



Strohm || IRO
Leden Ontmoeten Leden

Martin van Onna
Henk de Boer

Agenda

Introduction to Strohm & TCP: Martin van Onna

Design approach: Henk de Boer

HSE & Plant tour



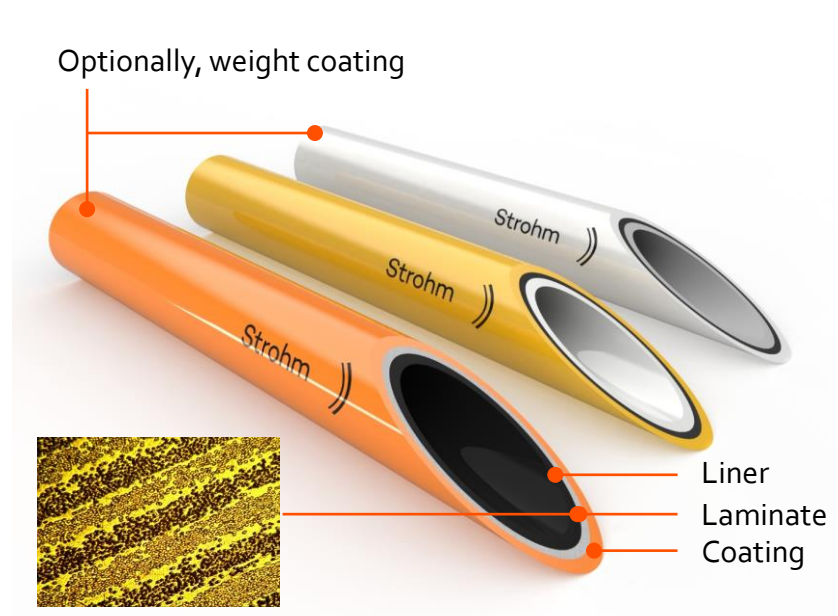
Introduction to Strohm

Martin van Onna



Thermoplastic Composite Pipe

Strohm developed and introduced TCP to the energy industry and is the market leader



- Two components, a fibre and polymer, selected and optimized for each application
 - Liner and protective coating for robust offshore and subsea application
 - Melt-fused composite laminate based on glass or carbon fibre with same polymer as liner & coating, to form a solid wall
- Flexible and spoolable in long lengths
 - No metals – no corrosion and chemically resistant
 - On-target weight – stable and light, reducing transportation and installation cost

TCP: No Corrosion, Lower Cost, Less CO₂

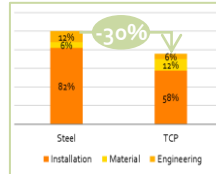
With the world's largest track record Strohm's TCP reduces capex and opex with a smaller footprint



TCP is lighter for lower installation costs and has a better carbon footprint. For CCUS, it eliminates the CO₂ corrosion issues that can affect unbonded flexibles, as TCP has no metal component or annulus. For H₂, it eliminates embrittlement.



Technical authority for composites and TCP, Shell



Reduced CAPEX and OPEX:

- Reduced total installed cost
- Significant reduction of maintenance cost



Smaller CO₂ footprint:

- Strohm is certified carbon neutral as organization
- Proven up to 60% reduction in footprint on as-installed basis

