

**Getting it right with brownfield extensions  
applying innovative communication approaches**



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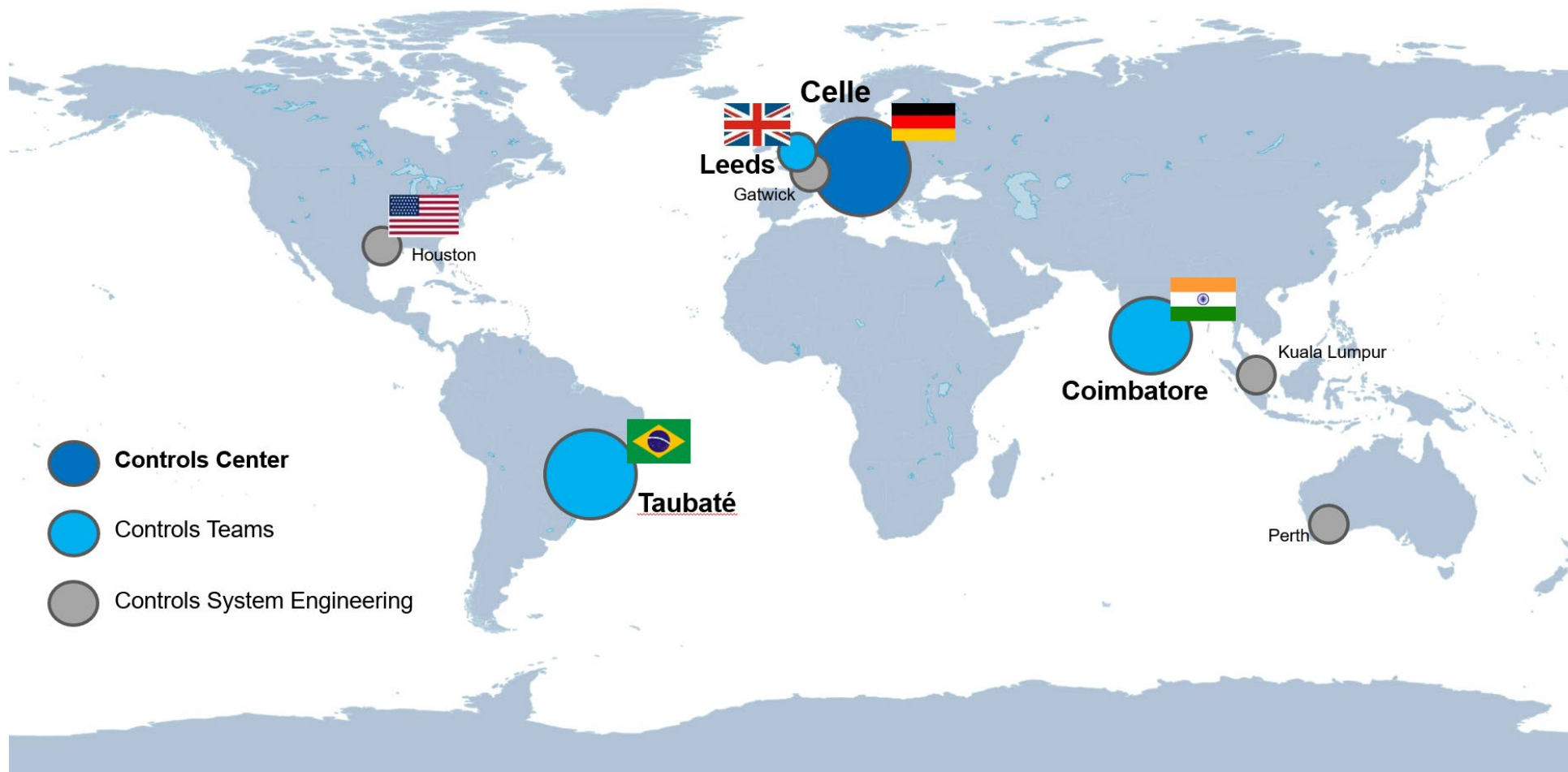
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Technology



