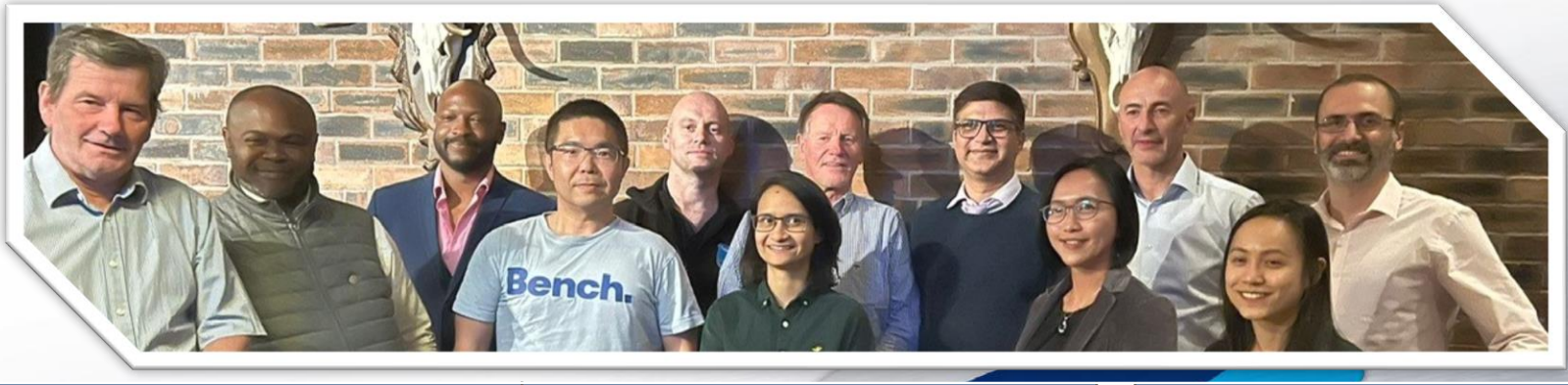
ICorr Aberdeen Technical Event

February 2024

2023 - 2024 Aberdeen Branch Committee



Branch Position	Committee member	Branch Position	Committee member
Branch Chairman	Adesiji Anjorin	Event Co-Ordinator	Eilidh MacDonald
Vice-Chair	Mei Ling Cheah	University Liaison / CPD Officer	Leela Ramachandran
Secretary - External	Dr. Nigel Owen	Website Officer	Dr. Yunnan Gao [National Vic President]
Secretary - Internal	Lian Ling Beh	YEP Case Study coordinators	Dr. Steve Paterson
Financial Officer	Dr. Bryn Roberts	Committee Members - Observer	Stephen Tate [National President]
Sponsorship Officer	Dr. Olubayo Latinwo	Committee Member	Stephanie Okoye

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- Presserv Ltd
- R&R Corrosion Ltd
- Rysco International Ltd
- Sonomatic Limited