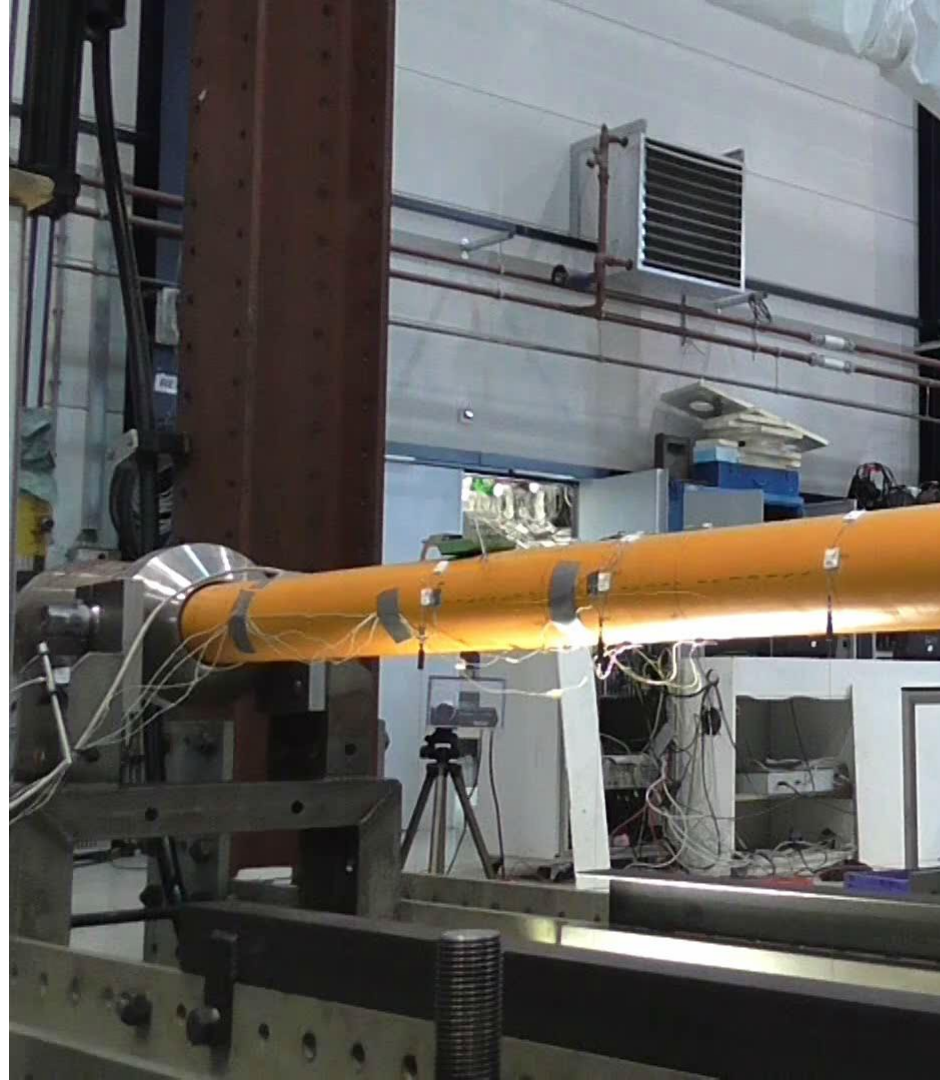


Largest track record in the world:

- TRL-9 on flowlines and jumpers
- Applications including hydrocarbon production, hydrogen and CCS

