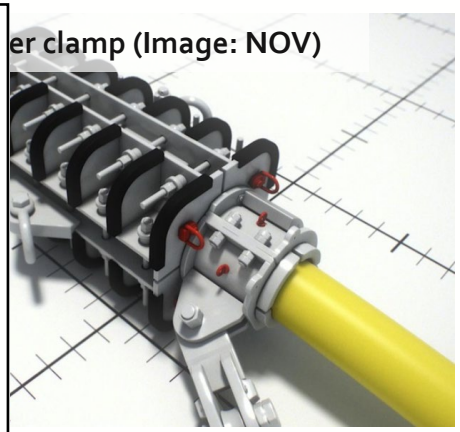
# Dynamic cable lazy wave design

## 4 – Add a tether to reduce seabed abrasion and migration



er clamp (Image: NOV)

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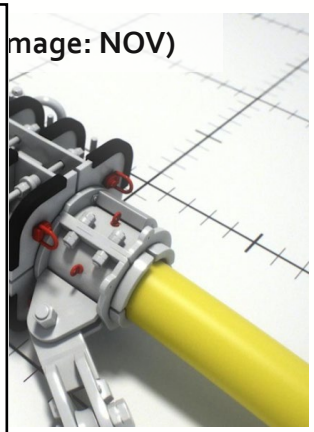
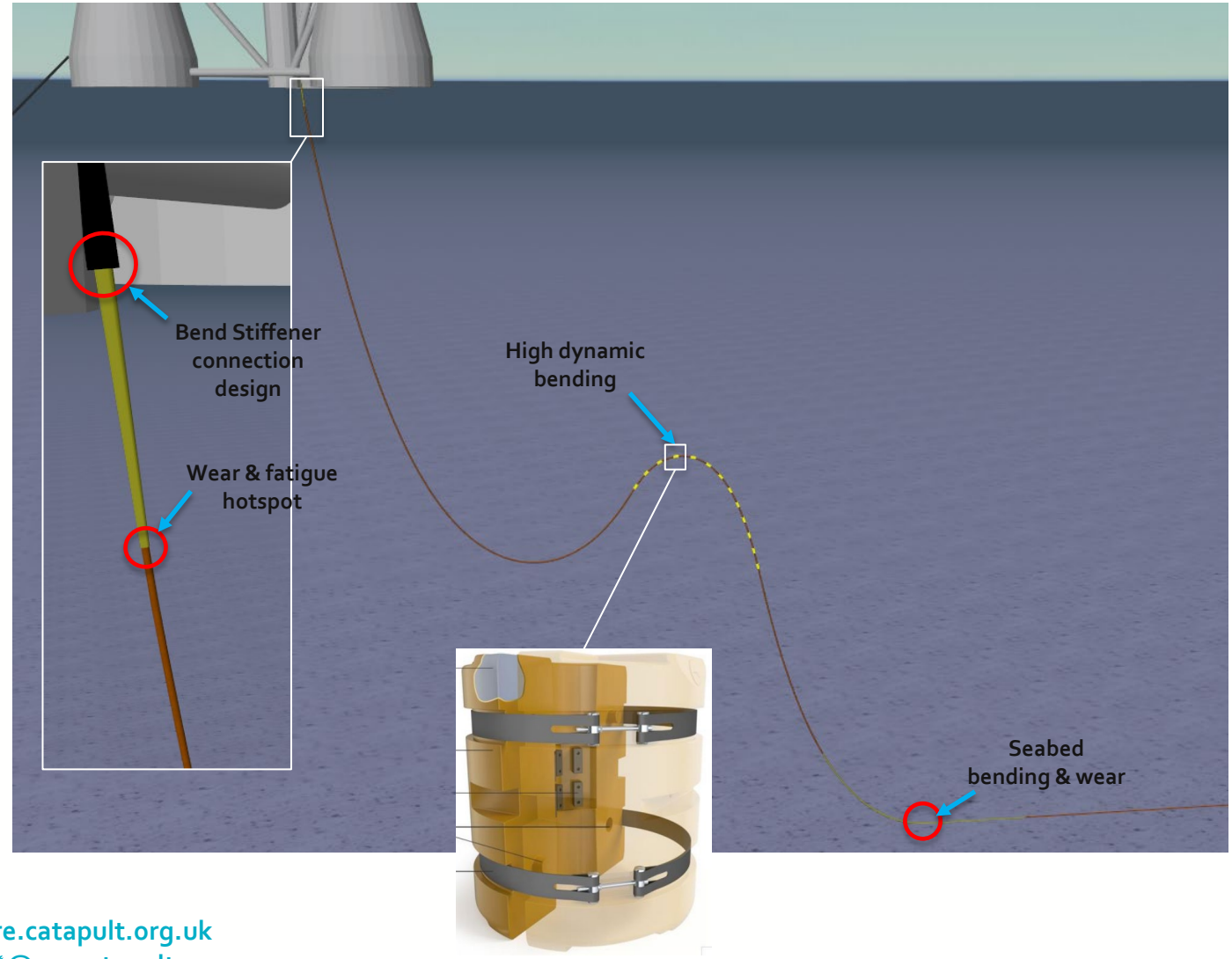
# Dynamic cable lazy wave design

