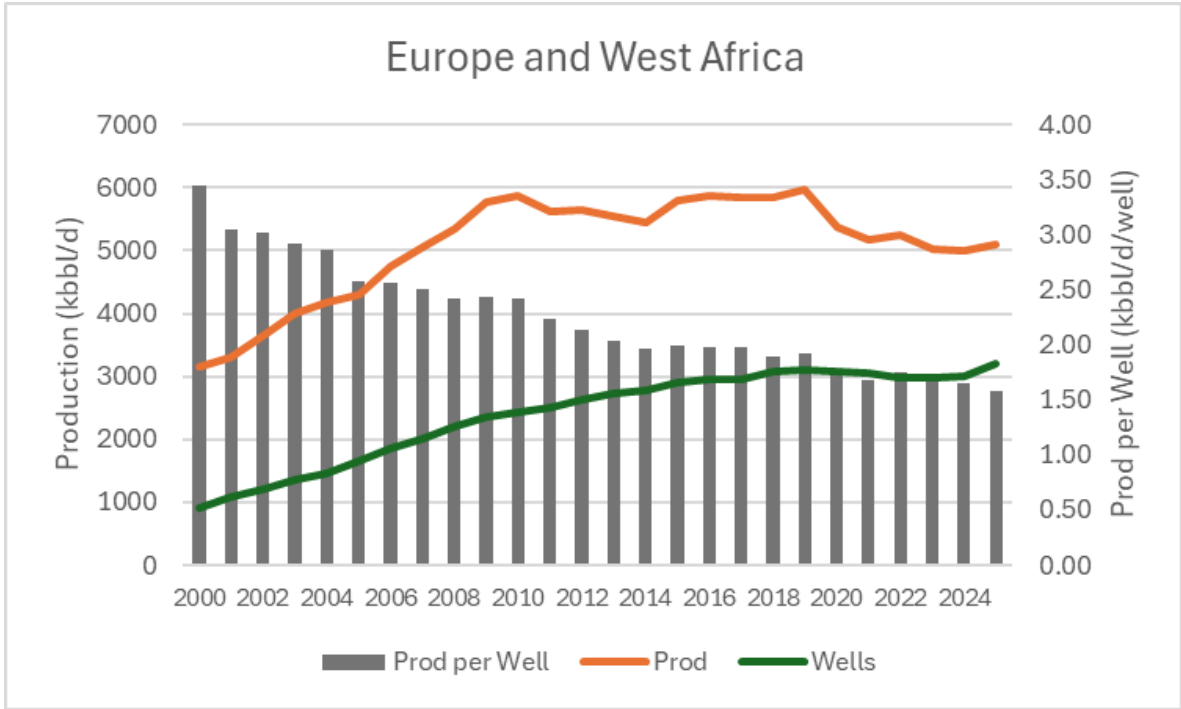
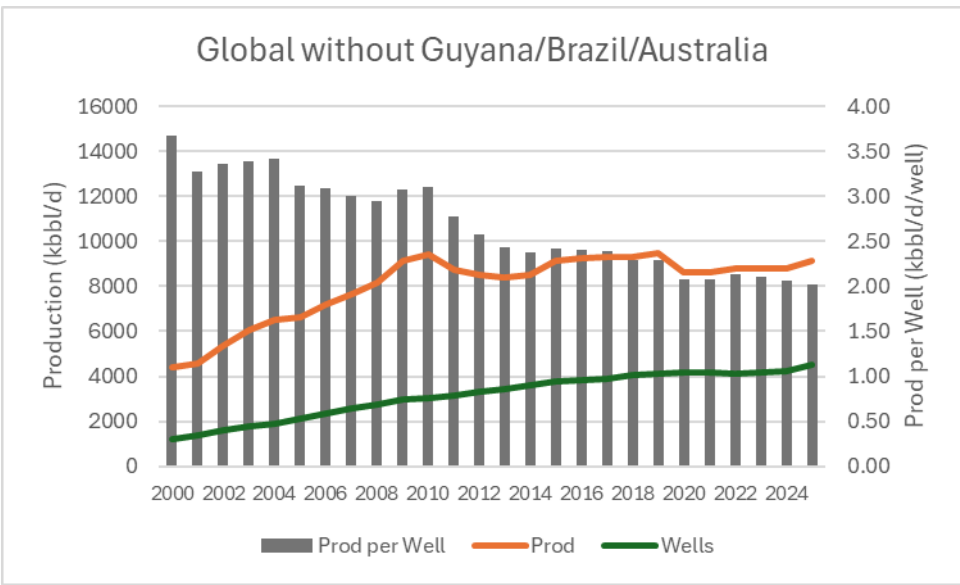
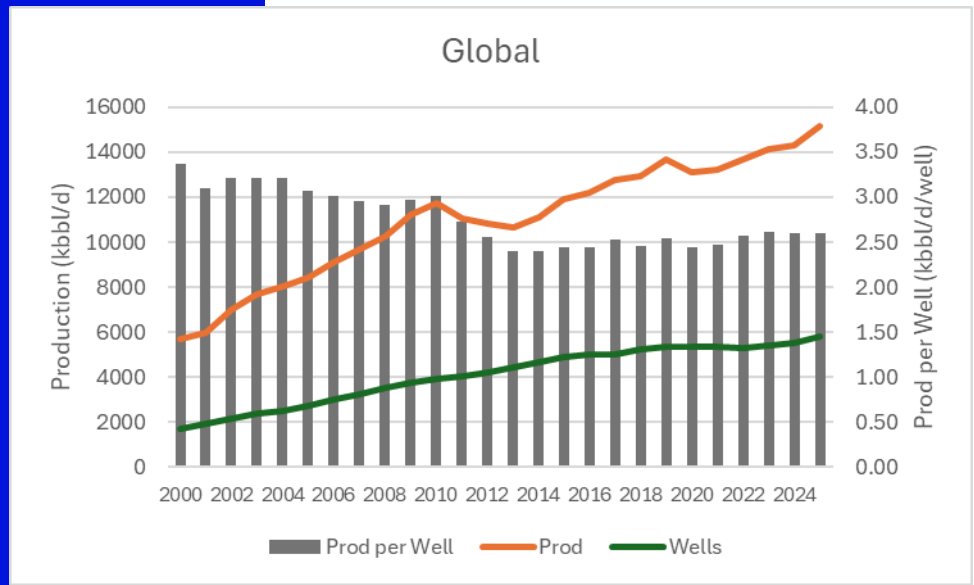