# Agenda

- OneSubsea Controls
- Brownfield
- Brownfield extension scenarios
- Introduction to PLM600c
- Coexistence options
- Coexistence in practice
- Summary

# OneSubsea Controls Technology Team





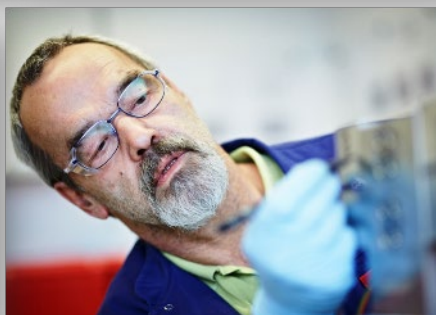
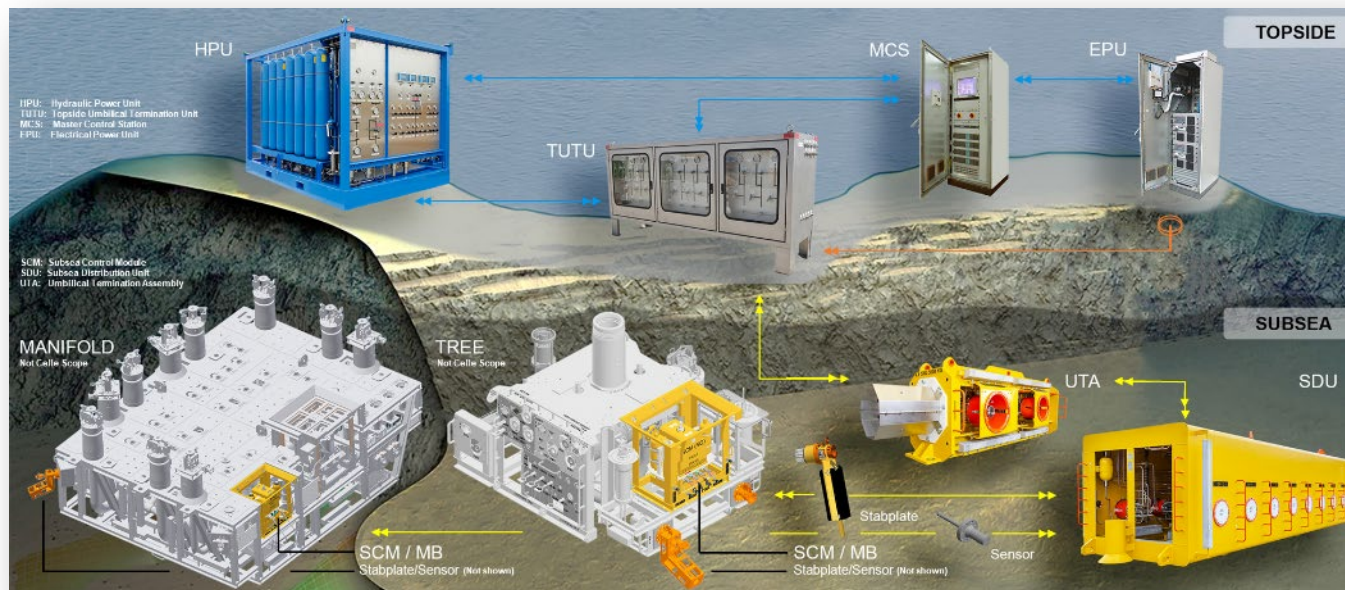


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# OneSubsea Controls Center Celle



