

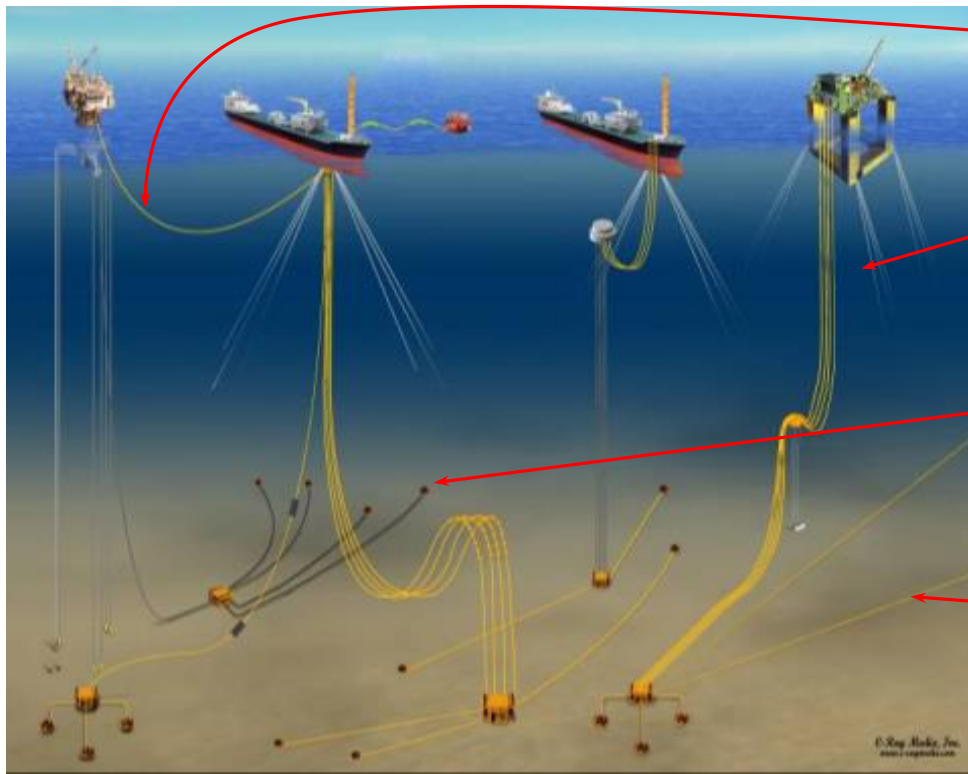
# Cost Reduction in Frontier Deepwater Riser Systems

Ray Burke  
Global Product Leader  
GE Oil & Gas



# Applications – Subsea Production, Injection, Export

*Combines the strength and durability of steel pipe with the ability to handle wave and wind induced motion; often the only solution for Floating Production Systems*



- Transfer lines link floating components
- Risers bring subsea production up to the platform
- Jumpers to connect wells to manifolds, or other structures
- Flowlines: long static lines for gathering or exporting fluids