# Step change in Wireline Subsea Intervention Lubricator Performance

Matt Billingham  
SLB Technical Director  
Gregory Orih  
TotalEnergies



# Subsea Production Macro



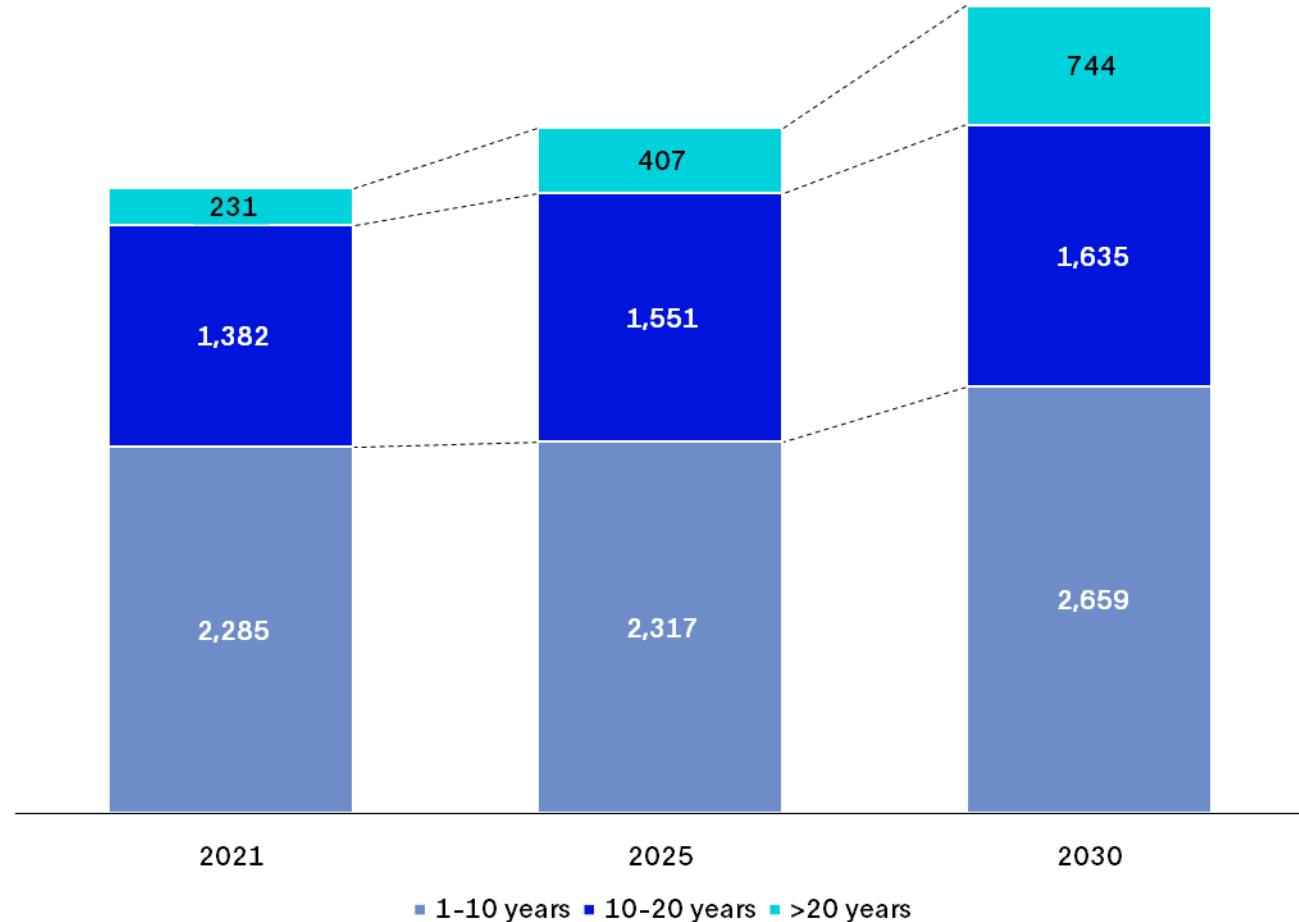
Data Rystad Subsea and Well Cubes, NSTA

# The Need for Subsea Intervention

By 2030 ~48% of the active wells will be more than 10 years old and ~15% more than 20

Subsea intervention is costly (in UKCS in one year 11% of activity but 50% of spend on interventions)

## Subsea wellcount split by well age

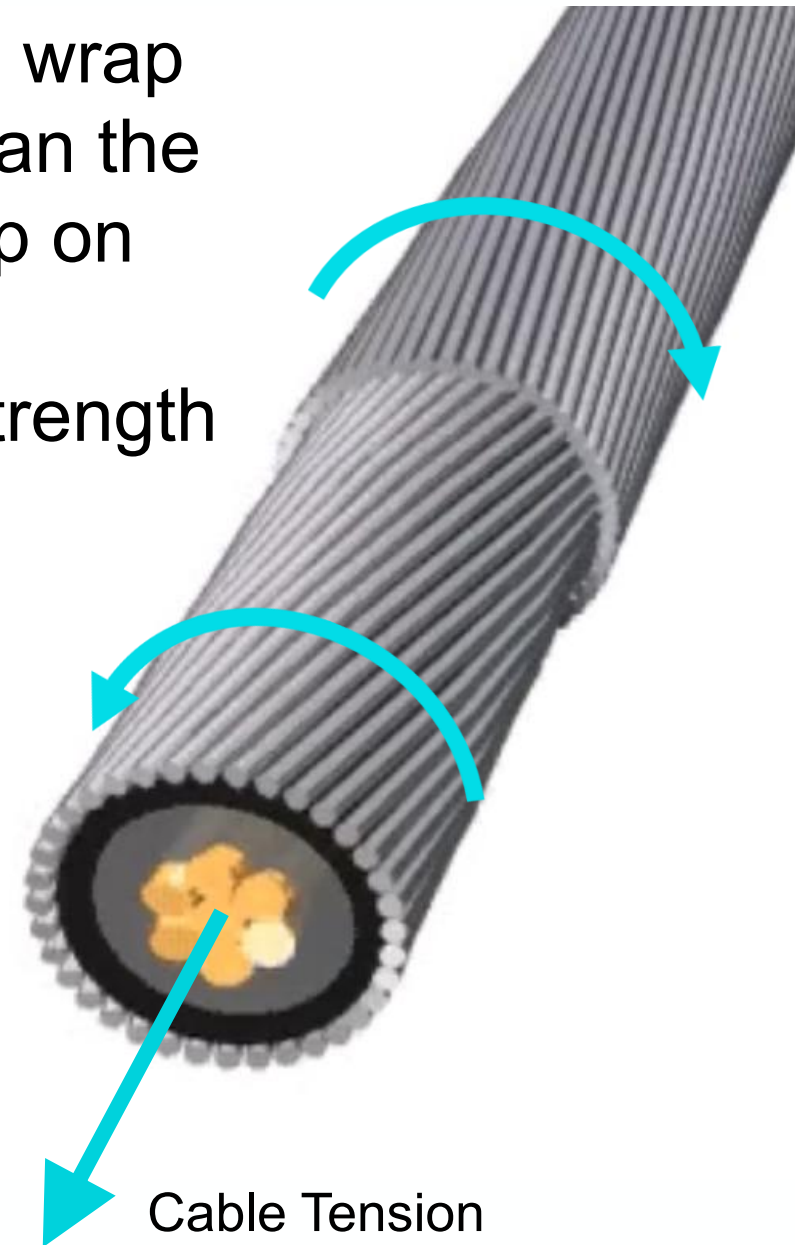


Subsea well – Offshore > 125m depth + Wellhead type: Wet and Producing/under development/to be discovered (future) Source: Rystad March 2025