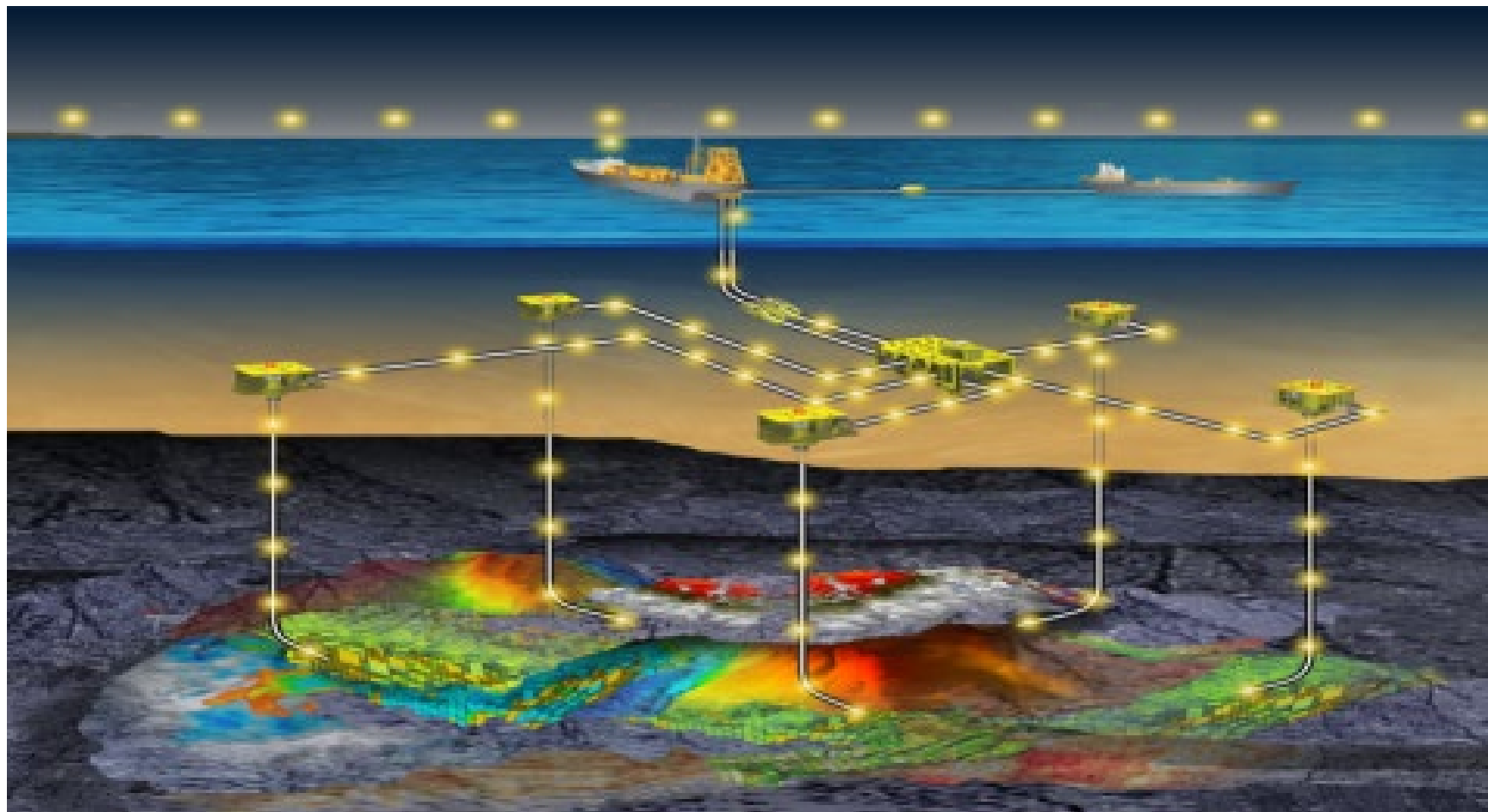
## Subsea system integration and Controls manufacturing



# Brownfield Extension

## Brownfield extensions without replacing the incumbent Controls System

- Single well extension
- Multi well extension
- Drill center extension
- Well replacement



