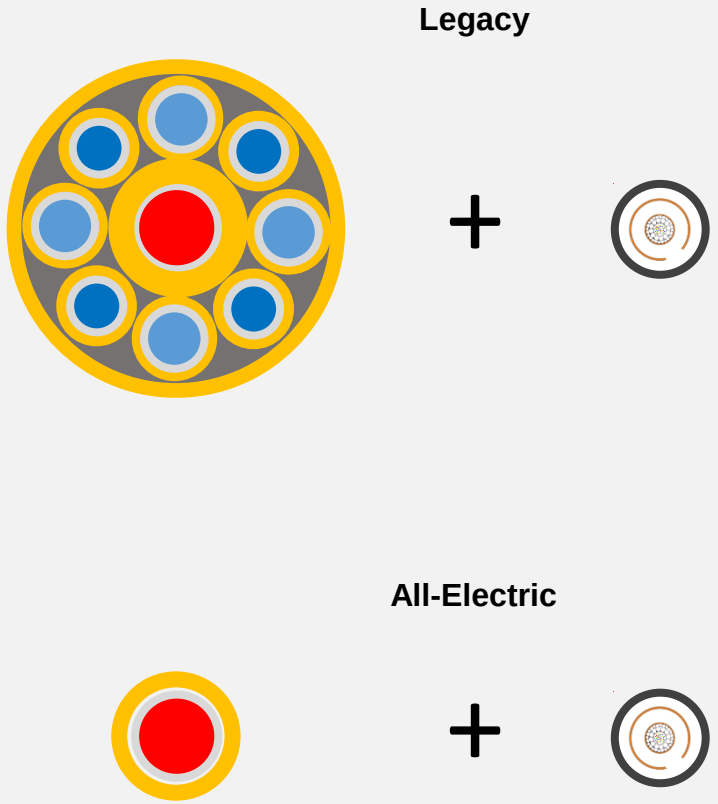


DC/FO TECHNOLOGY OVERVIEW
BUILDING BLOCKS

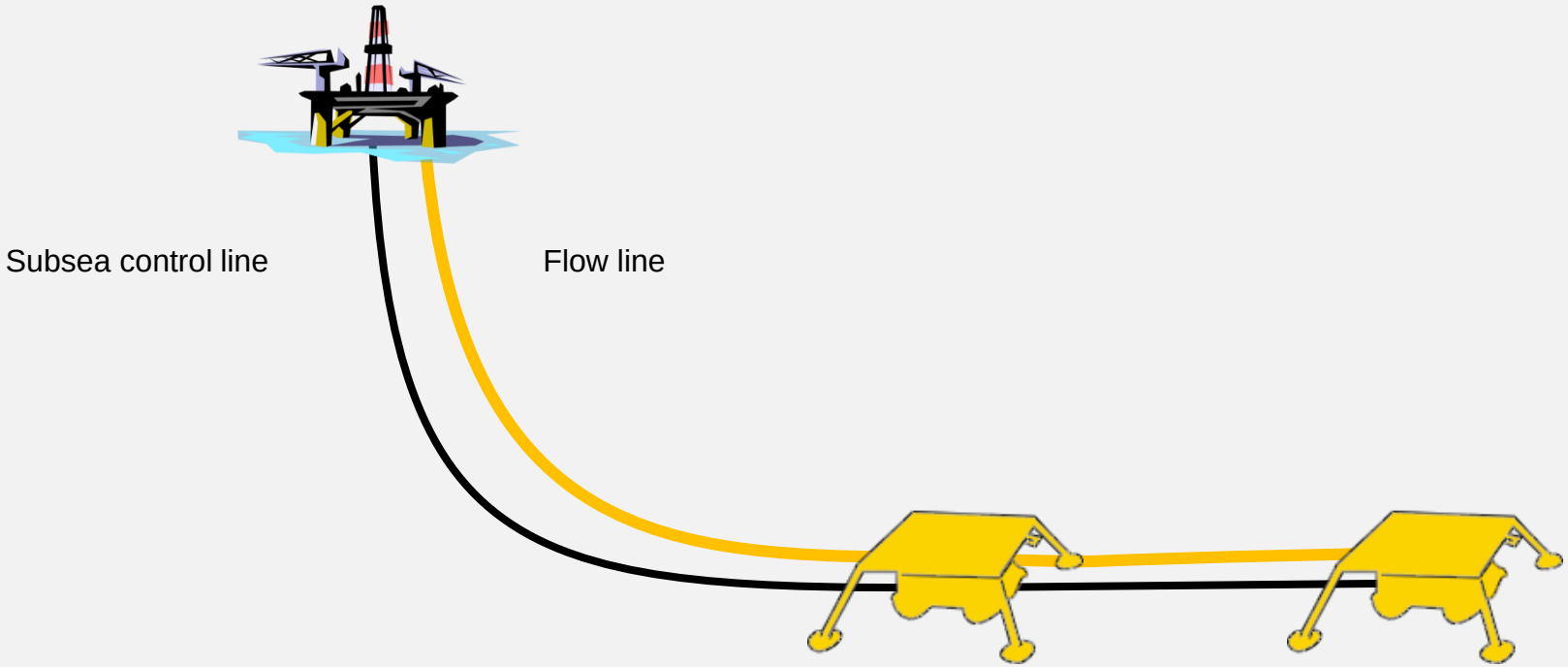


DC/FO SYSTEM OVERVIEW
USE CASE #1: GREEN FIELD and VENDOR AGNOSTIC