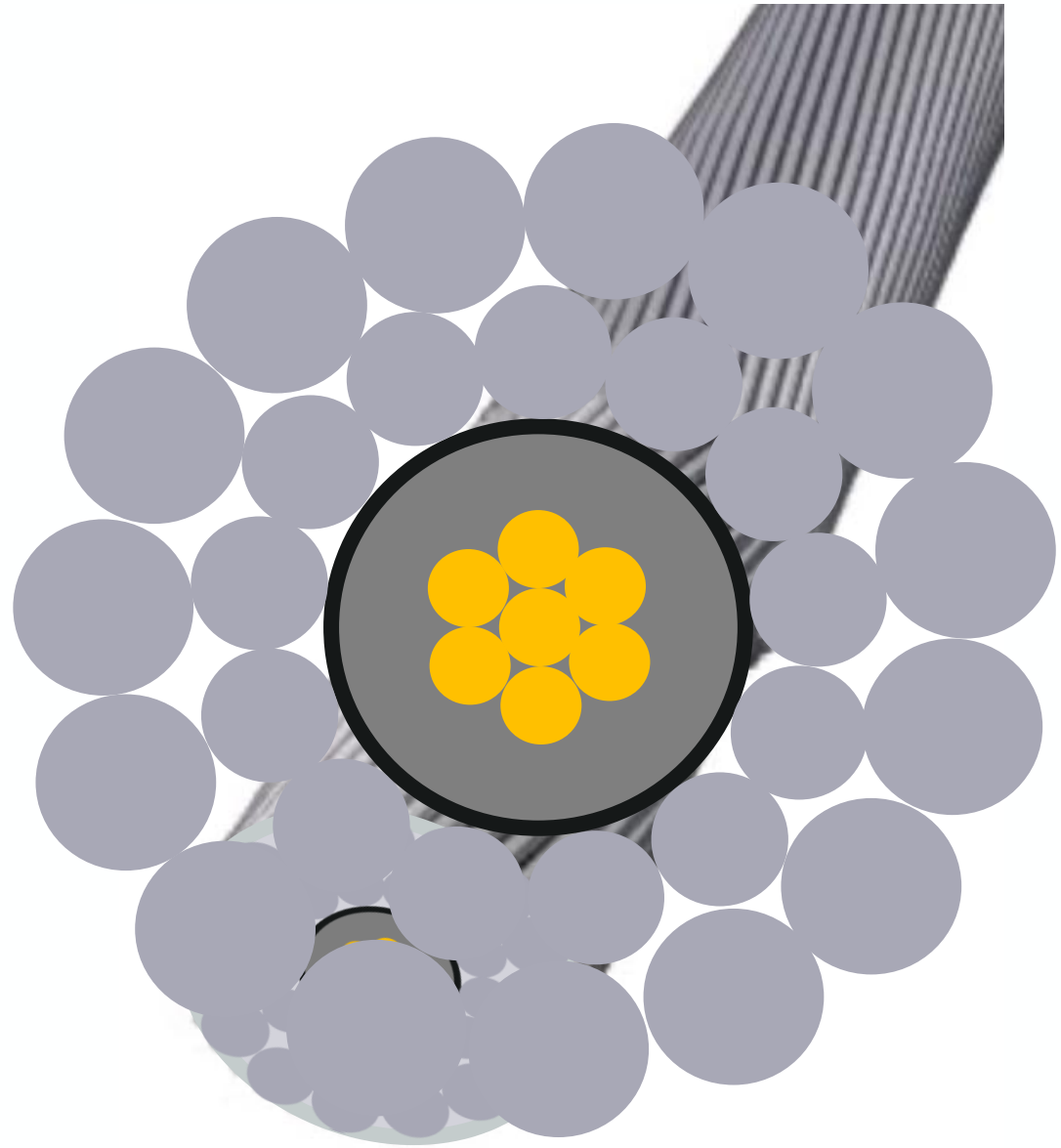
# Conventional Wireline Cable Construction

# Cable Torque: The Good

The opposing wrap directions mean the cable binds up on itself and has mechanical strength