# Typical Unbonded Flexible Pipe Product

3km - 8"ID - 12ksi  
Layer Weight

**Carcass** – Inner metallic layer prevents collapse due to hydrostatic pressure

20%

**Fluid Barrier** – Chemically resistant polymer boundary for conveyed fluids

5%

**Pressure Armour** – Interlocked metallic layer resists internal pressure loads

32%

**Tensile Armour** – Provides axial support for the entire riser

38%

**Insulation Layer** – Prevents excessive heat loss in bore fluids during operation

1%

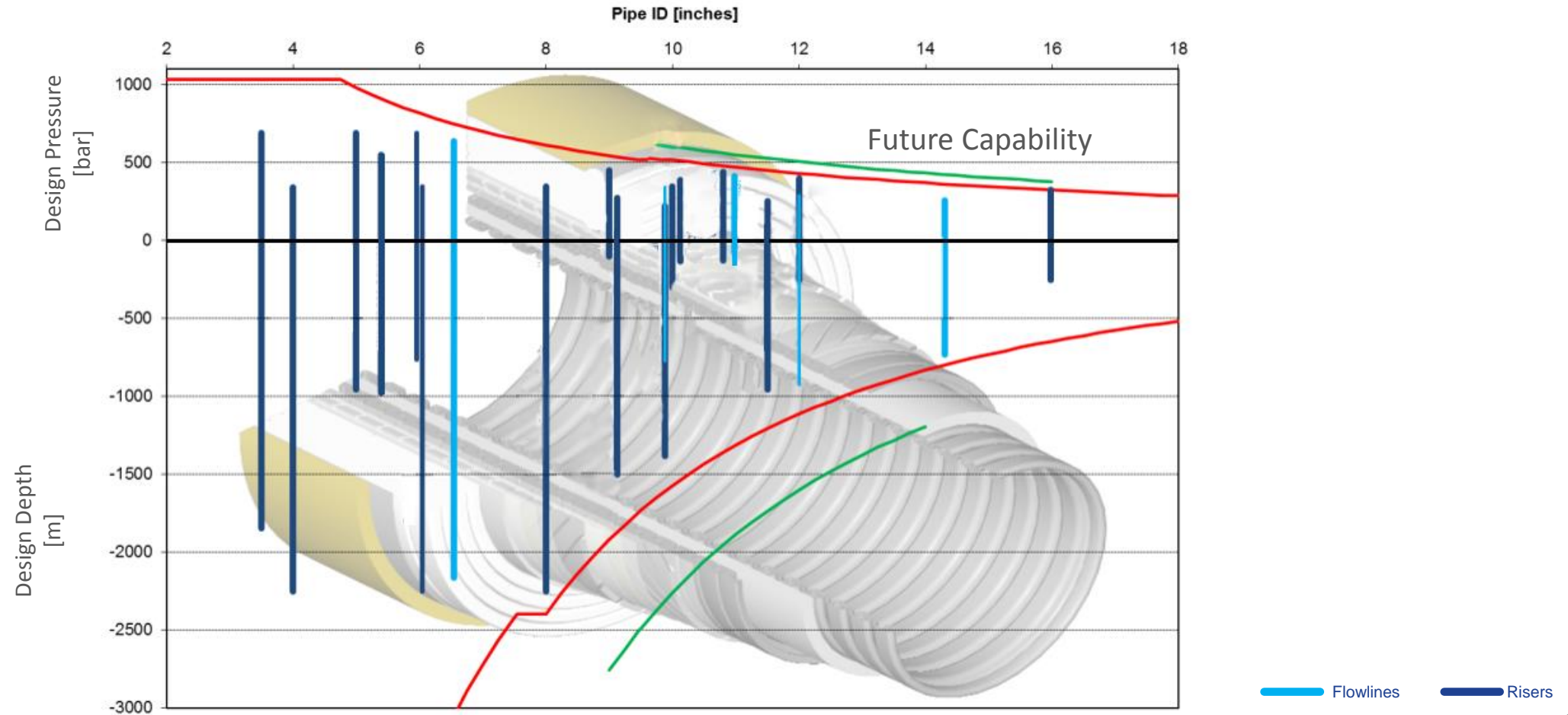
**Outer Shield** – Protects the pipe against seawater ingress and external damage