252 ICORR MEMBERS HAVE ELECTED TO BE AFFILIATED TO THE ABERDEEN BRANCH

2023-2024 Branch Programme

INSTITUTE OF CORROSION

Date	Event Type	Topics	Time	Location
Tuesday 22/08/2023	Full Day Event	**2023 Annual Corrosion Awareness Day: Introduction to Corrosion** **Speakers:** Various / **Host:** *Rysco Corrosion UK Ltd*	All day	Rysco Corrosion Ltd, Bridge of Don, Aberdeen
Tuesday 26/09/2023	Joint Meeting with TWI	**Effect of Microstructure on the Localised Corrosion and Atmospheric Stress Corrosion Cracking of 15-5PH Stainless Steel.** **Speaker:** Alyshia Keogh *[University of Manchester]*	18:00	Online [Zoom] Event
Wednesday 04 – Thursday 05 /10/2023	Conference & Exhibition	**Floating Offshore Wind Expo 2023**	All day	TECA Aberdeen
Tuesday 31/10/2023	ICorr Technical Event	**Routine Monitoring to combat Microbiological Issues in Oilfield Process Systems – Understand the Option for Better Visibility.** **Speaker:** Heike Hoffman *[Intertek]*	18:00	Palm Court Hotel, Aberdeen
Saturday 18/11/2023	Dinner	**TWI End-of-Year Dinner**	18:00	Aberdeen Altens Hotel, Aberdeen
Tuesday 28/11/2023	ICorr Joint Meeting with the IoM3/MIS	**Electo-Chemical Noise as a means of monitoring / assessing organic coatings, along with the advances made to date** **Speakers:** Tianyang Lan & Dr. Douglas Mills *[University of Northampton]*	18:00	Online [Zoom] Event
Wednesday 20/12/2023	ICorr Joint Meeting with IMechE (Hosts)	**The wise use of Hydrogen in the UK** **Speaker:** Tom Baxter, FIChemE	18:00	The Sandman Hotel, Aberdeen
Tuesday 30/01/2024	ICorr Joint Meeting with the EI	**Applying materials experience from oil and gas production to carbon capture and storage in North East Scotland** **Speaker:** Dr. Steve Paterson *[Arbeadie Consultants Ltd]*	18:00	Palm Court Hotel, Aberdeen
Tuesday 27/02/2024	ICorr Technical Event	**Predictable pipeline performance with polymer liners.** **Speaker:** Mark Smithson *[Subsea7]*	18:00	Palm Court Hotel, Aberdeen
Tuesday 26/03/2024	ICorr Technical Event	**Advances in Comprehensive Integrity Assessment of Buried Pipelines with Non-Contact Magnetic Gradient Tomography Method (MTM-G).** **Speaker:** Dr.Candidus Chukwuma Onuoha *[Canchuks Corrosion Inc., Canada]*	18:00	Online [Zoom] Event

Latest details of ABZ branch events can be found on the ICorr Website: https://www.icorr.org/events/category/aberdeen-branch/list/

2023-2024 Branch Programme

Date	Event Type	Topic (s)	Time	Location
Tuesday 30/04/2024	Joint Meeting with MCF	**Marine and Corrosion Forum – Various Topics**	18:00	In Person Palm Court Hotel Aberdeen
Tuesday ~~30/04/2024~~ **Rescheduled to 23/04/2024**	ICorr Event	**INDUSTRIAL VISIT: NCIMB**	18:00	In Person NCIMB, Wellheads Pl, Dyce, Aberdeen AB21 7GB,
Monday 13/05/2024 to Friday 17/05/2024	Joint with MCF (Lunchtime Events)	**ICorr Aberdeen / MCF Webinar week**	12:00 - 1300	MS Teams Event Registration via MCF website.
Tuesday 28/05/2024	Joint Meeting with AMPP	**Proportional hazard values for different pipeline coating types, used over the timeline from 1900s till now.** **Speaker**: Susan Jacob *[OneGas]*	18:00	Online [Zoom] Event
Tuesday 25/06/2024	ICORR Technical Event + AGM	**Metallographic Replication of In-Service Plant.** **Speakers**: Peter Beck & Simon Fenton *[IRIS NDT]*	18:00	Online [Zoom] Events
Tuesday 27/08/2024	ICorr Aberdeen 2024 Corrosion Awareness Day	**2024 Corrosion Awareness Day: Annual Corrosion Forum** **Theme: Integrity Management** The list of speakers and topics will be announced closer to date.	All day event	In Person Palm Court Hotel Aberdeen AB15 7YX

Call for speakers for technical session 2024/2025

- Keep an eye for the announcement.
- Please get on the ICorr Aberdeen branch website or email icorrabz@gmail.com for more details.

ICorr Aberdeen February 2024 Technical Presentation

Our speaker for Today is:

Mark Smithson BEng

- Senior Development Engineer, Internal Corrosion Management team, Subsea7 pipeline products.
- Bachelor of Engineering, Mechanical Engineering with Industrial Management, Liverpool University.
- Works with Subsea7's polymer-lined pipe development and execution team; responsible for increasing the qualification limits for the Linerbridge connector; he currently holds two patents relating to polymer liner developments [with a further application pending].
- Previously worked for Artis [an independent polymer consultancy].