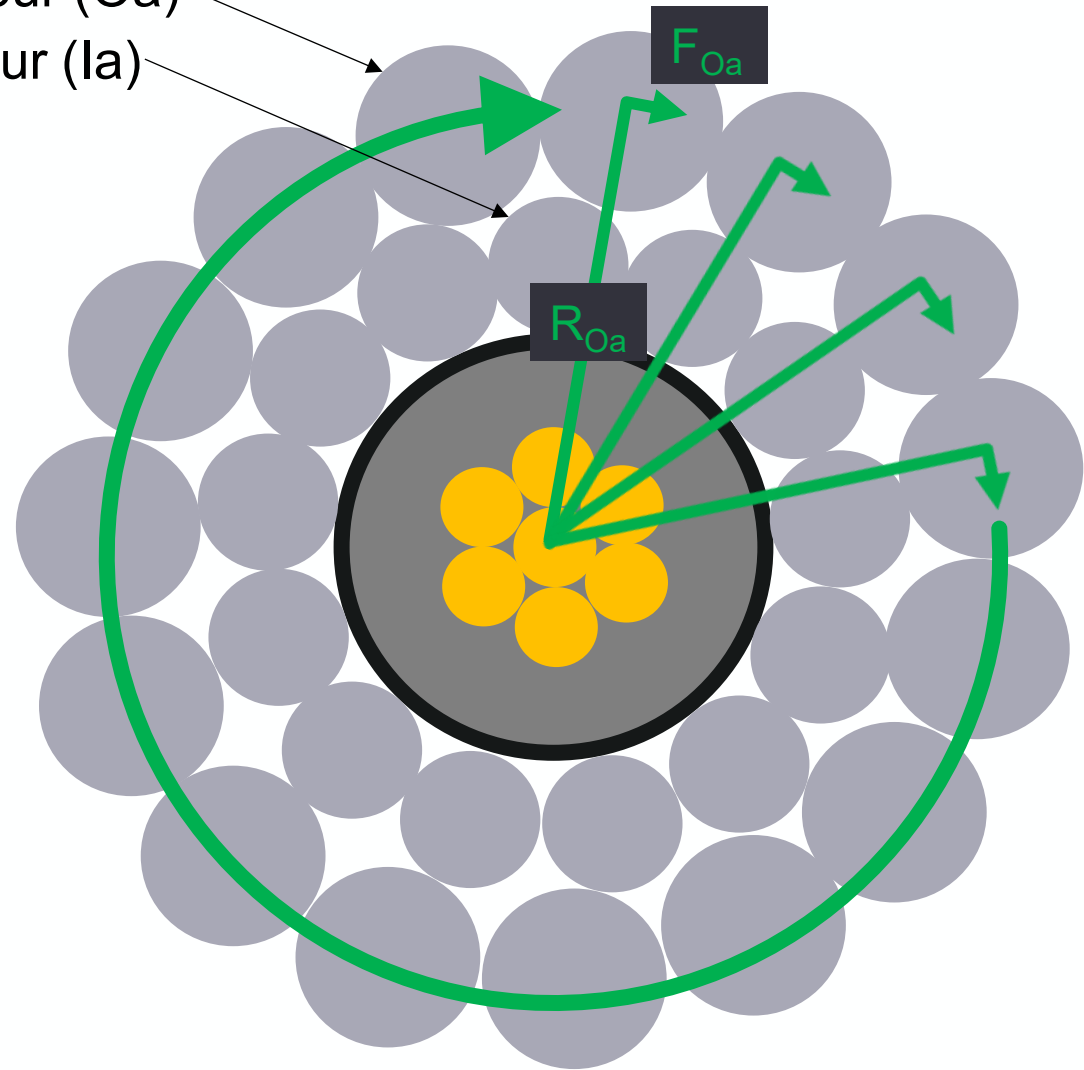


# Cable Torque: The “Not so Good”



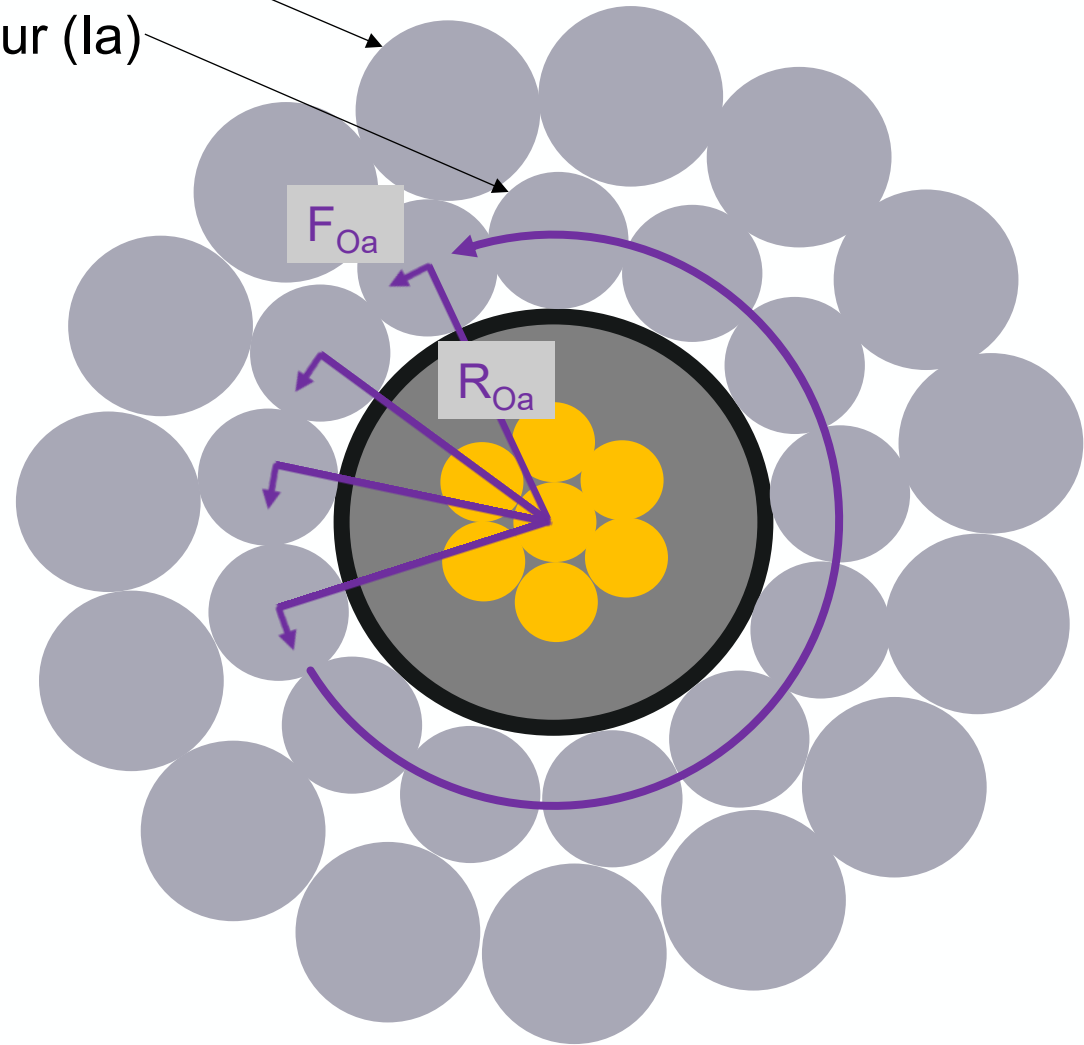
# Cable Torque: The “Not so Good”

Outer Armour (Oa)  
Inner Armour (Ia)



# Cable Torque: The “Not so Good”

Outer Armour (Oa)  
Inner Armour (Ia)