Critical success factors

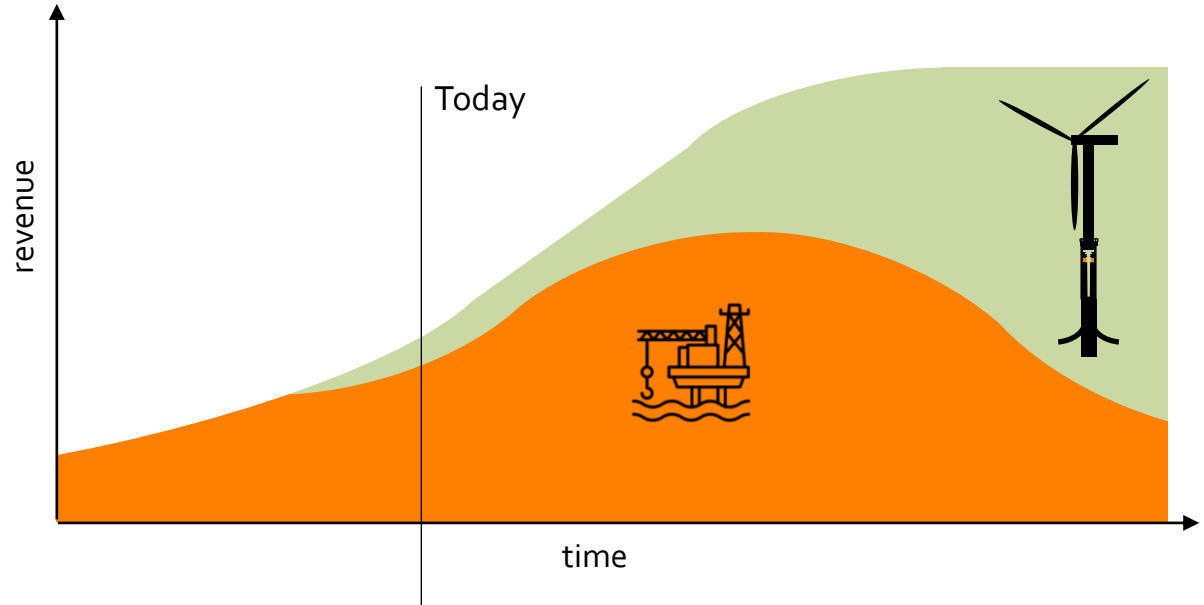
1. Safety and Quality
 1. Zero failures on installed pipe
 2. Excellent safety track record
2. Application driven product development
 1. As installed – in place analysis
 2. Installation loads
 3. Through life loads
3. Simple, robust product, agnostic to fluids
4. A solid market entry approach through pilots, and trusted relationships with key customers
5. Committed people who want to make a difference “I was there”



What is next?


Based on proven track record we industrialize and prepare for the future in hydrogen and CCUS

1. The energy transition requires technology to be available at scale
2. Only proven and mature technology can be scaled quickly
3. We build on our track record, we grow and we learn, and build the foundation to help accelerate the transition



Strohm: Proud of our track record



 SWI Downline/Jumper	 Jumper	 Flowline	 Riser	 Head Office	 Regional Office
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Building on a superior foundation

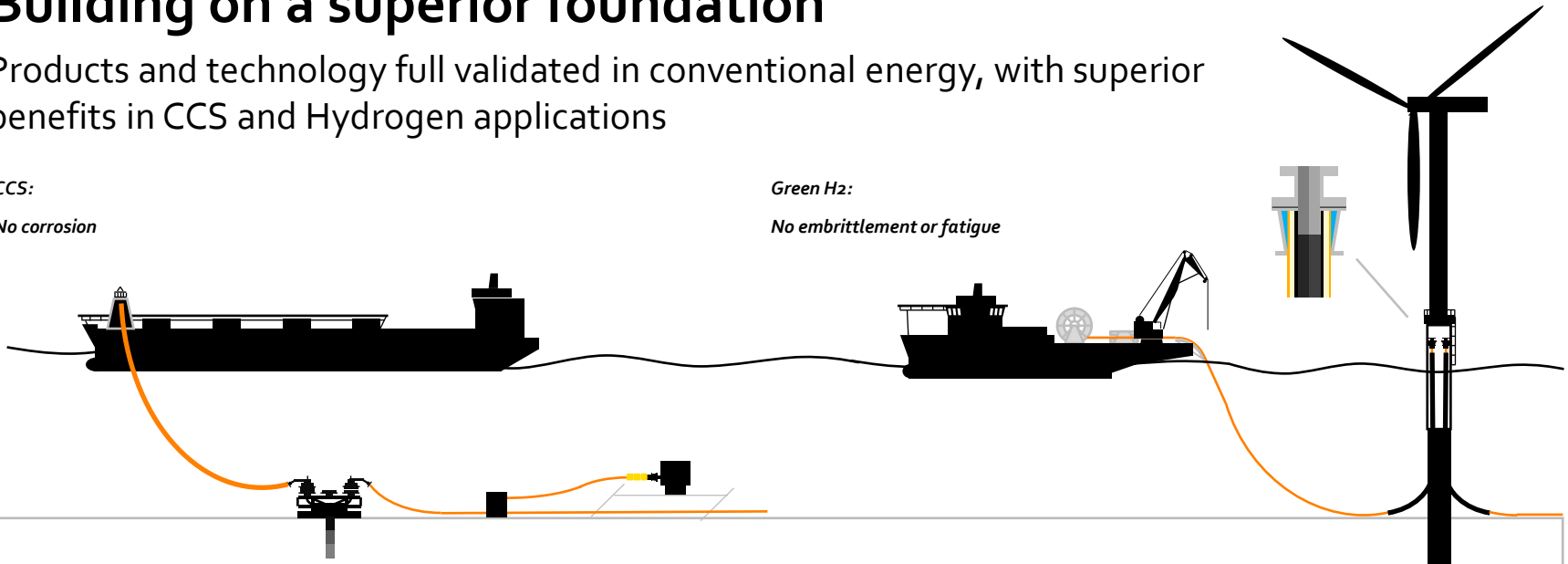
Products and technology full validated in conventional energy, with superior benefits in CCS and Hydrogen applications