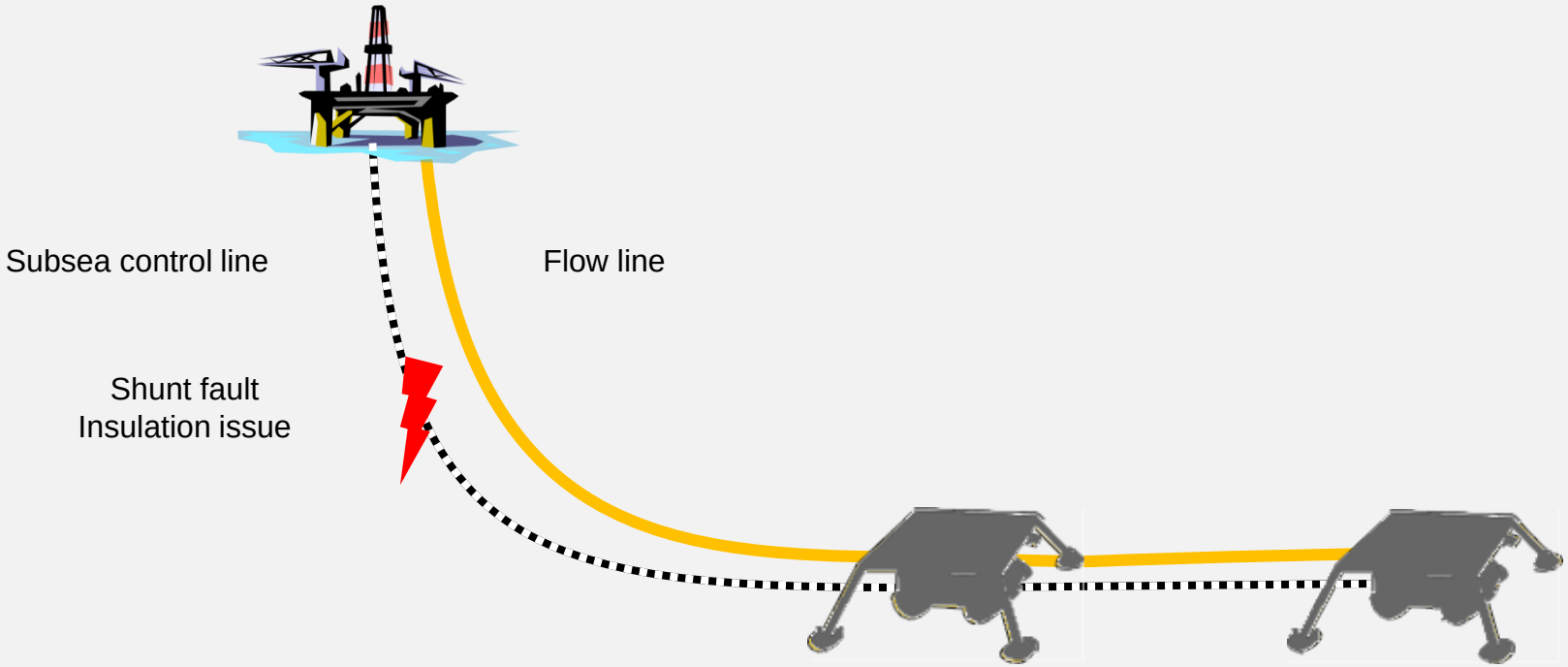




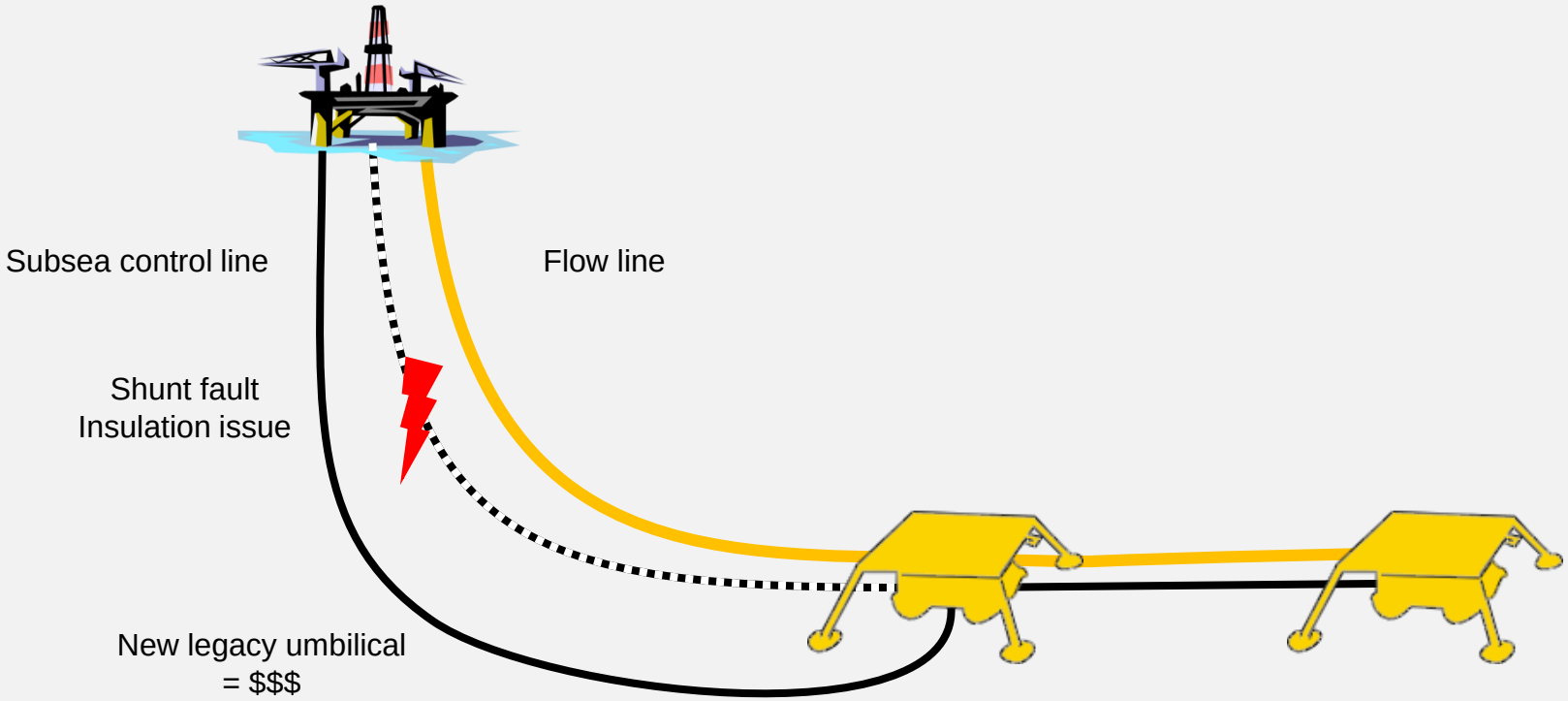
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD – REPAIRS