# Cable Torque: The “Not so Good”

Outer Armour Torque

$$T_{Oa} = F_n (F_{Oa} \times R_{Oa})$$

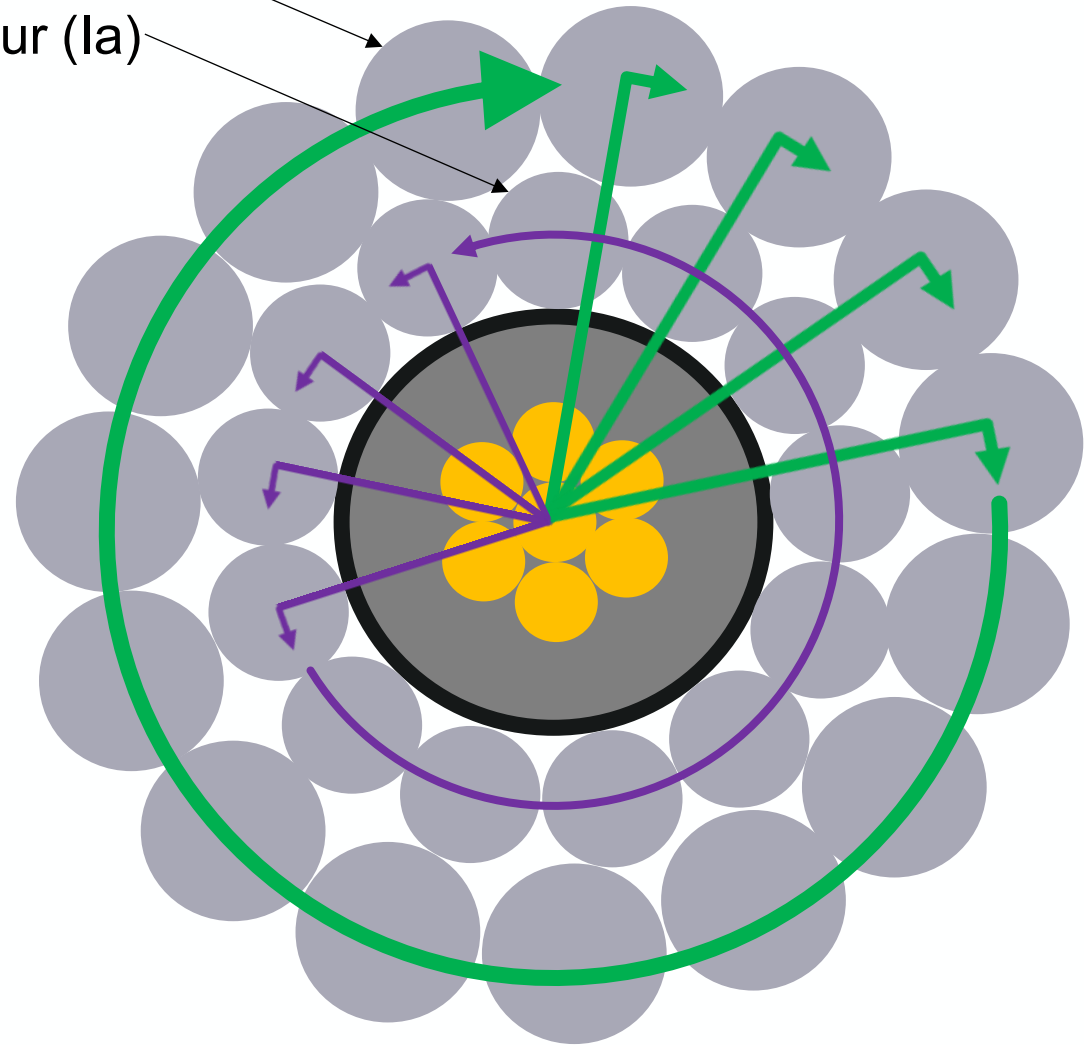
Inner Armour Torque

$$T_{Ia} = F_n (F_{Ia} \times R_{Ia})$$

$$T_{Oa} > T_{Ia} = \text{Unbalanced}$$

Outer Armour (Oa)

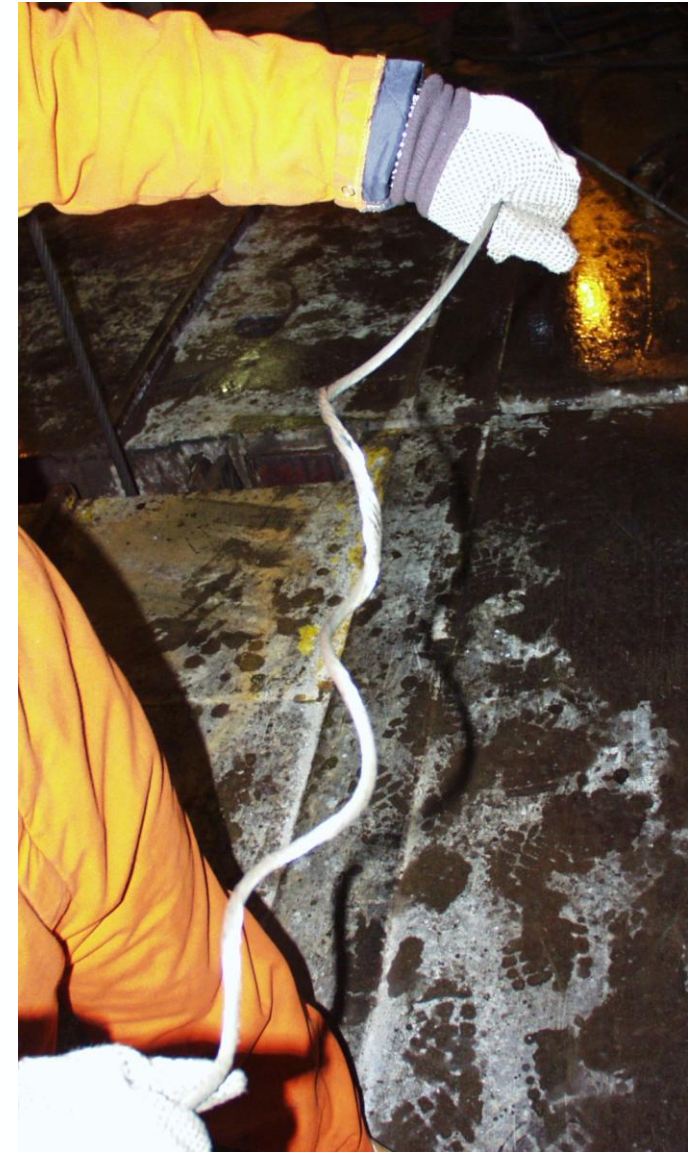
Inner Armour (Ia)



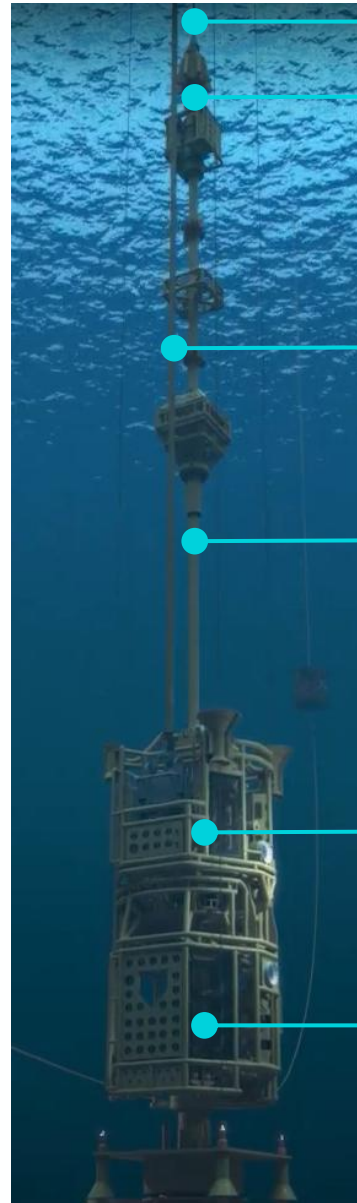
# The Real Consequences of Unbalanced Cable Torque