4%

190 kg / m

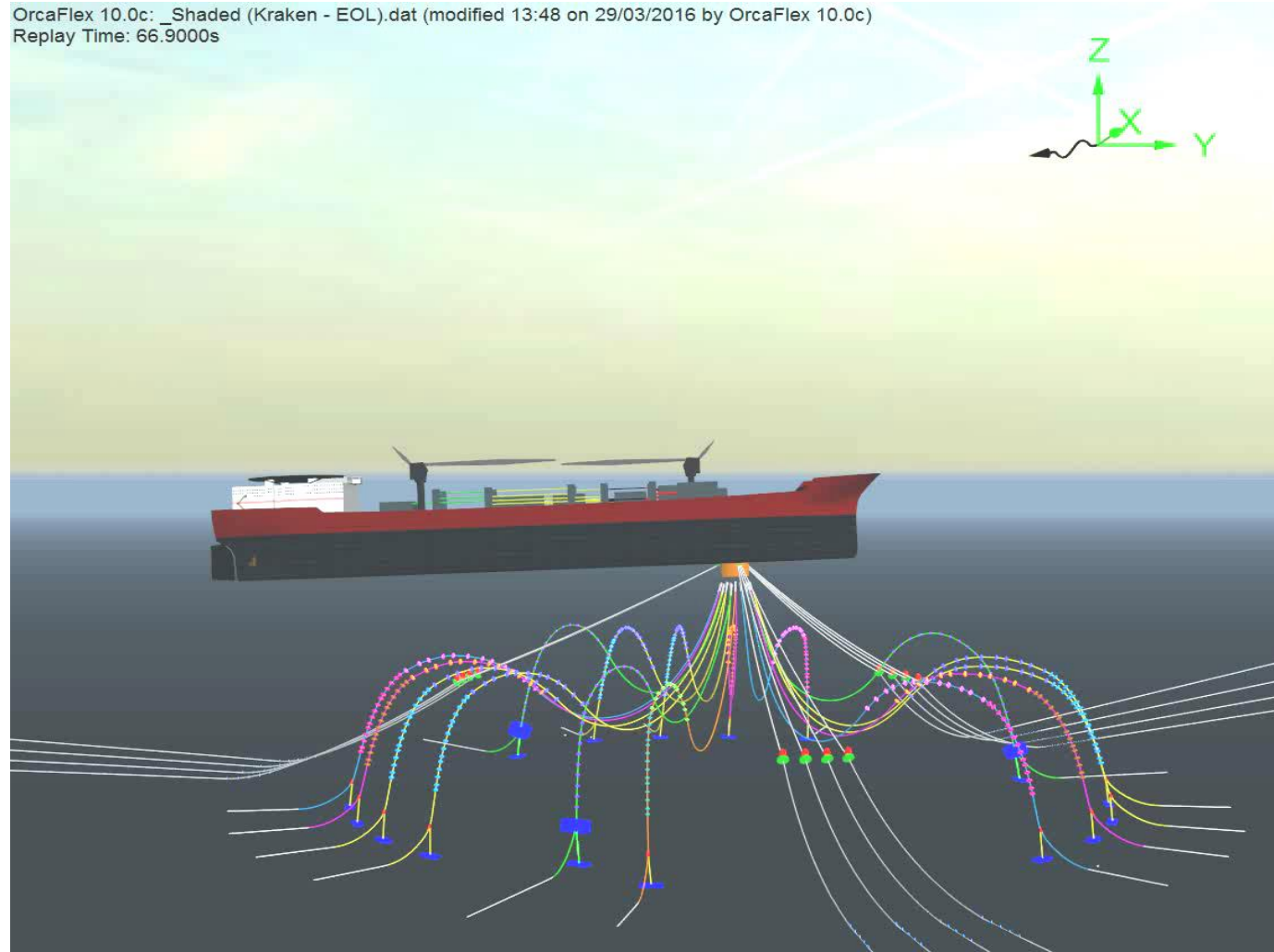


# Deepwater Capability & Operational Limits



# Riser System Analysis

OrcaFlex 10.0c: \_Shaded (Kraken - EOL).dat (modified 13:48 on 29/03/2016 by OrcaFlex 10.0c)  
Replay Time: 66.9000s



# Composite Pressure Armour Introduction



- High pressure capacity
- Well known and trusted materials
- State of the art manufacturing
- Simplified design
- Optimised material usage
- Flexible and fatigue resistant



- Mature and proven end terminations

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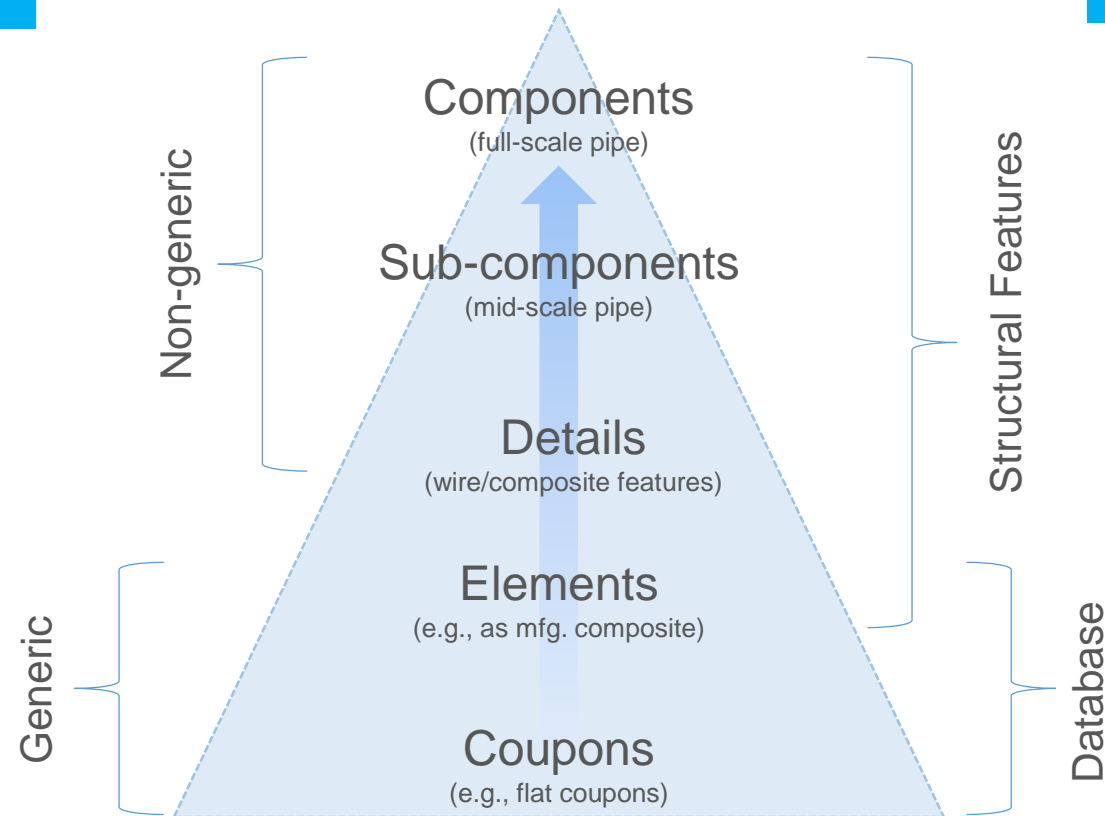