"Predictable Pipeline Performance using polymer liners"

2024

Agenda

- Introduction and Background
  - The Industry Challenge
  - The Solution - Swagelining® Products
  - The Value of Swagelining® Products
- The Swagelining® Process
- The Connector Solutions
  - Reducing Pipeline Build Complexity
- Dynamic Applications
- Swagelining® Products - A Global Solution
- Lined Spool Assessment
- Track Record
- What's Next?

The Industry Challenge - Internal Pipeline Corrosion

Reduced pipeline performance due to internal corrosion leads to –

- A reduction in field output.
- An increase in maintenance activities.
- Increased downtime risk – non-productive time.

All of the above mean - ***reduced production = lost revenue***.

Furthermore, corrosion ultimately leads to ***pipeline failure.***

Typical life expectancy of an unlined water injection pipeline - ***7yrs*.***

Estimated global cost of pipeline corrosion is ***$2.5 trillion*.***

Appropriate corrosion mitigation methods, could save industry ***35%*.***

The Solution - Swagelining® Products

Product Vision - To be the market leader of products which maximise pipeline performance and exceed our clients' expectations

Product Mission - Our mission is to engineer cost effective, sustainable, pipeline corrosion management products for new and existing global energy applications

Why Swagelining® Products? - The Value Proposition

- Simplification of onshore and offshore operations
- Greater service life assurance
- Predictable pipeline performance
- Reduced pipeline weight
- Potential for reduction in TotEx costs
- Increased process uptime
- Improved sustainability

Also, Swagelining® products can offer a reduced ***carbon footprint*** when compared to some competing technologies*

Swagelining® Products – Swagelining® Process - Animation

www.subsea7.com

Swagelining® Products - The Connector Solutions

LinerBridge® - (TRL 7)
Polymer connector for pipe to pipe tie-ins, cut-to-length and abandonment and recovery operations

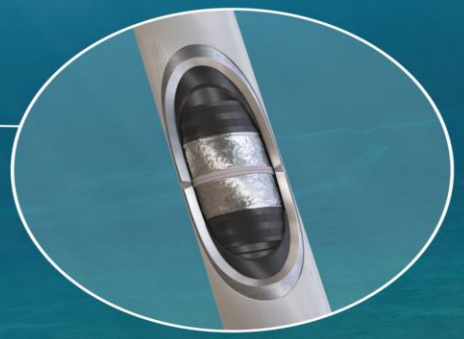
WeldLink® - (TRL 7)
Corrosion resistant alloy mechanical connector for pipe tie-ins and liner termination operations

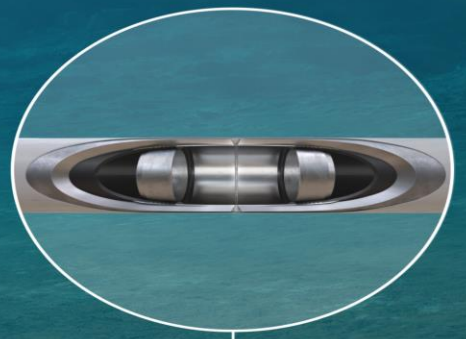
Swagelining® Products – Dynamic Applications

- Developed to address the specific challenges associated with dynamic applications
- DNV Technology Certification – TRL5
- First commercial project use – Q1 2022
- Reduced weight than conventional carbon steel (with CA) and MLP riser solutions

Tie-in to topside using WeldLink® to Stress of Flex joint

Mid-line connections made by WeldLink® or LinerBridge®





Sea-bed connection to flowline or inline structure made via WeldLink®

Swagelining® products are suitable for deep-water applications (1500m+)

Swagelining® Products – A Global Solution

Swagelining® Products - Deployed globally via reeled and towed Bundle pipelay methods