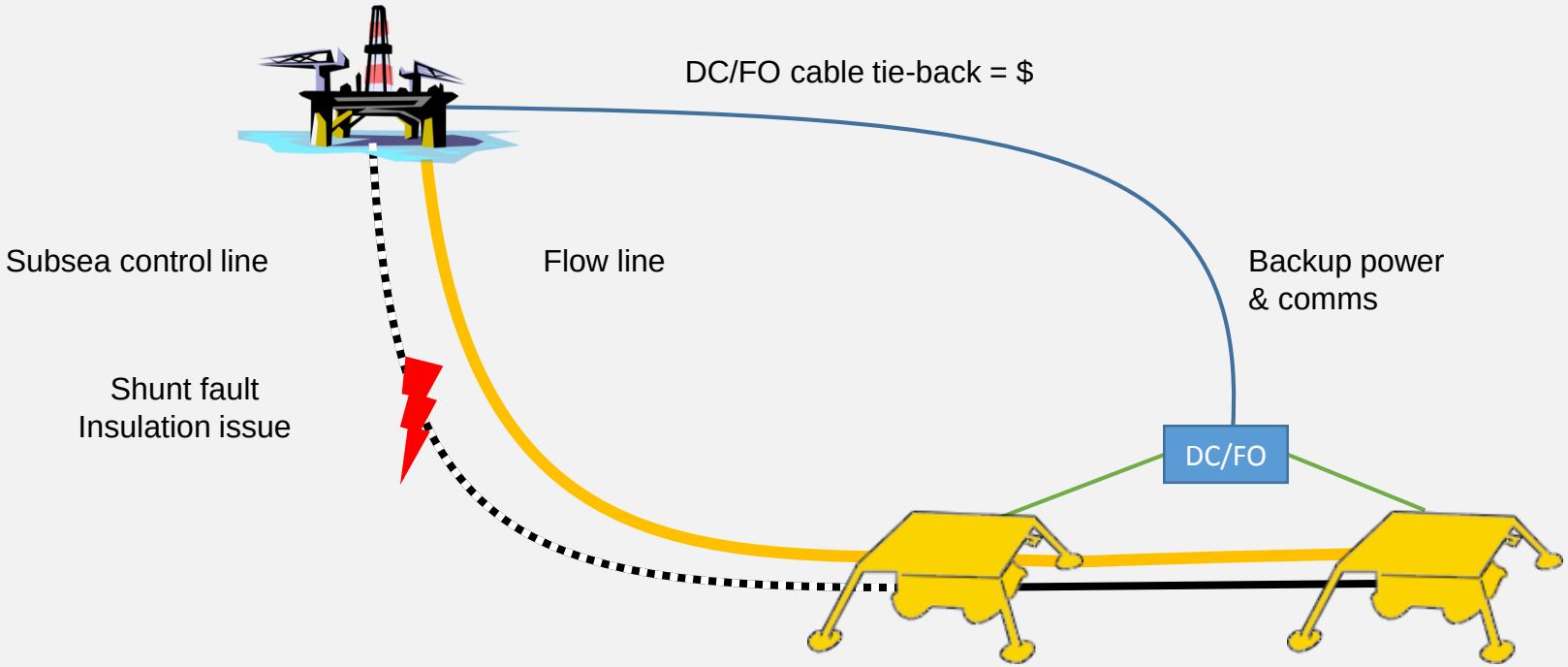
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD – REPAIRS