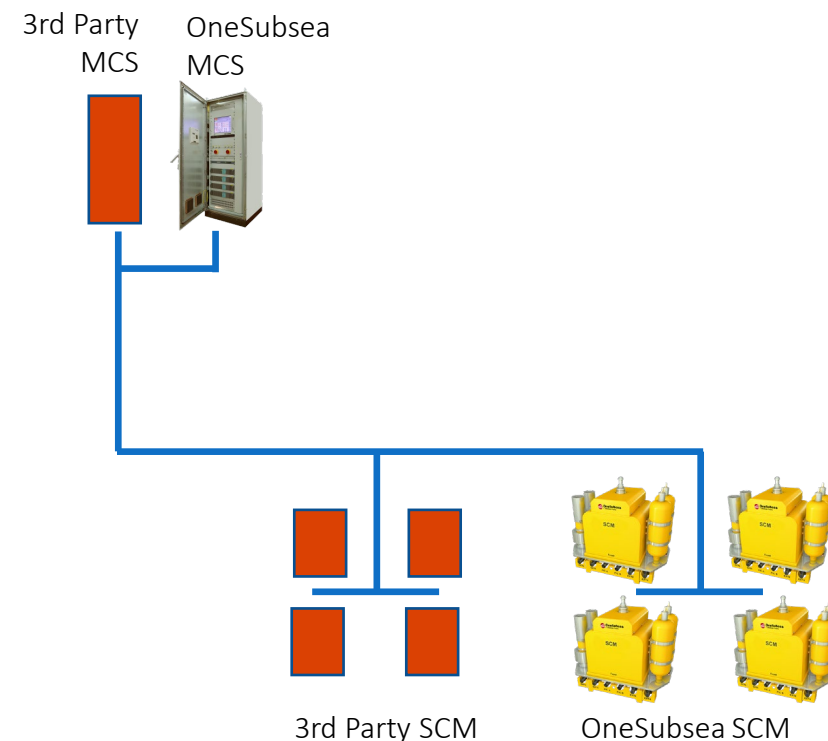
# Brownfield Extension Cases

**Scenarios to implement and operate two coexisting Controls Systems.**

**Chemicals, Hydraulics and Power typically match seamlessly.**

**Options to add new Comms channels for field expansion:**

1. Spare lines in existing umbilical
2. New umbilical
- ★ 3. Utilize power lines/cables in existing umbilical for comms on power (CoP)
- ★ 4. Shared medium for comms:  
Coexistence in frequency multiplex (multi band)
- ★ 5. Shared medium for comms:  
Coexistence in time domain multiplex