Vigra Spoolbase, Norway

Ingleside Spoolbase, GoM

Wick Fabrication Site, UK

Ubu Spoolbase, Brazil

North sea project experience – Lined spool assessment

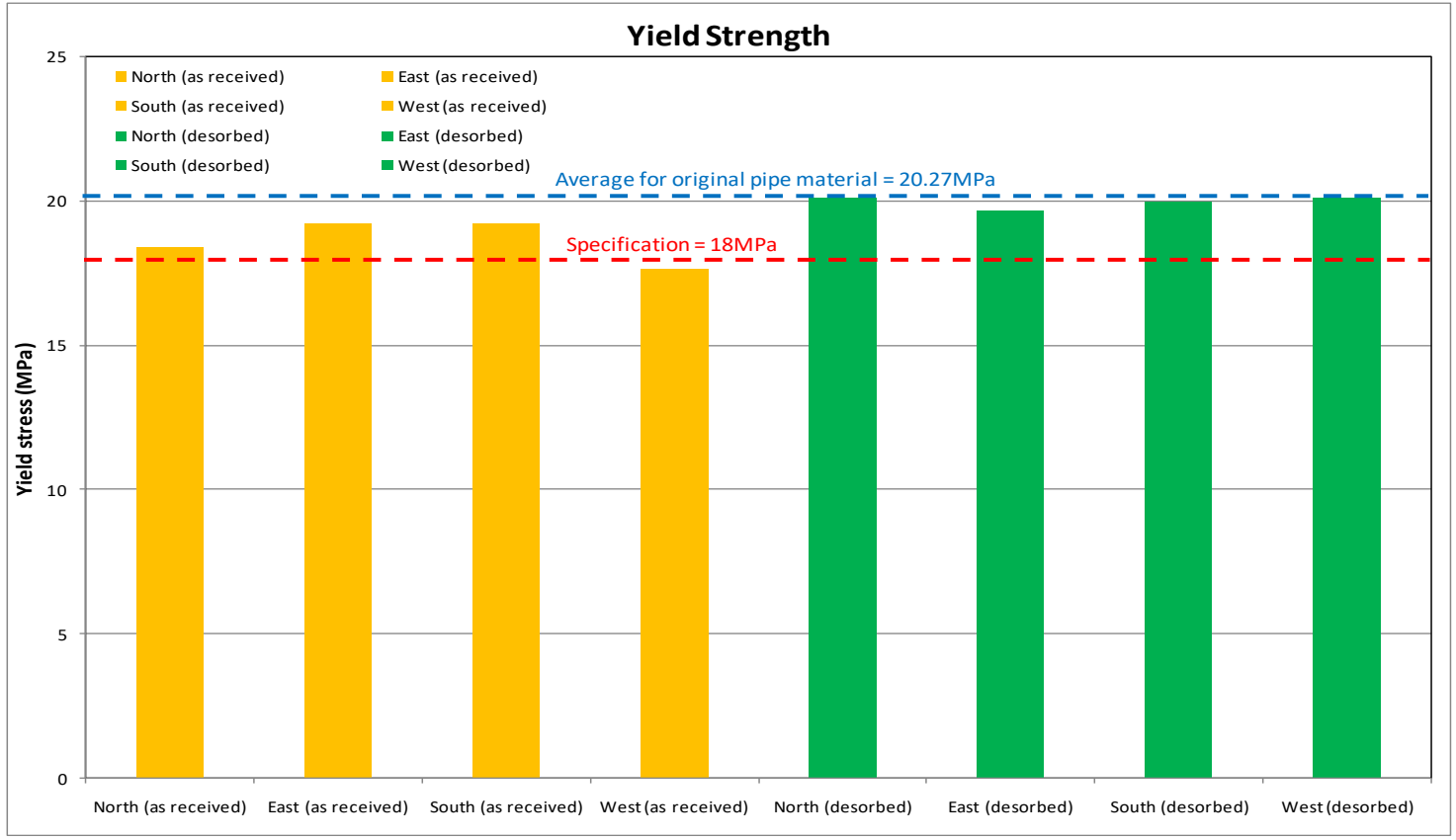
- PE Liner condition
- Weldlink™ condition assessment
- Carbon steel assessment
- Girth weld assessment
- Prediction of corrosion challenge