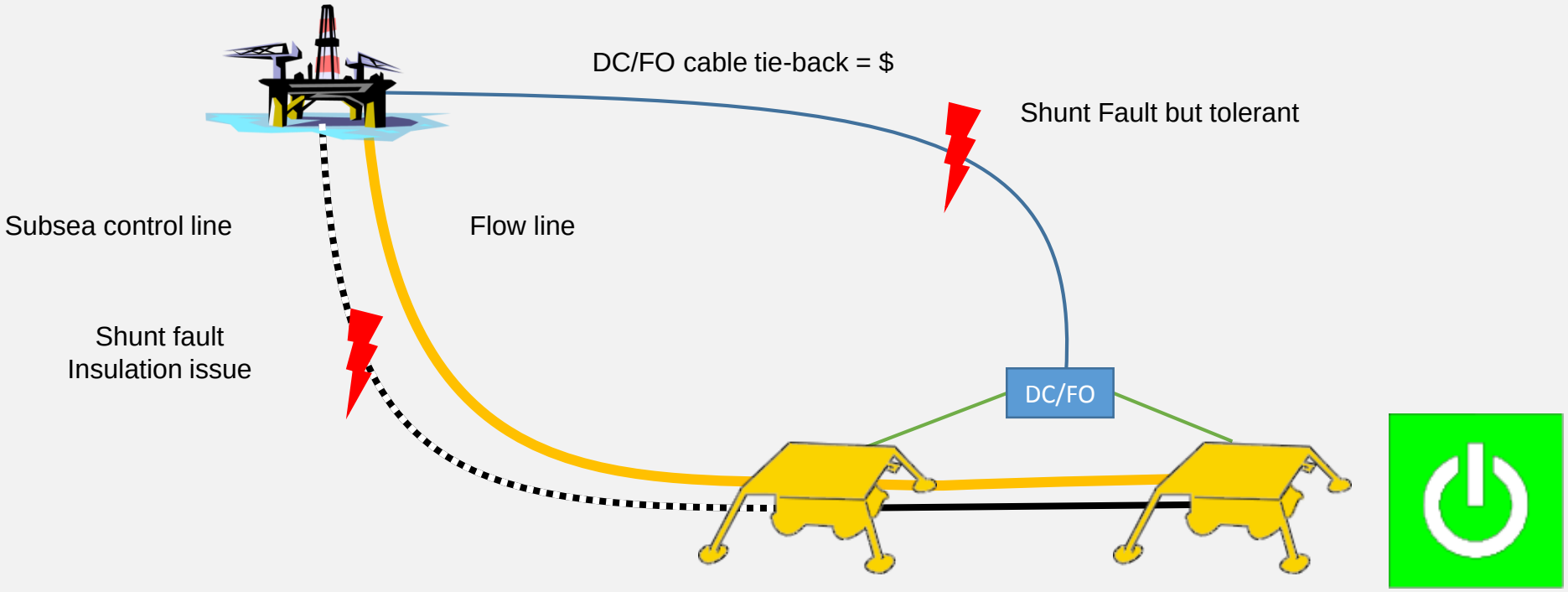
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD – REPAIRS



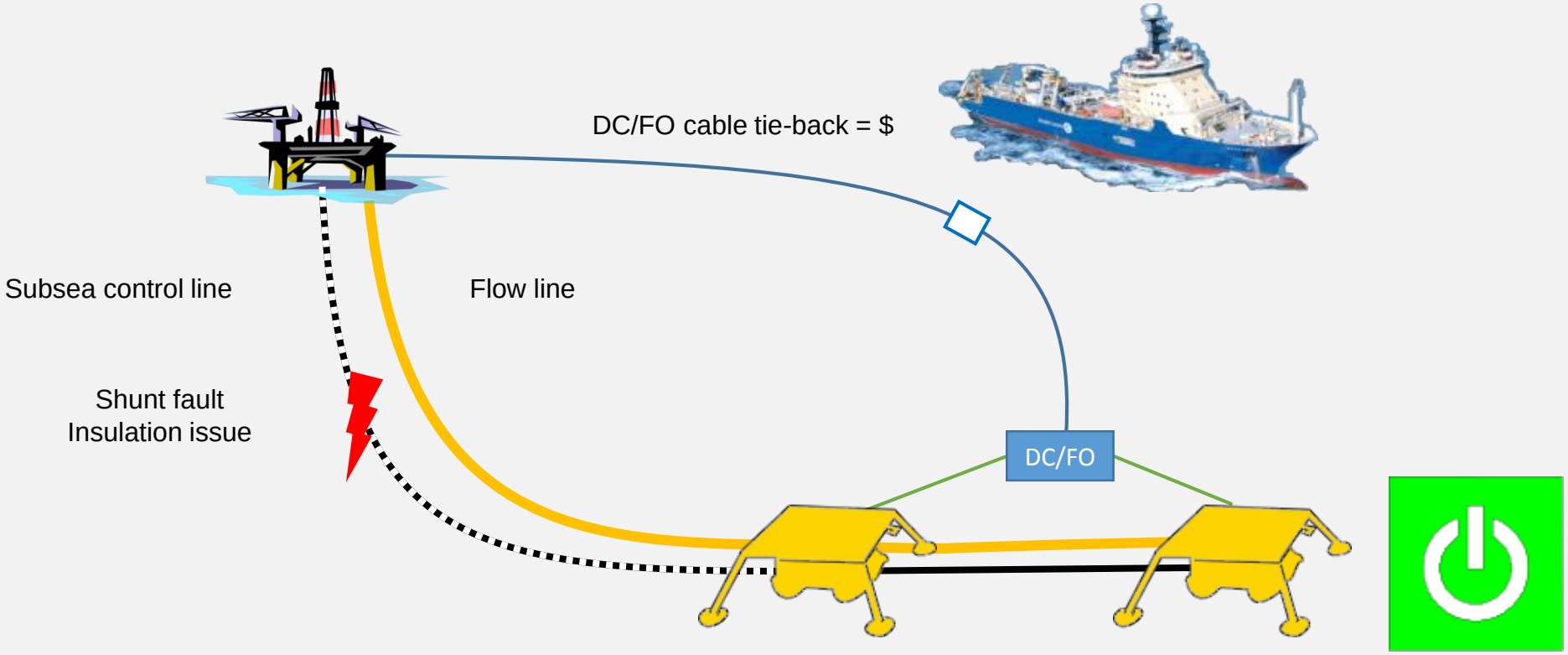
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD – REPAIRS