## Final lazy wave design

mage: NOV)

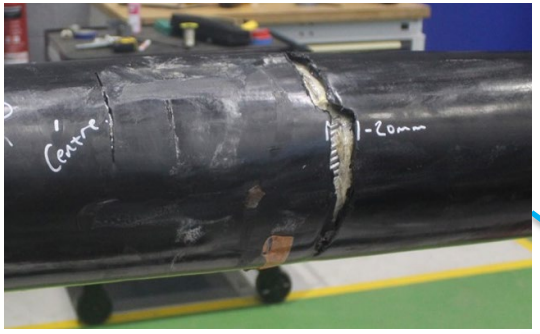


# Dynamic Inter-Array Cables – design for reliability

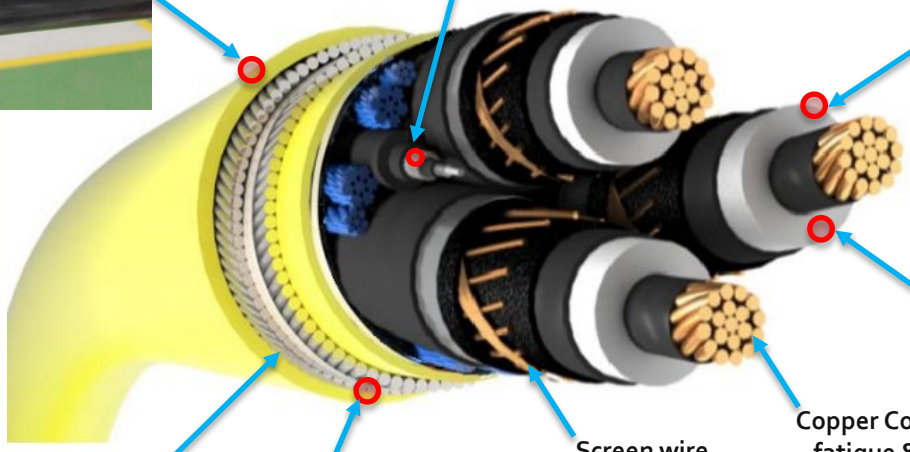


# Real Cable Integrity Problems

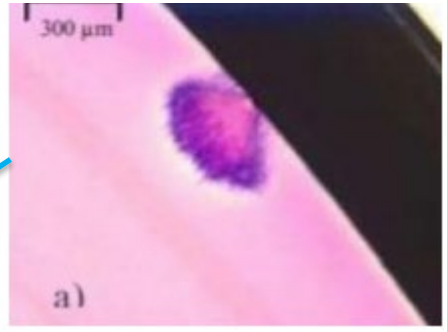
Sheath Damage




Fibre Optic Failure



Insulation water tree growth




Insulation thermal degradation

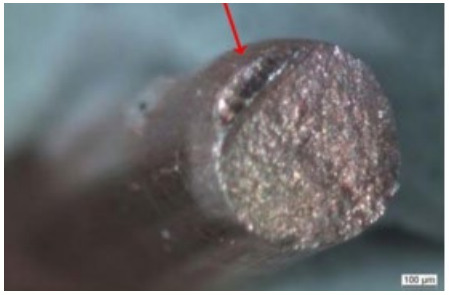
Armour wire impact damage

Armour Wire fatigue & corrosion

Screen wire fatigue & corrosion

Copper Core fatigue & corrosion

Copper wire fatigue



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# Improving Reliability by Lifecycle

## Design

- Strong case for improved component specifications
- Need for feedback from previous integrity issues


## Manufacturing

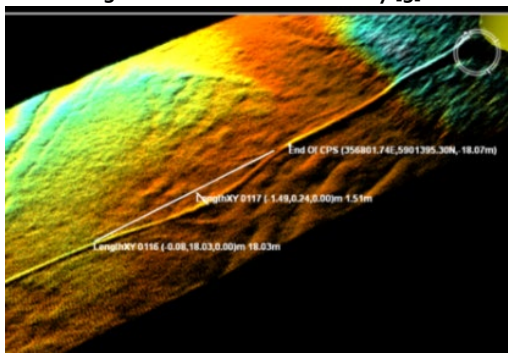
- "Root cause is…poor specifications and acceptance testing" [3]

**Power Cable Manufacturing [7]**

## Installation

- "The current power cables IEC standards do not provide adequate recommendations for after-laying testing…" [6]

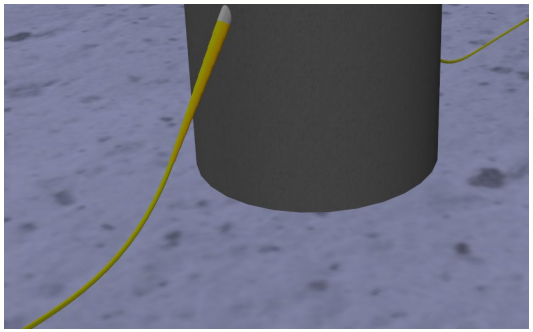
**3D sonar installation survey [5]**



## Operation

- Multiple causes; insulation most sensitive to wear-out
- More failures are likely to come with aging assets