CCS:

No corrosion

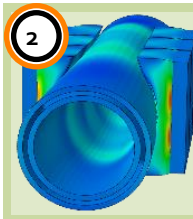
Green H₂:

No embrittlement or fatigue



1

Material know-how
Qualified materials to ensure most cost effective solution for each application



2

Digital design
Qualified predictive engineering tools, including all fluids and gas influence



3

Manufacturing
Proprietary, patented and fully automated inspection process for highest quality pipelines

Can TCP solve your issues?

TCP conduit protects array cables and allows easy installation



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Strohm's Design for Application approach

Our product development and qualification approach distinguishes three levels



Translate application needs and clients wishes into product requirements

Thorough understanding of the general application and client and project specific drivers



Design of Product Family

Select fit-for-purpose material
Select generic composite lay-up



Design specific member of Product Family

Optimizing composite lay-up and layer thicknesses
Design of ancillaries and T&I aids

Digital Prototyping enables fast and cost effective design

Strohmann uses digital prototyping to accurately predict the stiffness and strength of its materials and products, based on extensive material and product qualification testing

Qualified Digital Materials

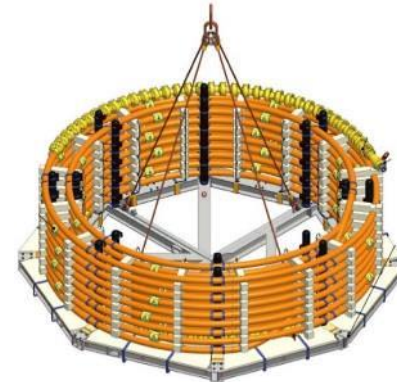
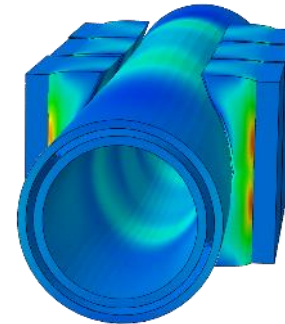
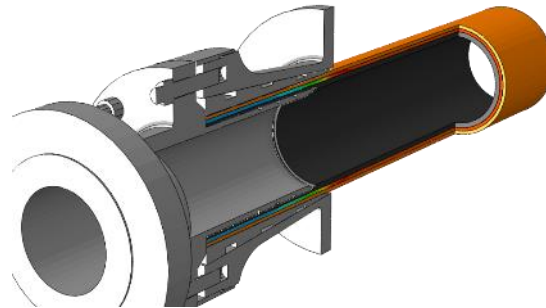
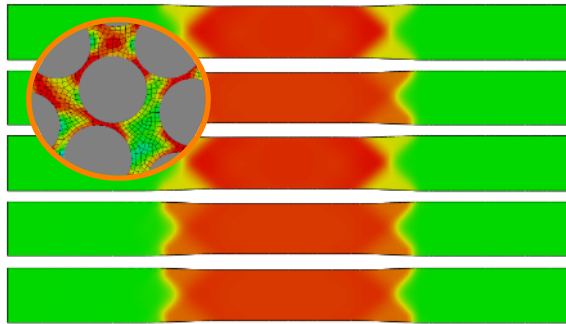
Material models validated by coupon testing:

- Polymer, fibre and fibre orientation
- Influence of temperature and fluids
- Validated by extensive coupon testing

Qualified Digital Prototypes

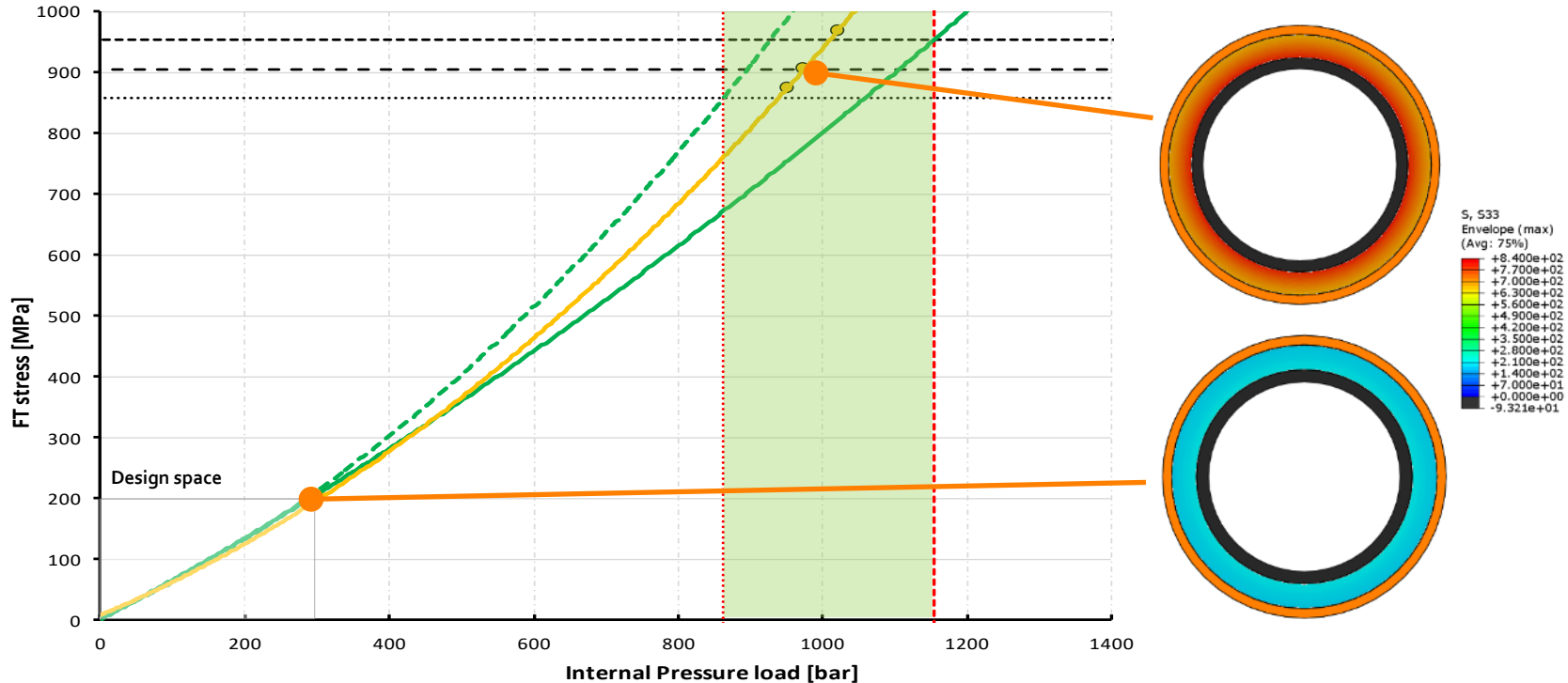
Digital prototype is created:

- Lay-up and layer thicknesses
- End Fitting and ancillaries
- Validated by full-scale tests (>8500 test results)



TCP design

All application load cases analysed for Digital Prototype, verification by few full-scale tests



Project design scope

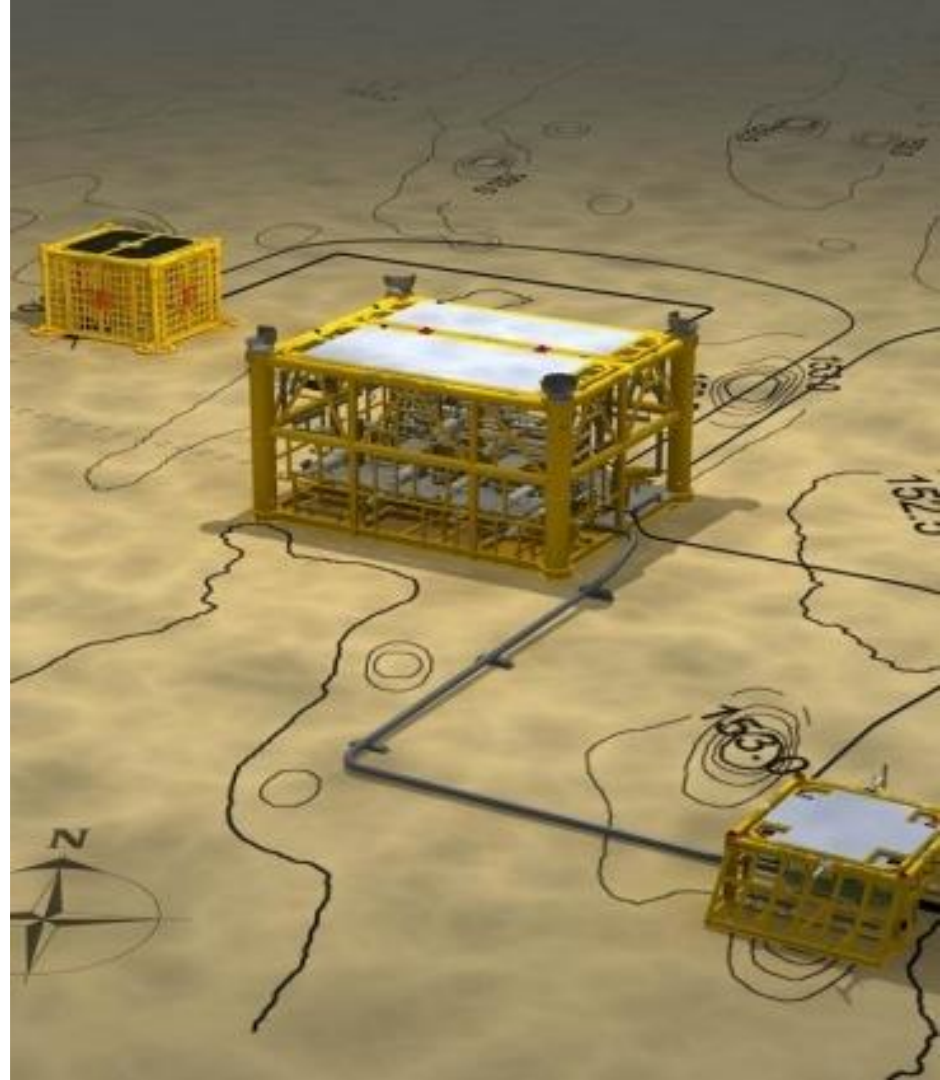
TCP design is only a part of total system design

Installation:

- Bending loads
- Dynamic application factors
- Current profiles
- Crushing loads (tensioners etc)
- Installation aids

As-installed:

- Dynamic analysis
- On-bottom stability
- Upheaval buckling
- Temperatures
- Fluids
- Loads acting on TCP and loads from TCP on connectors etc
- Ancillaries



No corrosion.

Lower cost.

Less CO₂.

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