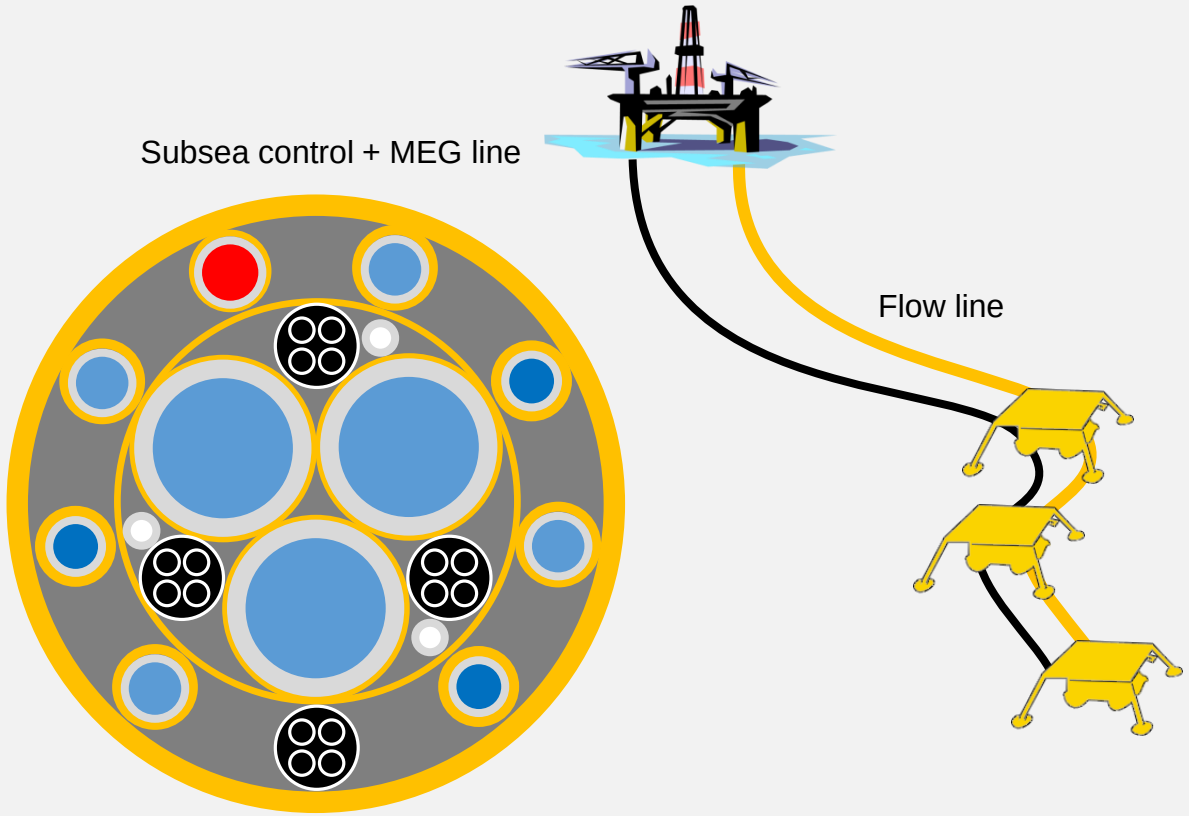
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD – REPAIRS