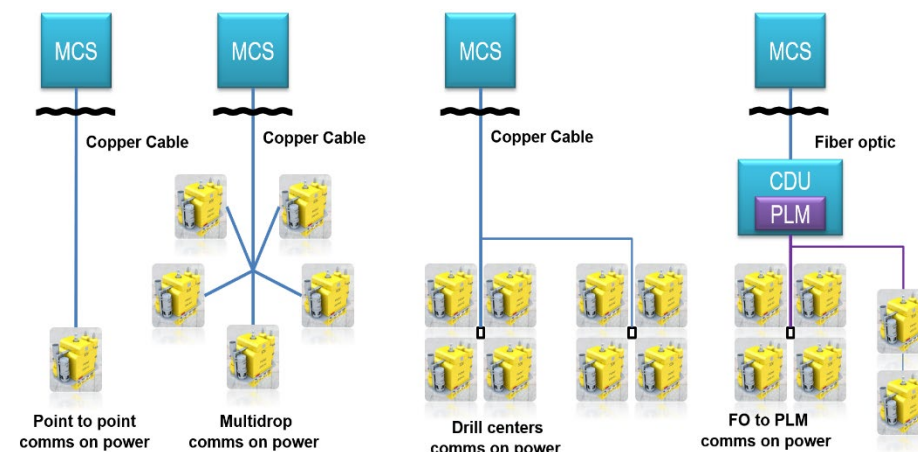
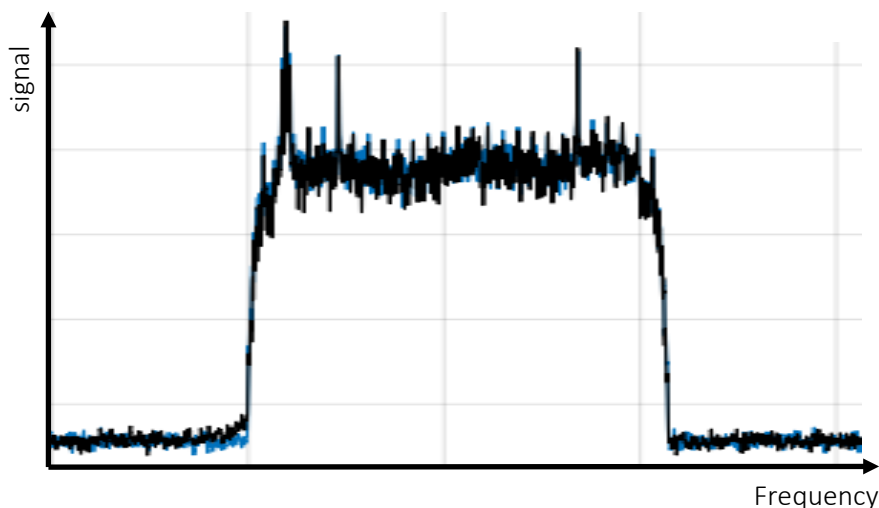




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# High-Speed Powerline Modem

Orthogonal Frequency-Division Multiplexing (OFDM) is a flexible wideband communication scheme, encoding digital data on multiple carrier frequencies





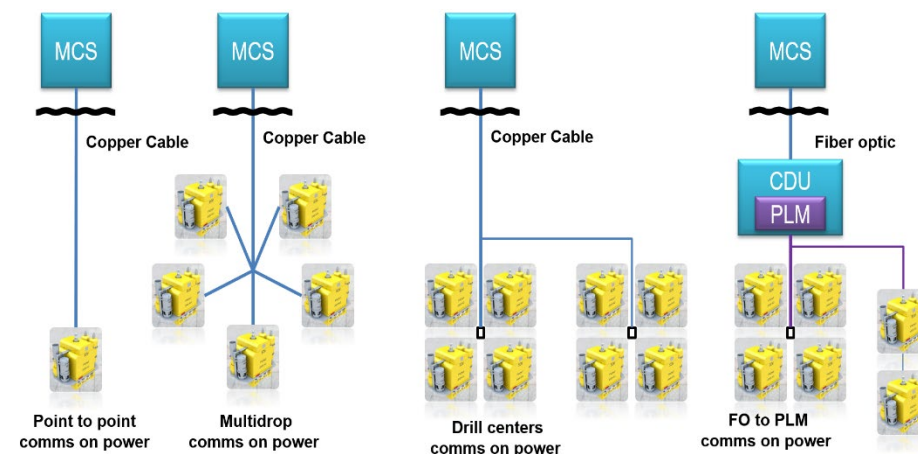


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# High-Speed Powerline Modem

## OneSubsea PLM600c Modem System

- High Speed OFDM (up to 2Mbit), Flexible Multicarrier Scheme
- State of the art Signal Processing and Modulation Scheme
- Long step-outs (up to 100km)
- Flexible Configuration Possibilities
- Optimal for Daisy-chain Configurations (Multidrop)
- Comms on Power capable
- Cost Competitive Field Layouts
- Enhanced Field Level Diagnostics
- Brownfield Applications for Coexistence with non-OSS systems
- API17F qualified