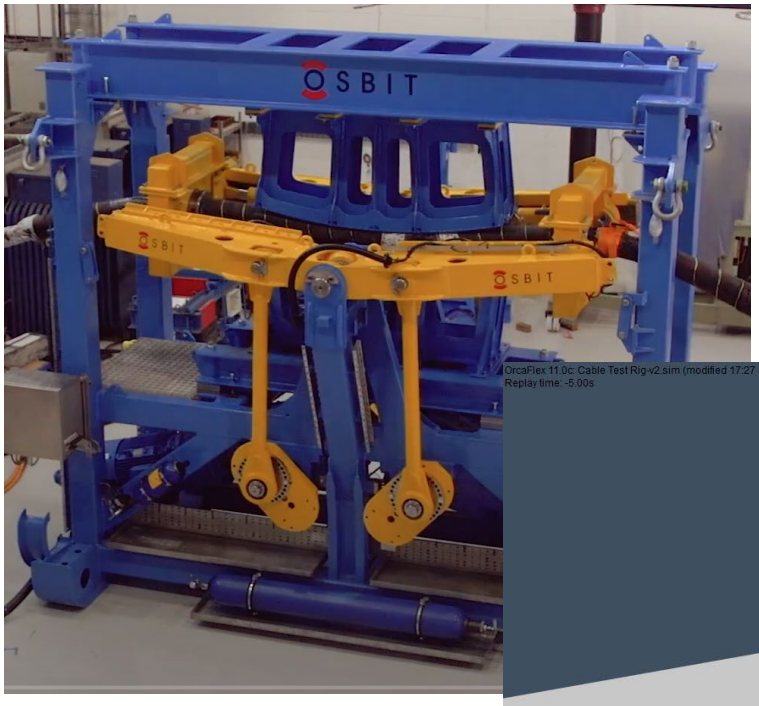
**Cable to structure interface**



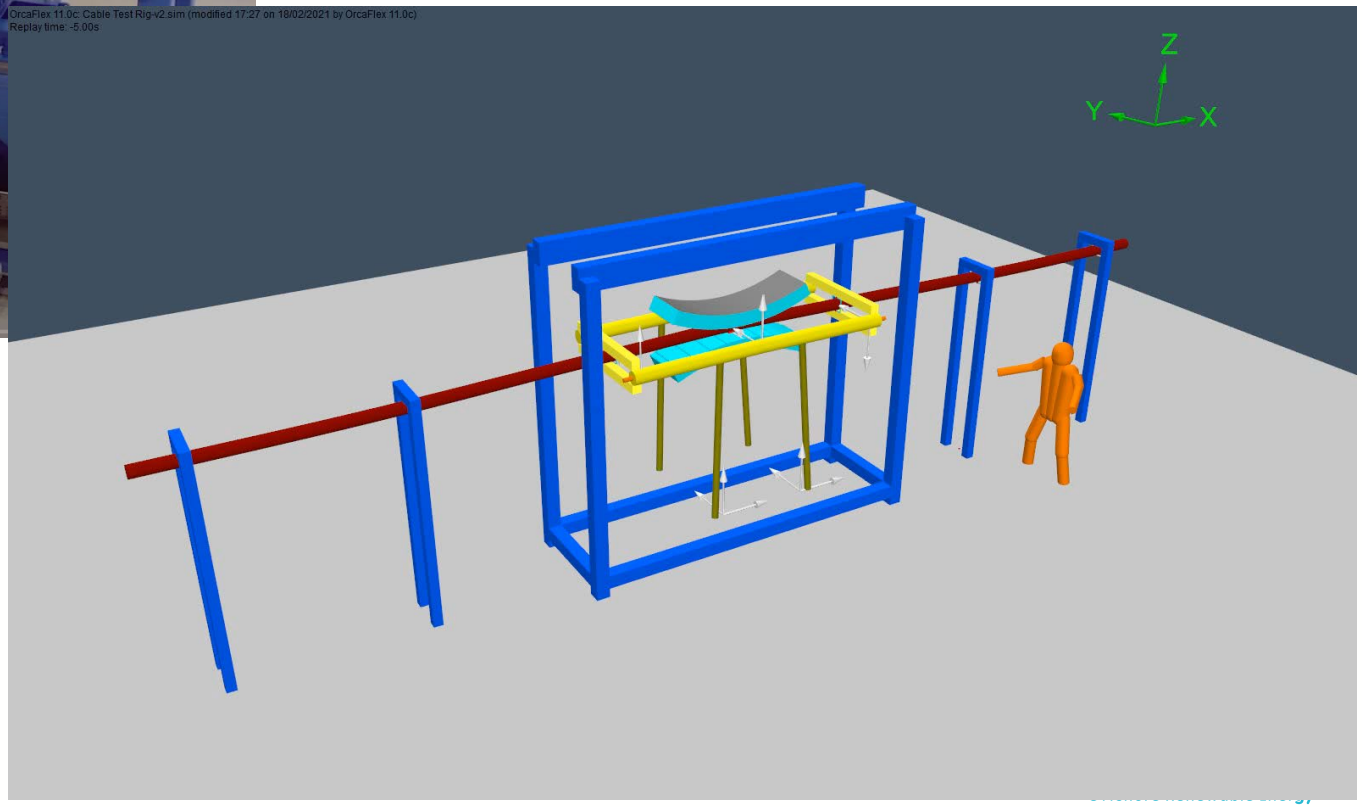
[3] V. Buchholz, "Finding the Root Cause of Power Cable Failures", Electric Energy Online
[4] M. Froese, "How the wind industry is reducing cable failures", Wind Power Engineering, 2018