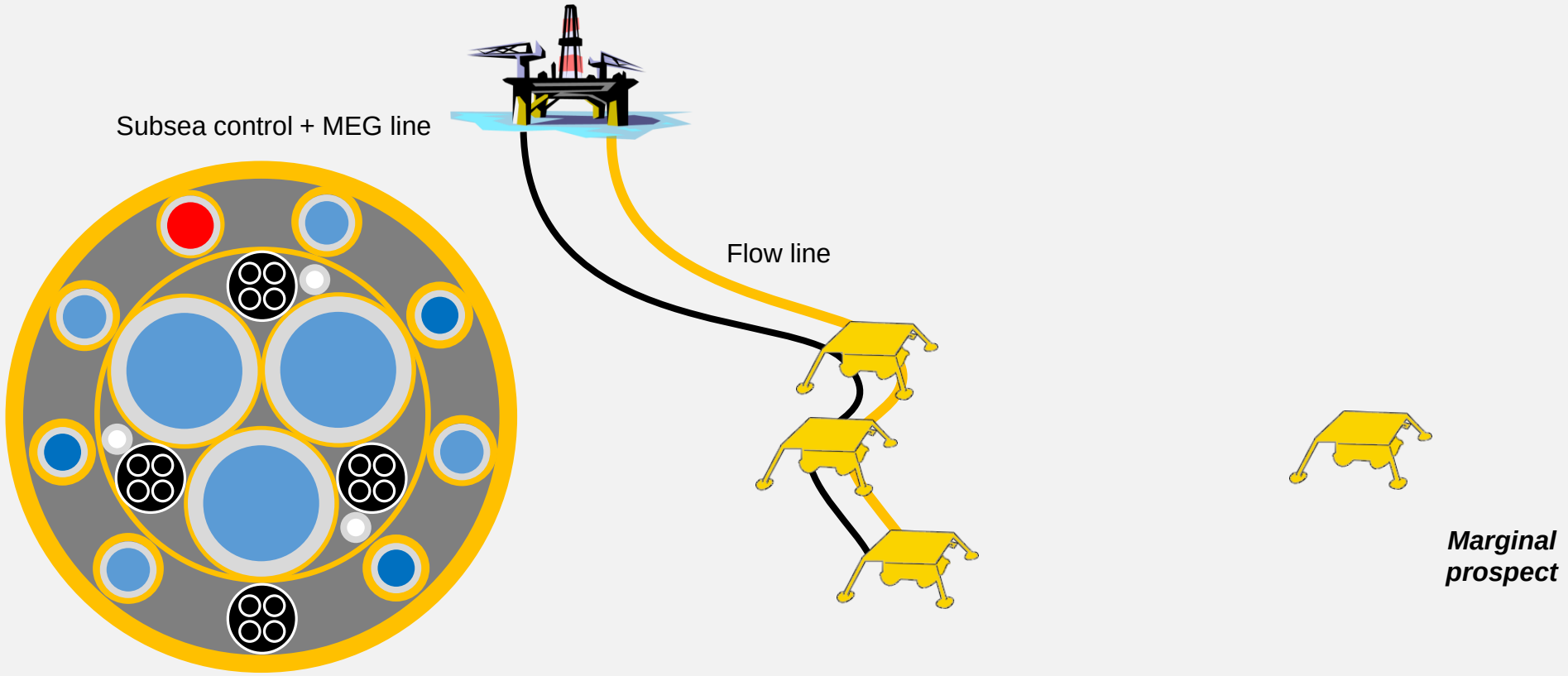
DC/FO SYSTEM OVERVIEW
USE CASE #2: BROWN FIELD – REPAIRS



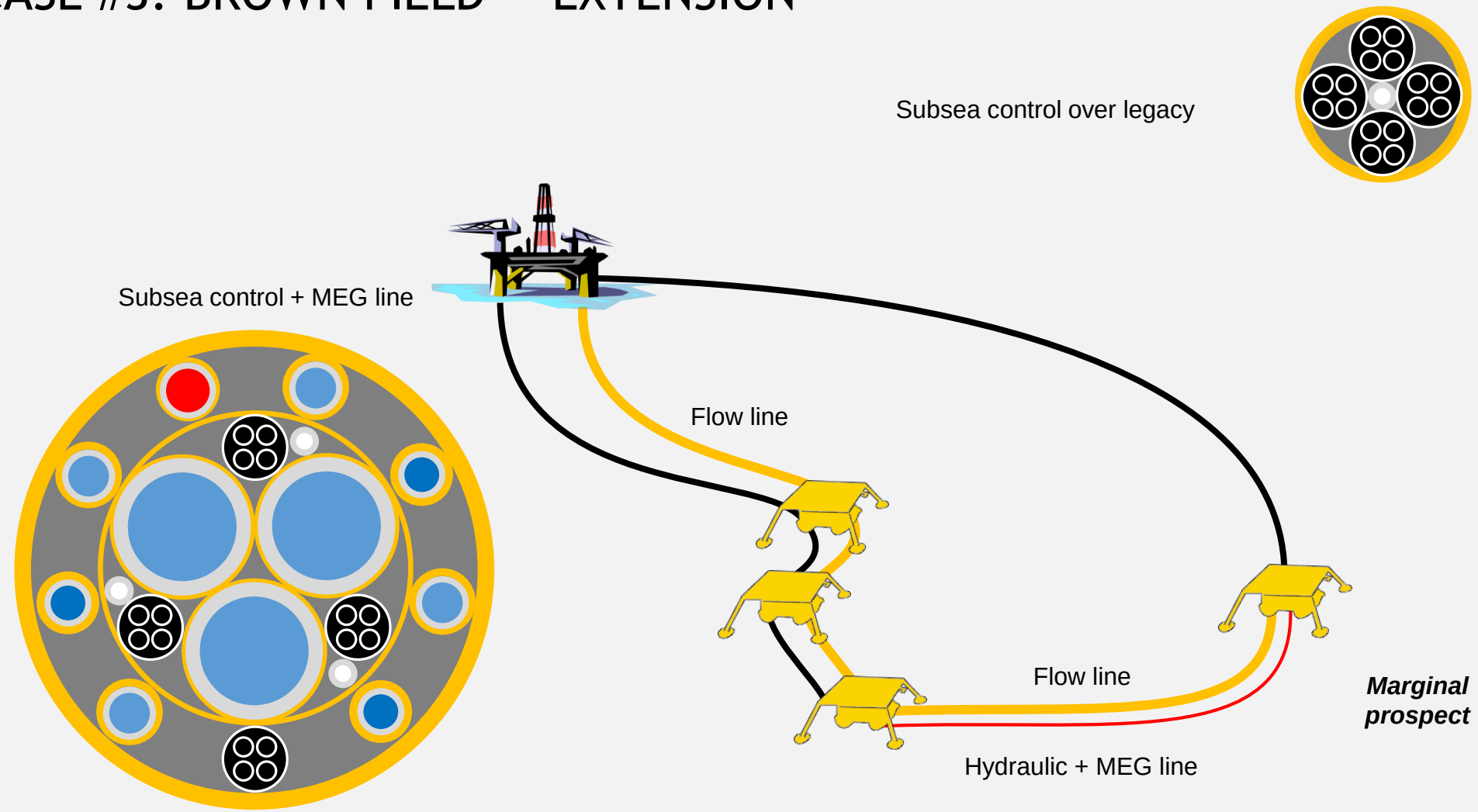
DC/FO SYSTEM OVERVIEW
USE CASE #3: BROWN FIELD – EXTENSION



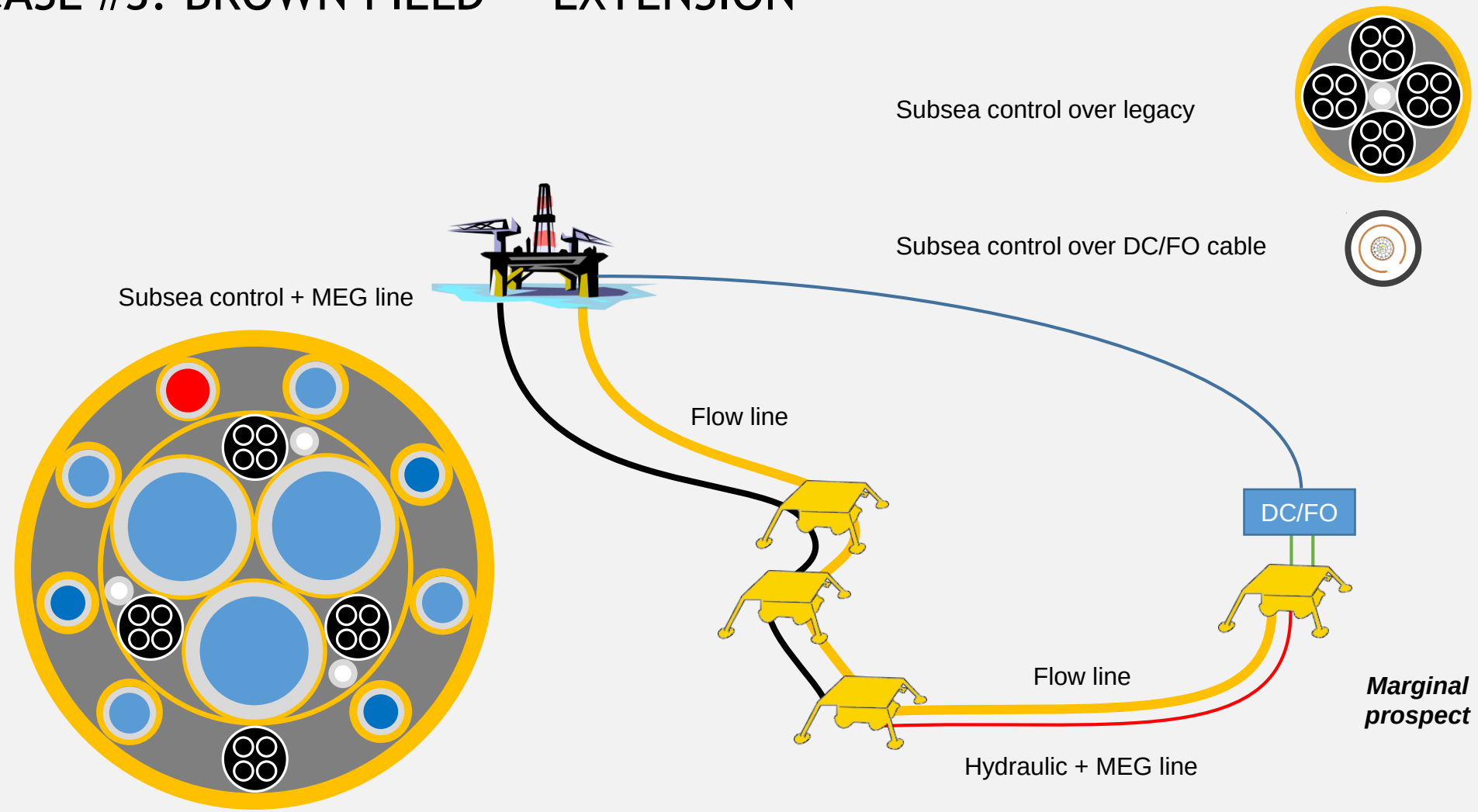
DC/FO SYSTEM OVERVIEW
USE CASE #3: BROWN FIELD – EXTENSION

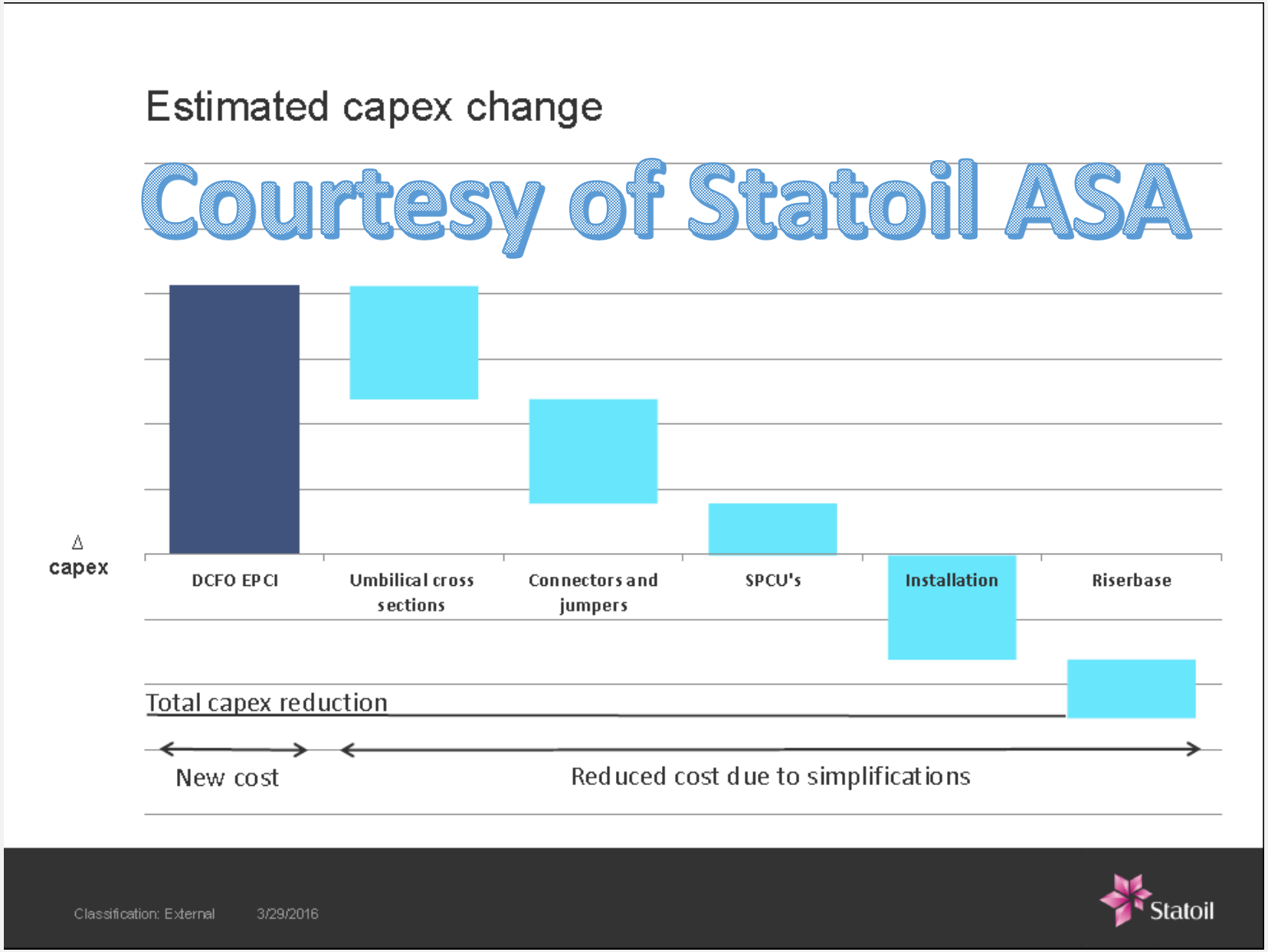


DC/FO SYSTEM OVERVIEW
USE CASE #3: BROWN FIELD – EXTENSION