Project experience- Lined Spool Assessment

- PE80 lined WI spool
- Installed in north sea in 1995
- Recovered from seabed in 2008
- First opportunity to retrieve and examine a PE lined pipeline section after 13 years of service
- Summary of inspection scope
    - Condition of PE liner
    - Condition of Weldlink™ assembly
    - Corrosion of carbon steel
    - Condition of girth welds

PE Liner Condition Assessment

- **Tensile performance –** No degradation in performance compared to original pipe material
- **Environmental stress cracking –** Improved stress cracking due to absorbed service fluids
- **Chemical stability –** No change in melt flow rate and stabilizer package still active
- **Recovered strain –** Liner still retains residual stress indicating a continued tight fit



Weldlink™ Condition Assessment

- Weldlink™ and compression ring assembly remain fully intact after reeling installation, 13 years service and recovery
- A pull out test on the PE liner from the Weldlink™ joint demonstrated that the force required to pull the liner out of the assembly exceeds the yield strength of the PE liner after 13 years service

Weldlink section extracted from test spool

Test spool machining prior to liner pull out test

Corrosion of Carbon Steel

- Internal section of carbon steel pipe after PE liner removal including girth weld region

- Internal view of half shell of carbon steel pipe after PE liner removed – Superficial internal corrosion

Corrosion of Carbon Steel

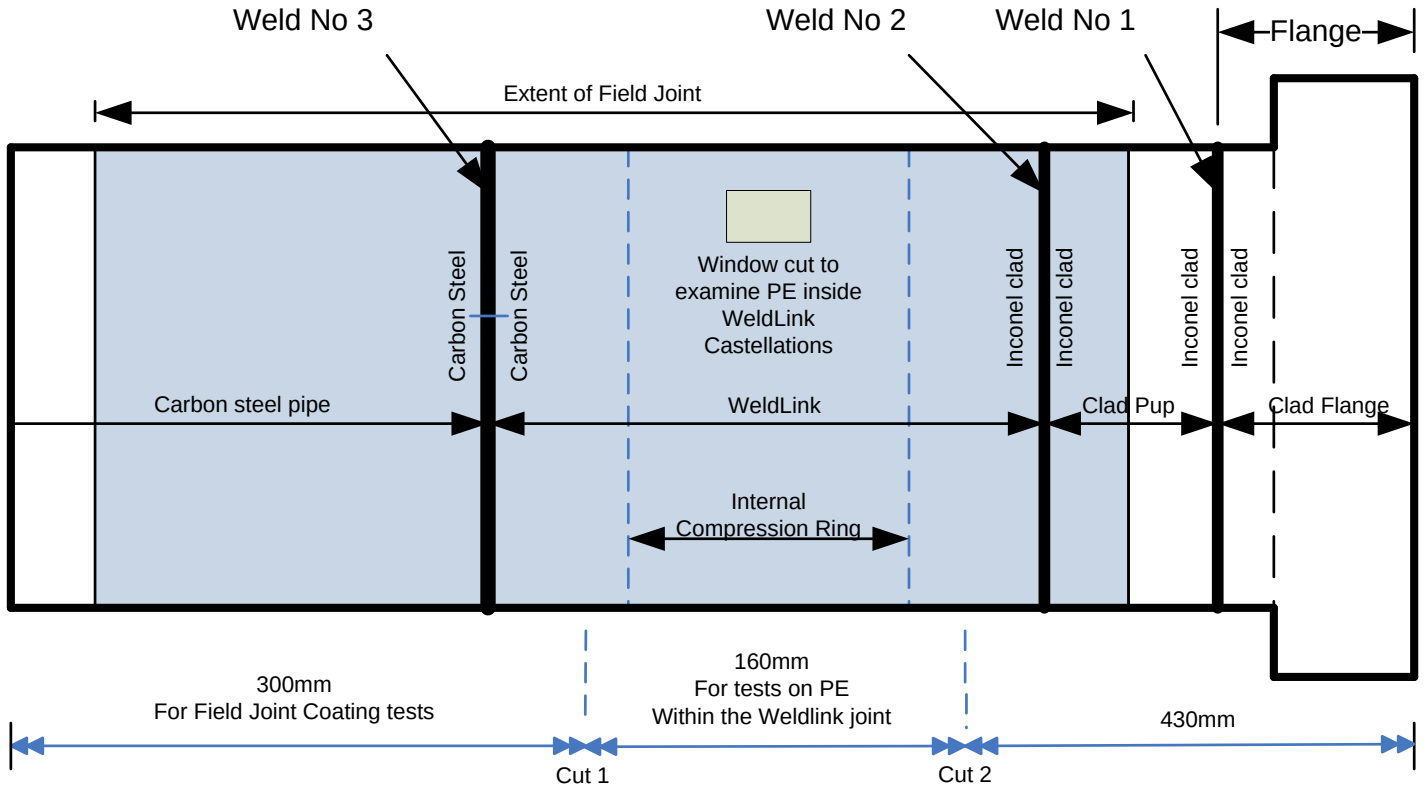
- The majority of the internal surface was covered with cracked mill scale
- Internal corrosion was superficial in most areas
- Worst case corrosion was examined in section
    - The maximum depth of metal loss was 280µm
    - Approximately 1.6% of nominal wall thickness