UK North Sea 2002

Cable cut at seabed  
to recover



# Sealing Against Wirelines in Live Wellbore



Wireline to surface

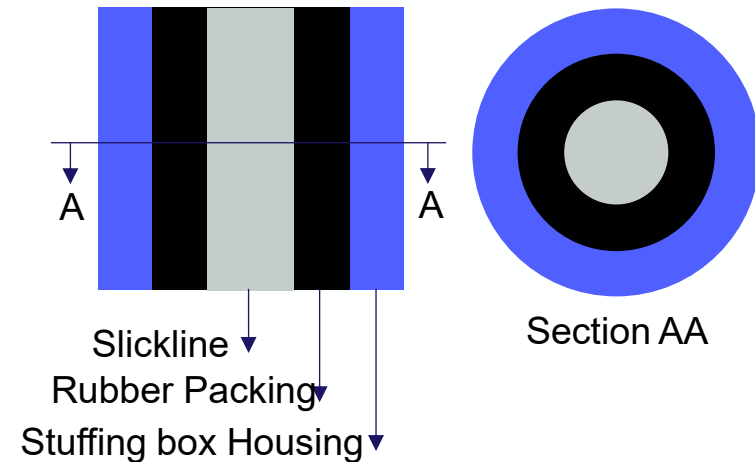
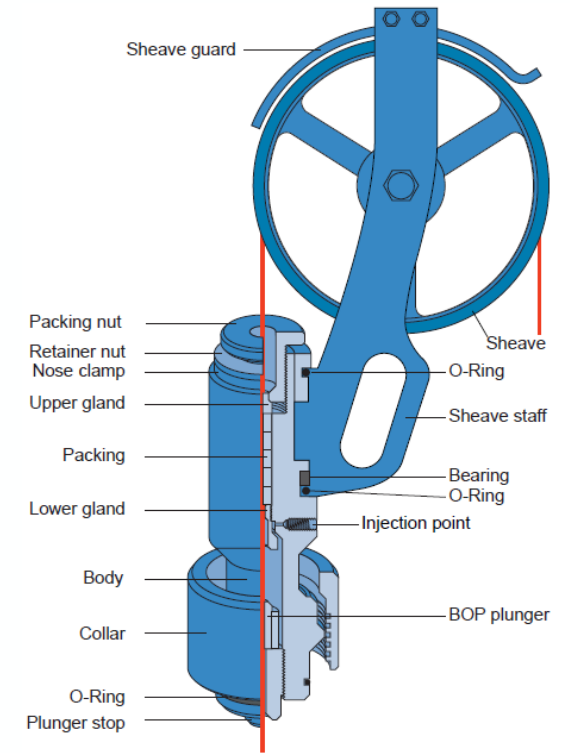
**Seal against wireline from sea hydrostatic and wellbore pressure**

Umbilical from vessel to subsea lubricator

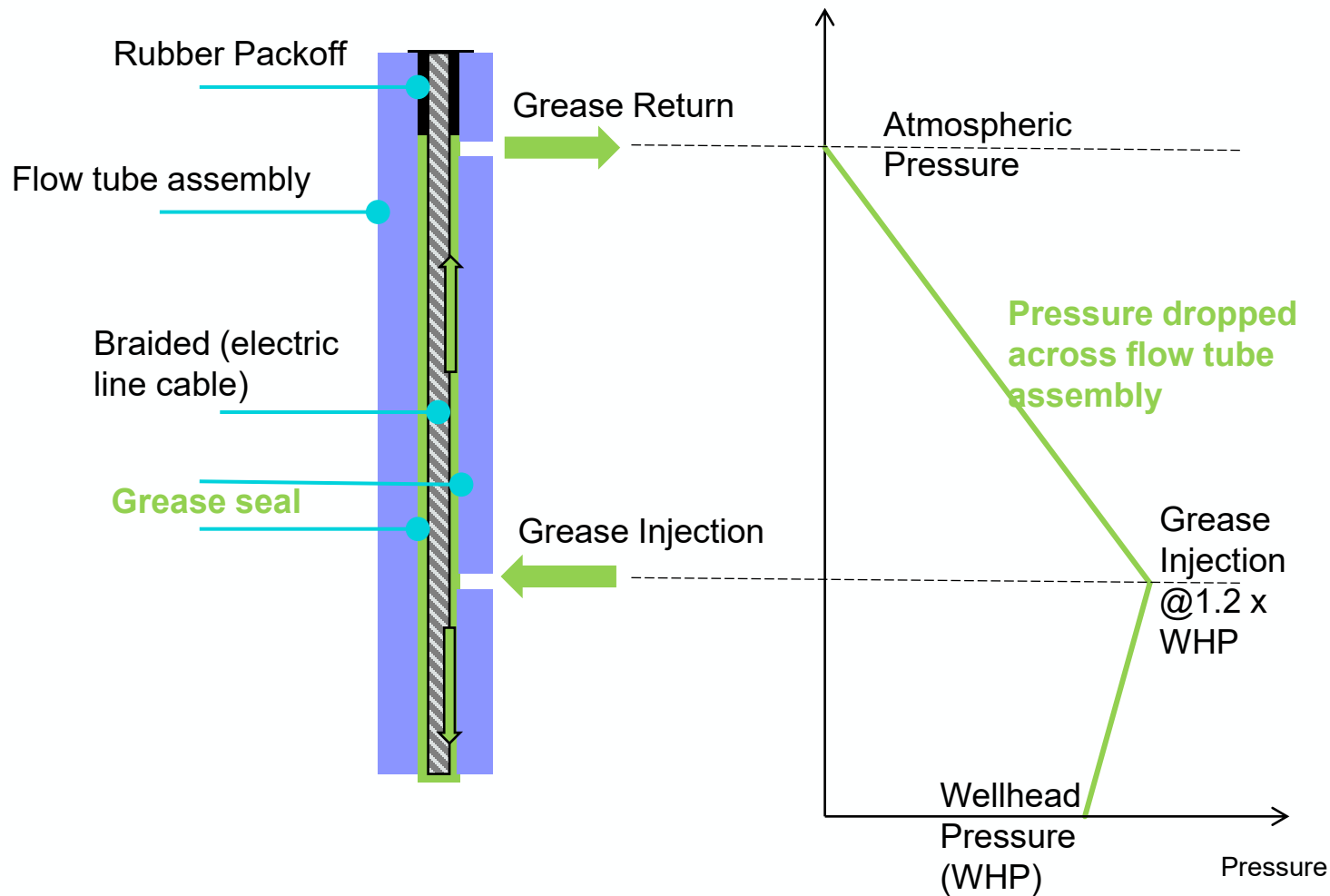
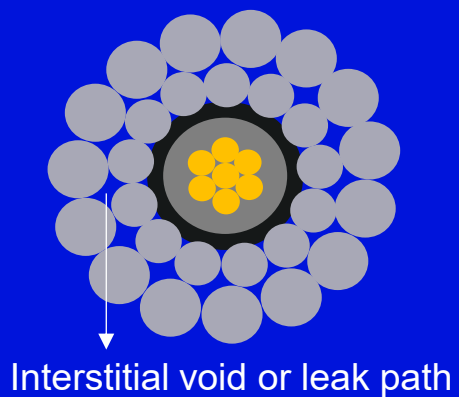
Lubricator (facilitates tool deployment into live well)

Emergency disconnect package

Lower riser package



# Sealing Against Wirelines in Live Wellbore



## COUETTE'S EQUATION

$$P_2 - P_1 = \frac{6 L u Q}{R_c h^3} (\Delta P)$$

- P<sub>2</sub> = grease injection pressure @ flow tube
- P<sub>1</sub> = grease outlet pressure @ flow tube
- L** = Length of flow tube
- u** = grease viscosity
- h = clearance between Flowtube & cable
- R<sub>c</sub> = cable radius
- Q** = quantity of grease injected