[5] CodaOctopus, 3D sonar installation survey
[6] Energies article, "On-Site Submarine Cable Testing and Diagnosis with Damped AC", 2019
[7] JDR Cables, "Subsea Power Cables"

# Solution: robust cable testing & qualification

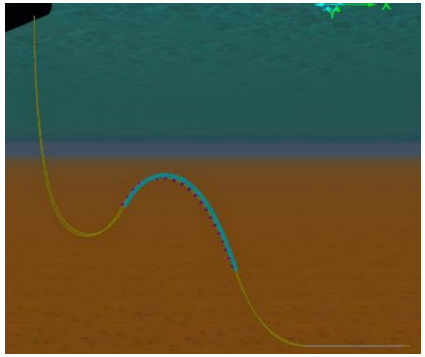


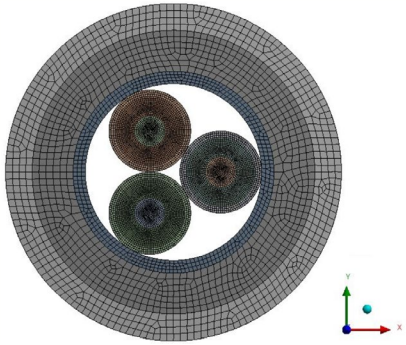

- Demonstrate cable performance at full-scale in a realistic environment

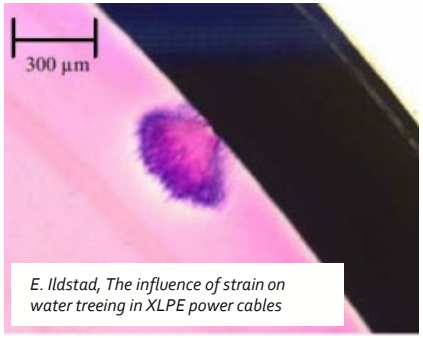


# Solution: cable in-service health monitoring (digital twin)

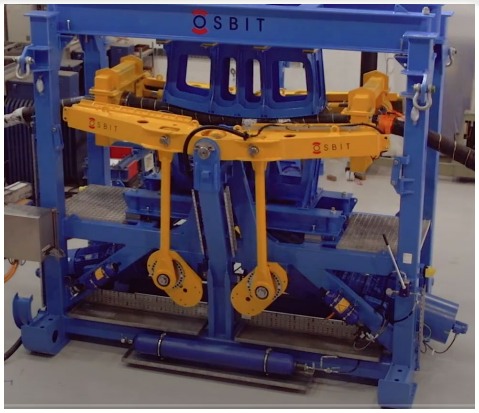
**Model**



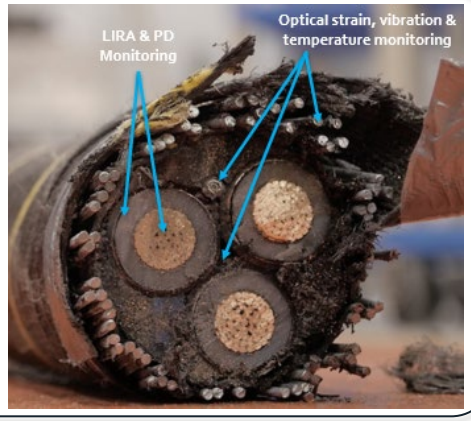





**Test**




**Monitor**




**Digital Twin**

# Floating Wind Failure Scenario – Mooring Failure & Drift-Off