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





DC/FO SYSTEM OVERVIEW
Value proposition

Extendibility

Standardized

Large power supply

Lean

Open platform

DC/FO

Repairability

Standard cross section

@Virtually unlimited reach

Any SPS supplier equipment

SYSTEM

Acknowledgment of contributions:

- Statoil and Chevron for sponsoring the development and qualification of this technology
- Statoil Johan Castberg project team for selecting DC/FO technology in base case and for use of project information

Thank you for your attention!

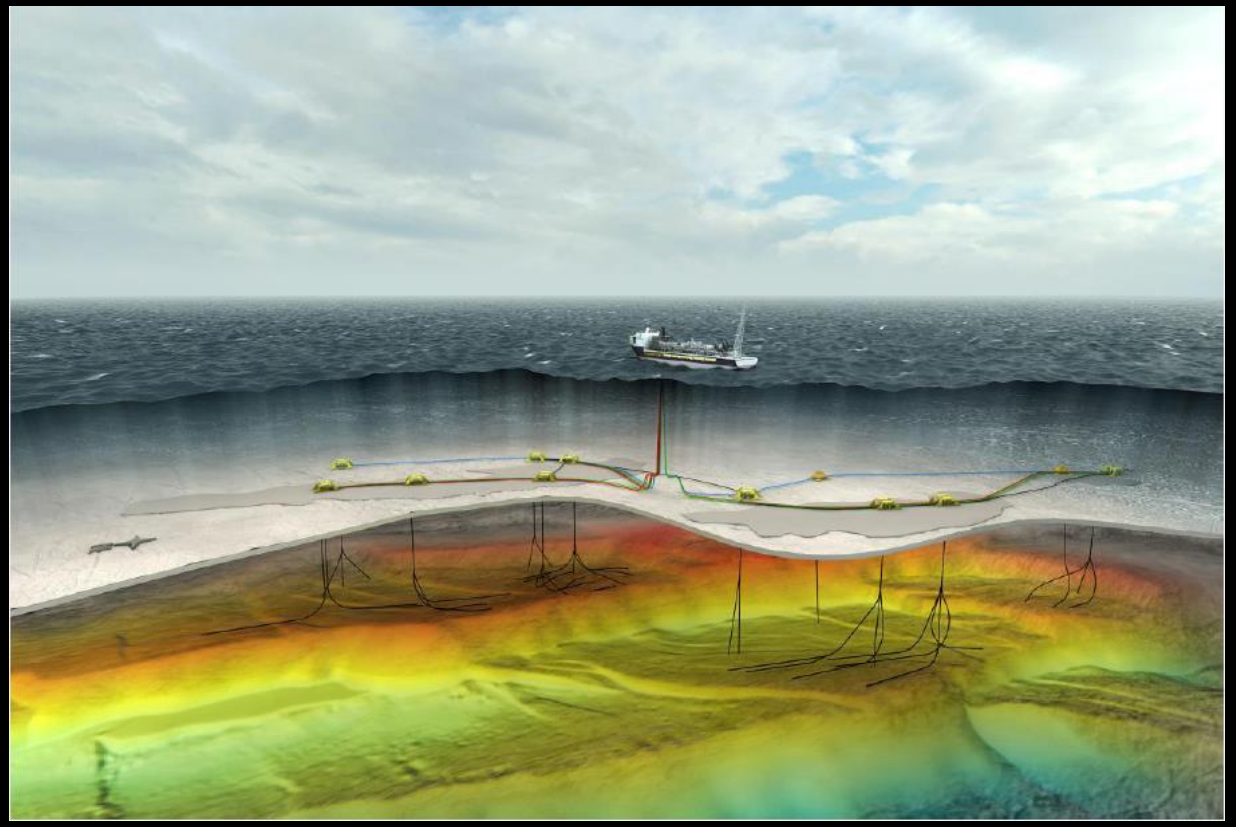
stephen.keenlyside@alcatel-lucent.com

O&G Commercial Manager, (Sydney)

ronan.michel@alcatel-lucent.com

O&G Product Line Manager

+33 6 72 00 90 21



Next slide not presented, but inserted in pdf.

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.