# Wireline Grease Supply to Subsea Lubricator



Many variables to control:

- Water depth
- Temperature profile
- Wellhead pressure
- Cable running speed

Surface pumping of wireline grease limited to approx. 600/800m

Deeper requires subsea grease storage with own limitations



Pressure loss pumping along a hose – Darcy Weisbach

$$\Delta P = f \times (L/D) \times (\rho v^2/2)$$

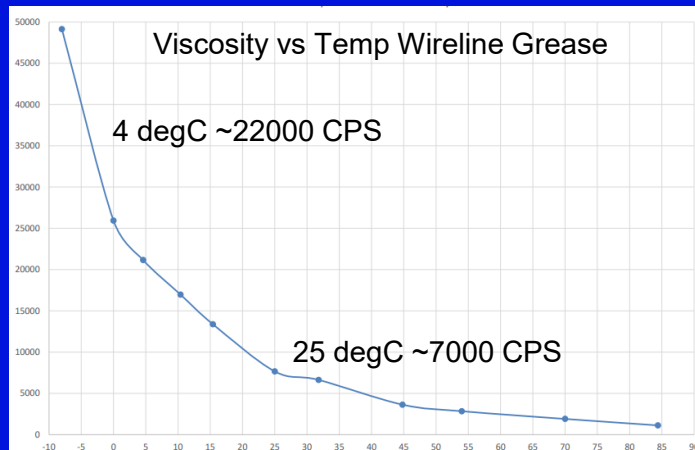
- $\Delta P$  = pressure loss
- $f$  = friction factor (dimensionless) =  $f_n(Re)$
- **L = length of the hose**
- $D$  = internal diameter of the hose
- $\rho$  = fluid density
- $v$  = average fluid velocity

Highly viscous fluid, laminar flow, use Hagen Poiseuille's law

$$\Delta P = 8\mu LQ/\pi R^4$$

- $Q$  = volumetric flow rate
- $R$  = pipe radius (m)
- $\mu$  = dynamic viscosity

A challenge at 2000m+ water depth where considerable length is at low temperatures with a large volume of grease with a high viscosity



# Reducing Risk in Subsea Interventions

**SPE-228275-MS**

**The Evolution of Riserless  
Wireline Subsea Intervention  
in Deepwater Gulf of Mexico,  
Doing More with Less**

S. E. Townsend, J. Duenas,  
and L. W. Ramnath, BP  
America Inc 2025

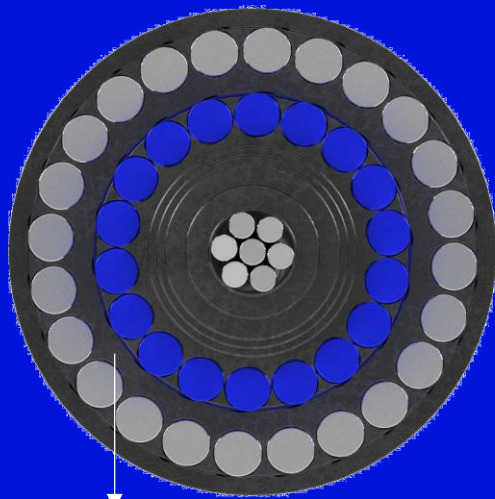
## Key Challenges Observed

1. Loss of grease seal primarily related to grease supply
2. Stranded Wireline



Use of a polymer encapsulated wireline can eliminate need for a grease seal and eliminate stranded wires

# Polymer locked electric line cable technology



NO Interstitial voids or leak paths



Cable armours are locked together with a polymer coating

Brings the following benefits:

- No need for grease injection to seal against well bore pressure
  - Shorter pressure control head
  - Simpler pressure control
- Cable torque eliminated as armours locked together meaning no stranded lines
- Lower friction between cable and wellbore
- Lower weight meaning higher effective pull on BHA

Commercial for many years **but a subsea pressure control device to enable well access had not been developed**

# Subsea Wireline Packoff

## Intensive Field Input to Design

- 12.5kpsi working pressure rating
- Grease injection for pressure control eliminated
- Polymer locked cables only
- Redundant packoffs with 3 total
- Dual ball check valves
- Low friction due to low actuation pressure
- Split packers, inserts, & bushings for quick and easy line redress
- Can be configured with different stabbers/SIL connections