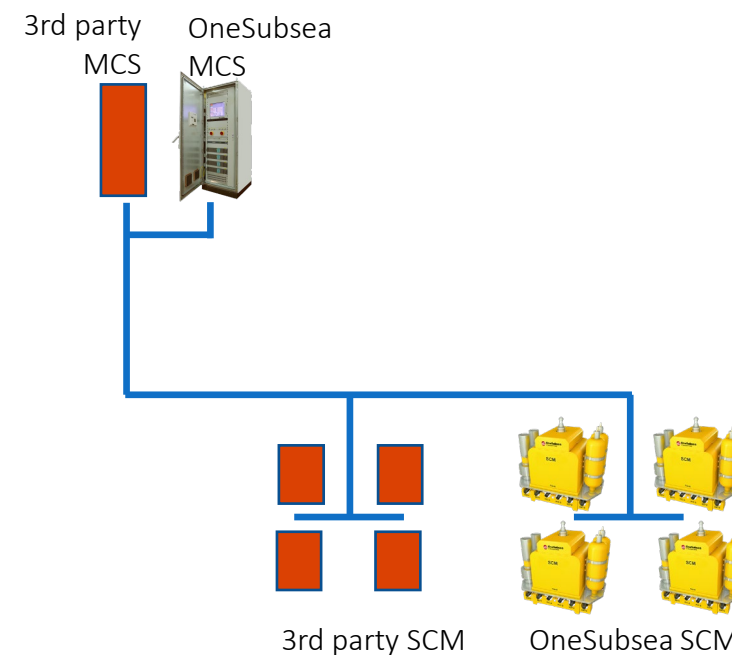
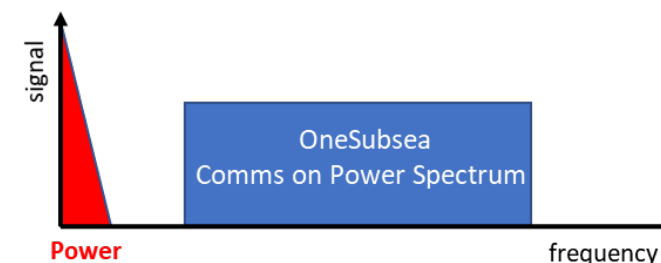




# Case 1 - Comms on Power

## Coexistence by utilizing power cables

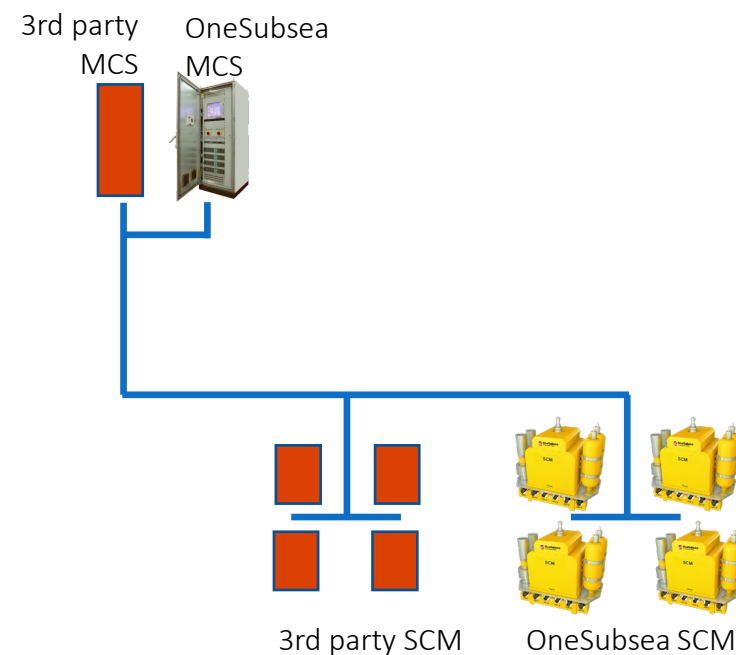
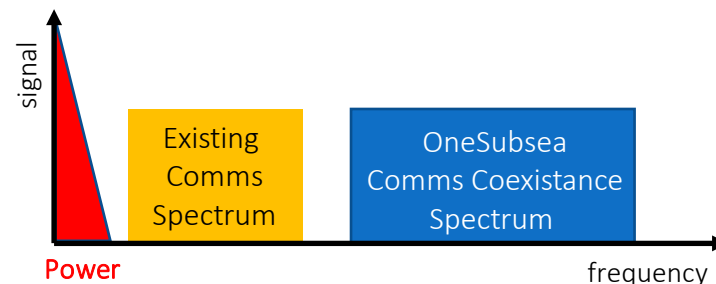
- New comms added on power cables
- No changes to existing Controls System
- Option to select if :
  - ✓ Existing system runs comms on separate cables
  - ✓ No more spare lines/cables in existing umbilical