- Internal surface – mill scale – x40 mag

Internal surface – worst corrosion – x20 mag

Girth Weld Assessment

- 3 girth welds examined (X-ray NDE)
- **Girth weld 3** – Within the polymer lined section – Was acceptable
  - Polymer liner protects weld
- **Girth weld 1** – Outside the lined section – Was unacceptable – examination concluded corrosion due to fissure in protective inconnel
- **Girth weld 2** – Within the Weldlink assembly – Was acceptable



What next for Polymer liners

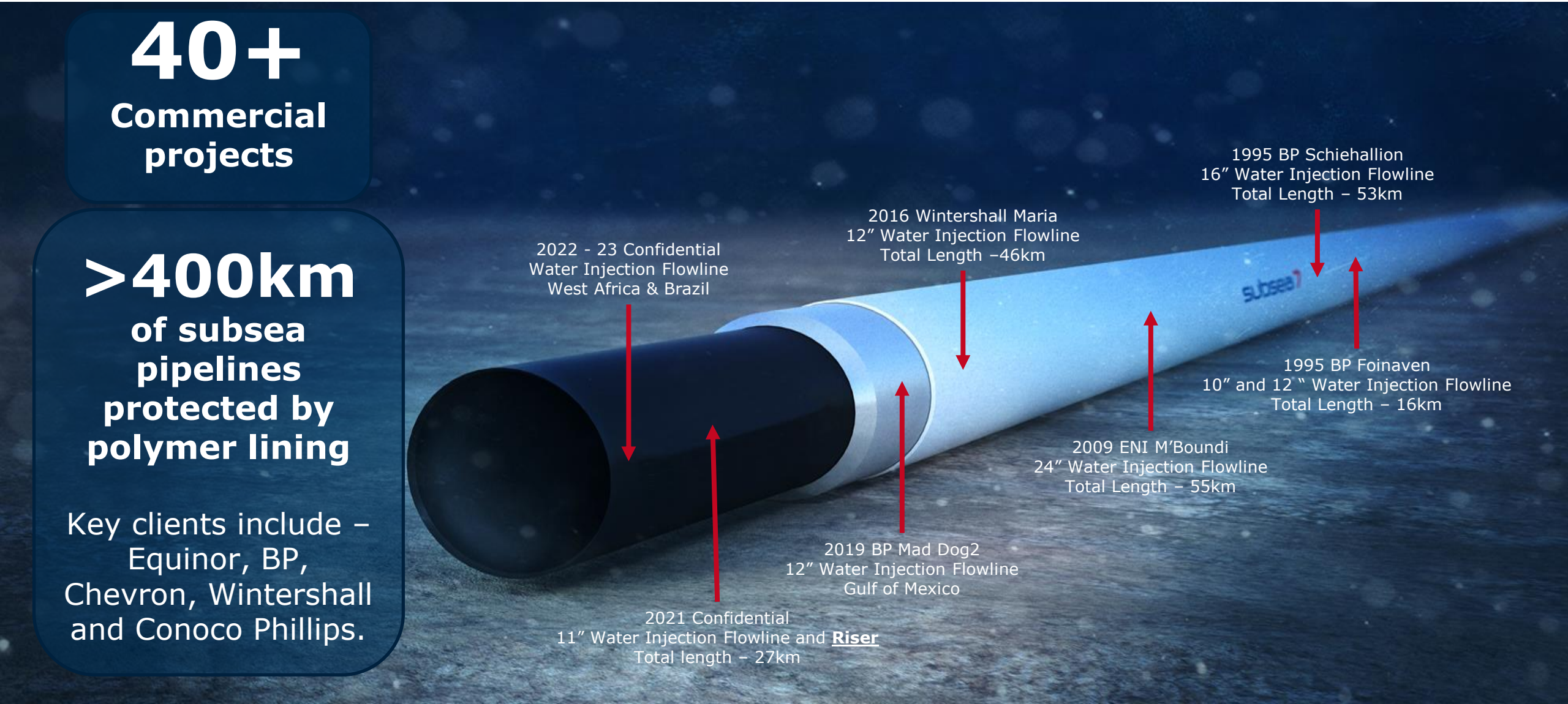
- Track record
- Future challenges

Swagelining® Products – Track Record (Summary)

40+
Commercial projects

>400km
of subsea pipelines protected by polymer lining

Key clients include – Equinor, BP, Chevron, Wintershall and Conoco Phillips.



Swagelining® Products – What's Next?

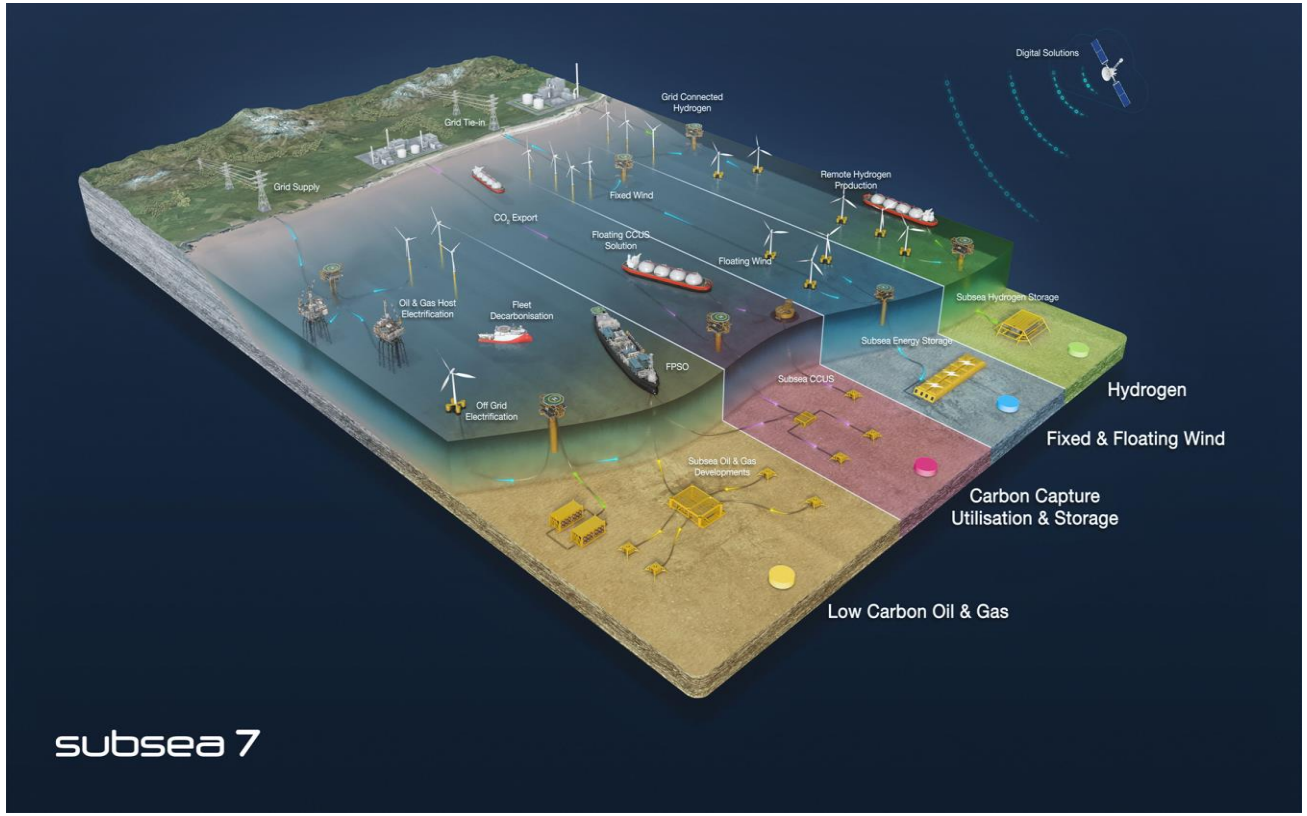
Swagelining® Product Team are now working towards expanding the applicability of polymer lining technology in–