Cable Guide

Line Wiper

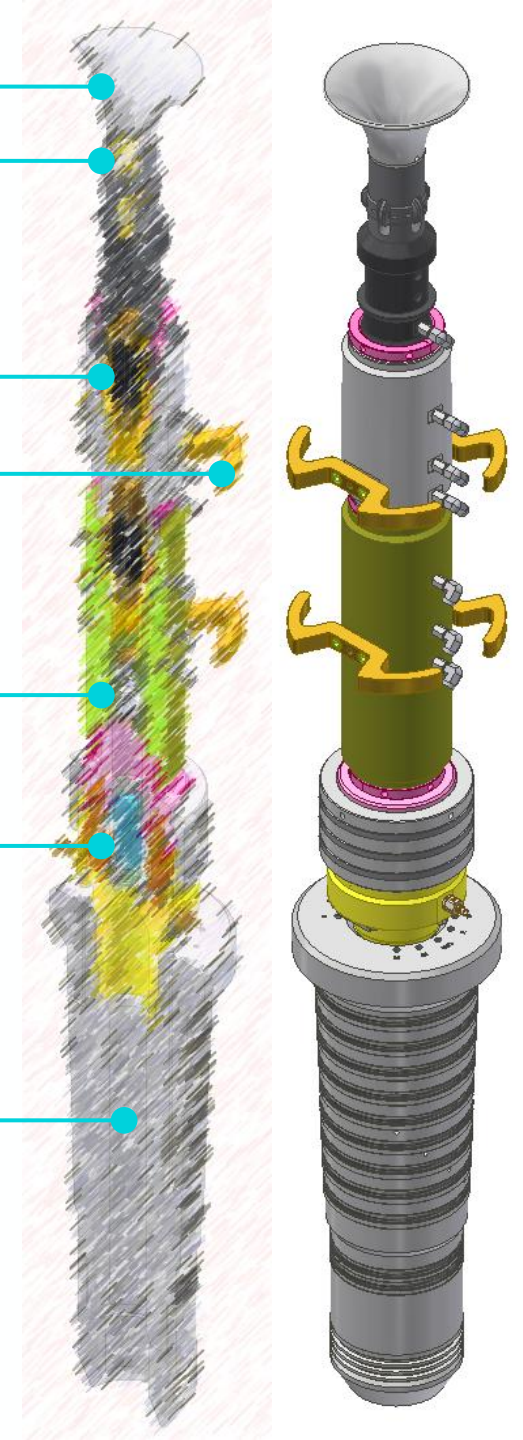
Cable packoffs

ROV Handling Arms

Dual Ball Check Valve

Tool Catcher

Lubricator Stabber



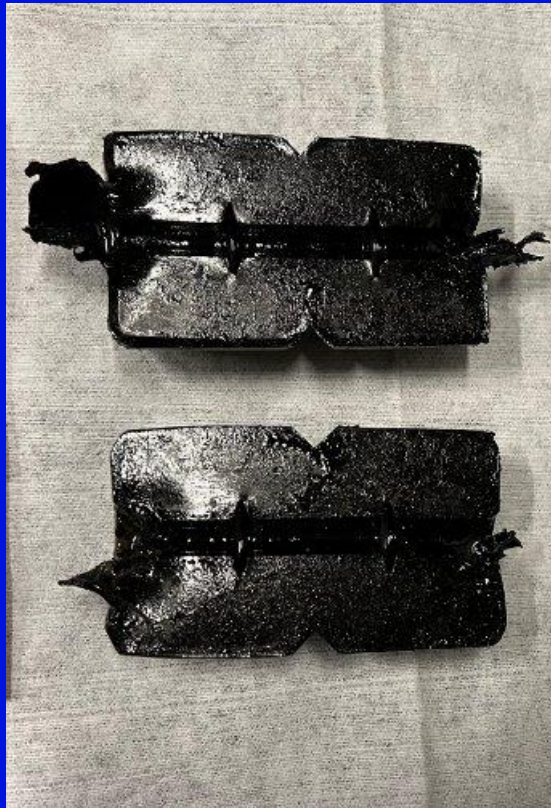


# Engineering Qualification Plan

Huge focus on engineering qualification testing prior to going to field

Guidelines reference including API 16A, API 6A, API17D, API 17G

Look ahead to API 17G4 and API 16B



Photos from pack off testing – 200K ft over wheel at 8000 psi

Qualification Area	Description of Test	Qualification Standard	Status
Spanning clamps/welds	Static fracture/tensile test	API 16A, Sec 4.7.2	Complete
New design temperature	Low temperature test	API 16A, Sec 4.7.2 API 17G, Annex H	Complete
New design temperature	Continuous high temperature test	API 16A, Sec 4.7.2	Complete
Fatigue test	Fatigue test	API 16A, Sec 4.7.2 API 17G, Annex H	Complete
Hypertek testing	Hypertek test	API 17G, Annex H	Complete
Tool joint evaluation	Tool joint evaluation test	SLS 160V	Complete
Tool joint evaluation	Tool joint evaluation test	SLS 160V	Complete
Stalling box/packer string	Friction test	SLS 160V	Complete
Cumulative torque	Free and Rotation Test	ENP	Complete
Ball Check Valve qualification	Internal and external pressure testing	API 6A, Sec 1.1	Complete
Gas holding capacity	Static gas test	SLS 160V	Complete
New design temperature	Extreme high temperature	API 16A, Sec 4.7.2	Complete
Aluminum Assembly	Fracture Test		Complete
Cable storage by packer/bushings	Cable pull/abandon	SLS 160V	Complete
Calibration line	Tool joint evaluation on the line	SLS 160V	Complete
Pressure integrity	System integrity test	SLS 160V	Complete
Dynamic testing of packer	Stalling box/dynamic test	SLS 160V	Complete

## FIELD EXPERIENCE

# Riser-Less Light Well Intervention 2025

Objective: Acquire Wellbore Acoustic and Temperature Data for Well Integrity Assessment



### Success Factors

- Effective **collaboration** between TotalEnergies, SLB & field teams.
- Extensive **pre-job planning**, preparation covering; **risk assessment**, training, execution monitoring, and post job analysis.
- Equipment **inspected** after every run – minimal pack-off wear observed.
- Deployment and operational **lessons learned**.

### Operations Overview:

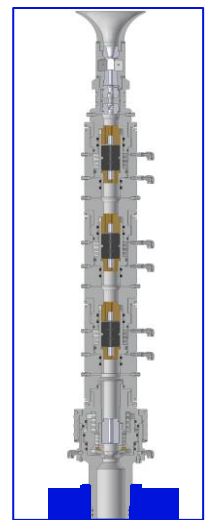
- Deployed via LWI vessel in a riser-less configuration
- 1st operation: WD = 112m, TH = 136mMD
  - Planned in a low-risk well context.
  - 1st deployment: Camera investigation at HXT (LCP in place)
- 2nd operation: THP of 850 psi; WD = 112m , MD ~3350m
  - 1st deployment: Multi-finger caliper and corrosion survey
  - 2<sup>nd</sup> deployment: Noise survey
- Dual pack-off configuration on both operations.



Successfully deployed in 2 x wells

# Greaseless Wireline Subsea Intervention System

- Subsea pressure control packoff
- Enables polymer locked cable operations on riserless light well intervention vessels

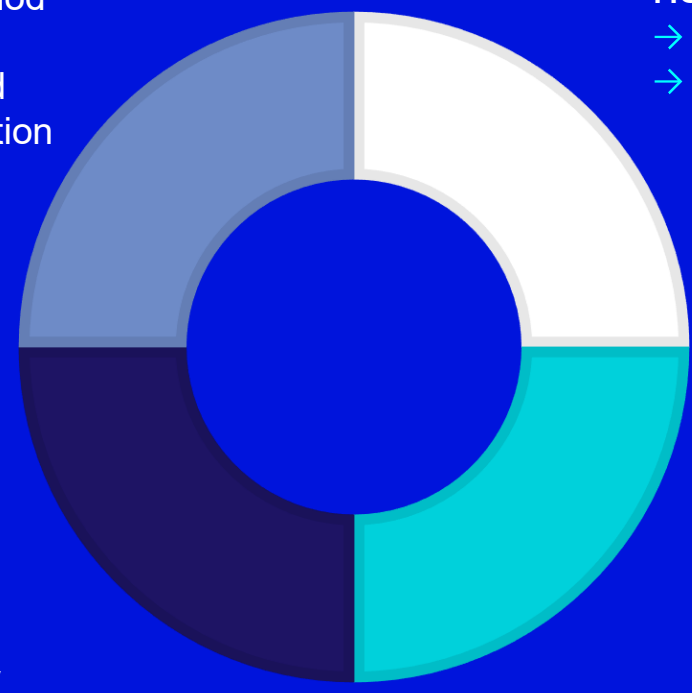


- ### Efficiency increase
- Single conveyance method
  - Avoid grease tank refill
  - Increased tripping speed
    - 40% friction reduction

- ### Operational flexibility
- Agnostic connection
  - Single conveyance unit
  - Reduced crew size
  - Greater depth capability

- ### Reduced operational risk
- Eliminate stranded armor
  - Reduced risk of pressure leaks

- ### Environmental stewardship
- No grease injection
  - Overall lowered CO2 emissions with interventions



**12,500psi**  
pressure rating

**-50%**  
footprint reduction  
(single winch)

**+50%**  
CO2e reduction  
LWIV vs MODU

Thank you to TotalEnergies, SLB  
and Helix for enabling these first  
field tests



# Questions?