# Case 2 - Shared Medium for Comms

## Coexistence in frequency multiplex (multi band)

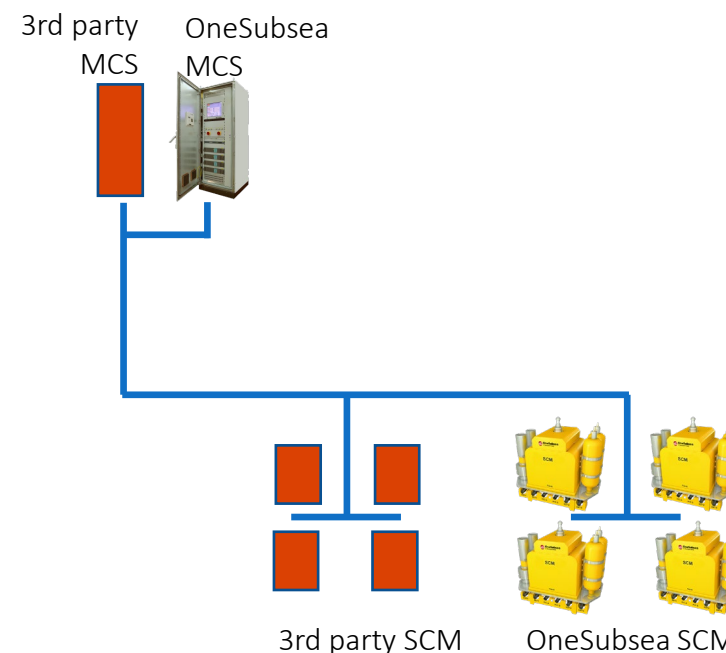
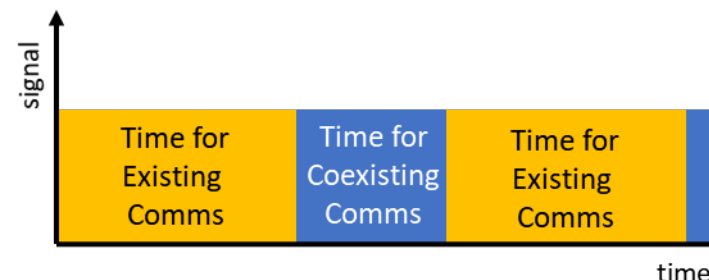
- New comms on same cable pair as existing
- No changes to existing Controls System
- Option to select if
  - ✓ Existing system runs comms on power
  - ✓ No more spare lines/cables in existing umbilical
  - ✓ Frequency range beyond existing comms can be utilized
  - ✓ Coexistence feasibility is proven



# Case 3 - Shared Medium for Comms

## Coexistence in time domain multiplex

- New comms on same cable pair as existing
- Time synchronization with coexisting system
- Option to select if
  - ✓ Existing system runs comms on power
  - ✓ No more spare lines/cables in existing umbilical
  - ✓ Frequency range beyond existing comms is unavailable/heavily attenuated