Subsea Field of the Future –

- Water Alternating Gas (WAG) flowlines and risers
- Production flowlines and risers
- Low carbon pipeline solutions

Energy Transition –

- Carbon capture, utilisation and storage (CCUS)
- Hydrogen transportation
- Energy storage



THANK YOU

For enquiries, please contact either –

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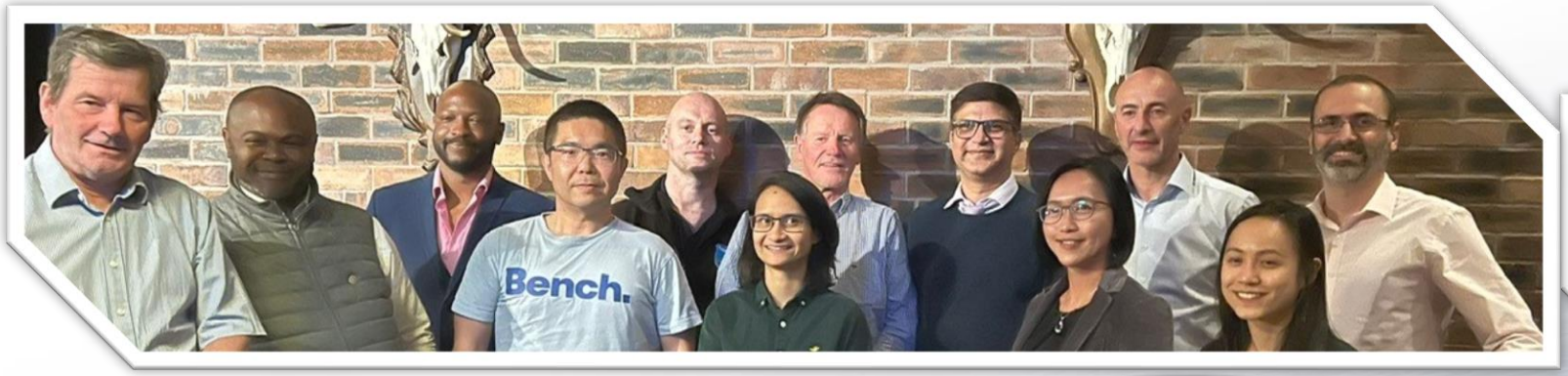
Colin Jones – Product Engineering Manager – colin.jones@subsea7.com



Thanks for your time