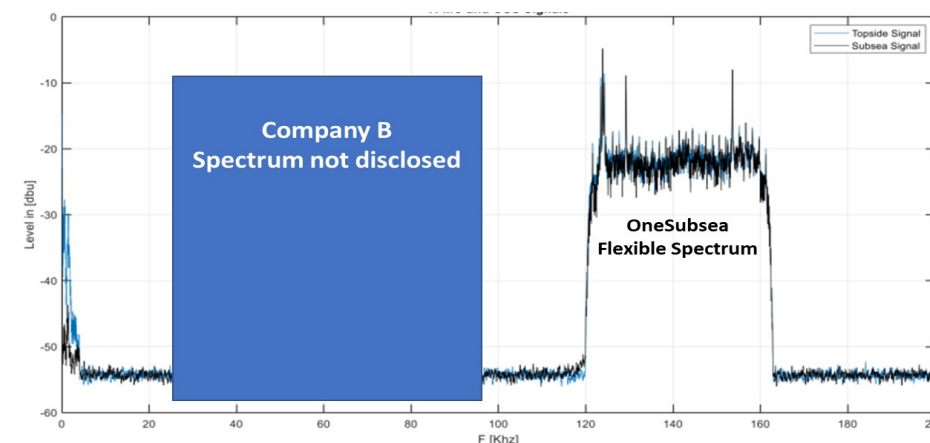
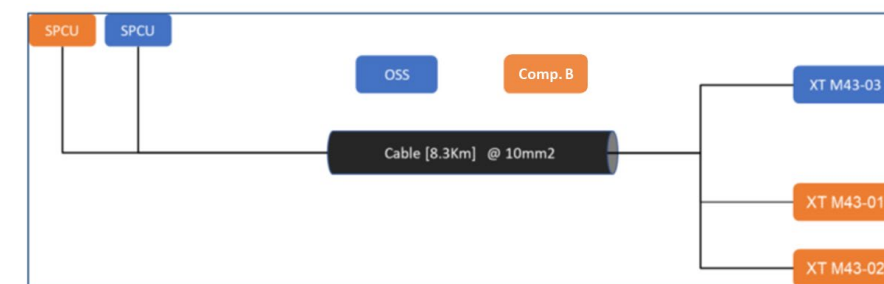
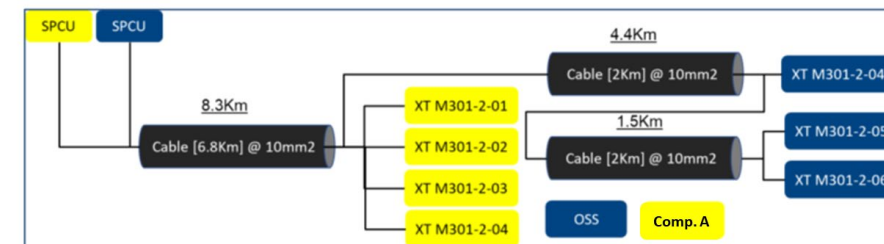




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# Coexistence Test Results

- Practical tests have been performed
  - Operator driven test project with three major players
  - Company A+B equipment shipped to Celle
  - Project specific setups reproduced in Celle
  - System characterizations done and analyzed
  - OneSubsea Modem configured for coexistence
- ✓ **Case 2:** Coexistence in frequency on same cable demonstrated successfully with both competitors
- Company A: OneSubsea coexists with approx. 130 kbps
  - Company B: OneSubsea coexists with approx. 45 kbps





# Summary

- **Flexible OneSubsea PLM600c enables subsea communications coexistence**
- **Selection of suitable coexistence case done during FEED or preFEED**
- **Practical test campaign carried out to de-risk project**

→ **PLM600c opens new options to expand Brownfield Subsea Control Systems**

→ **PLM600c adds a new level of Subsea Control Systems Diagnostics**

# Questions



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