# Multi-scale Qualification

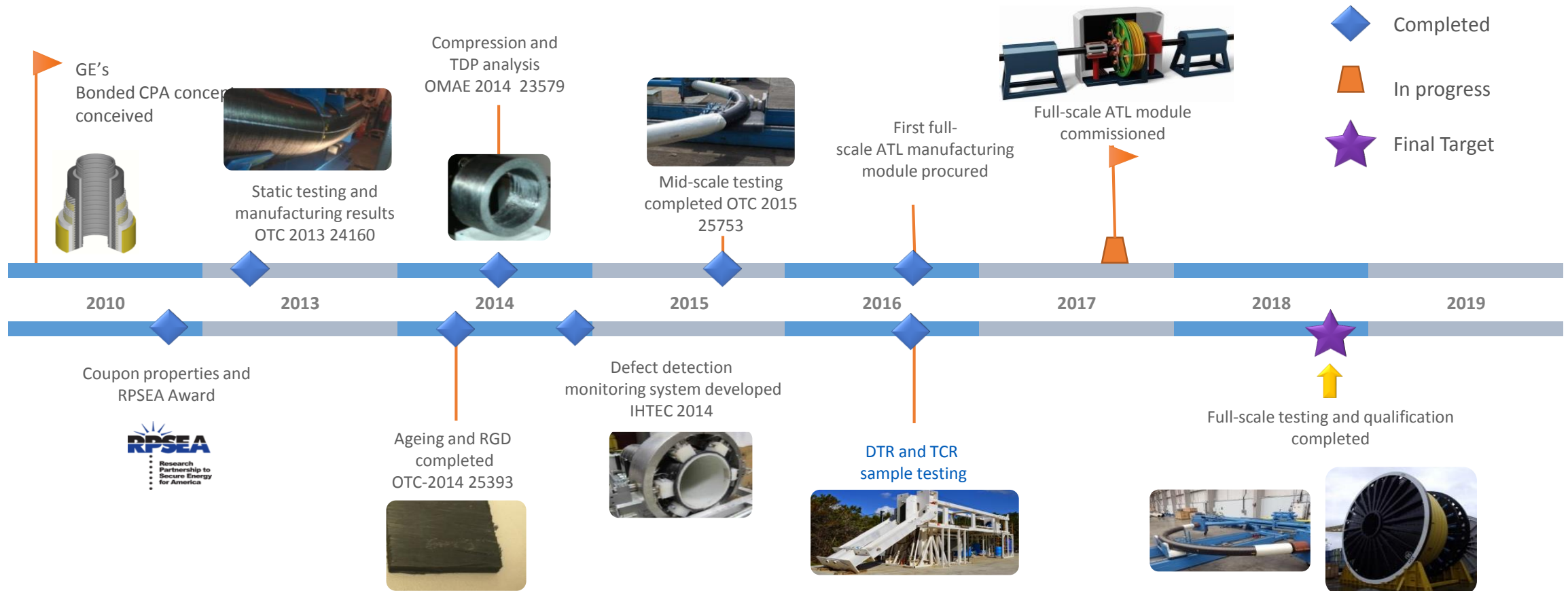
## Hoop / Pressure



## Flexural/Bending

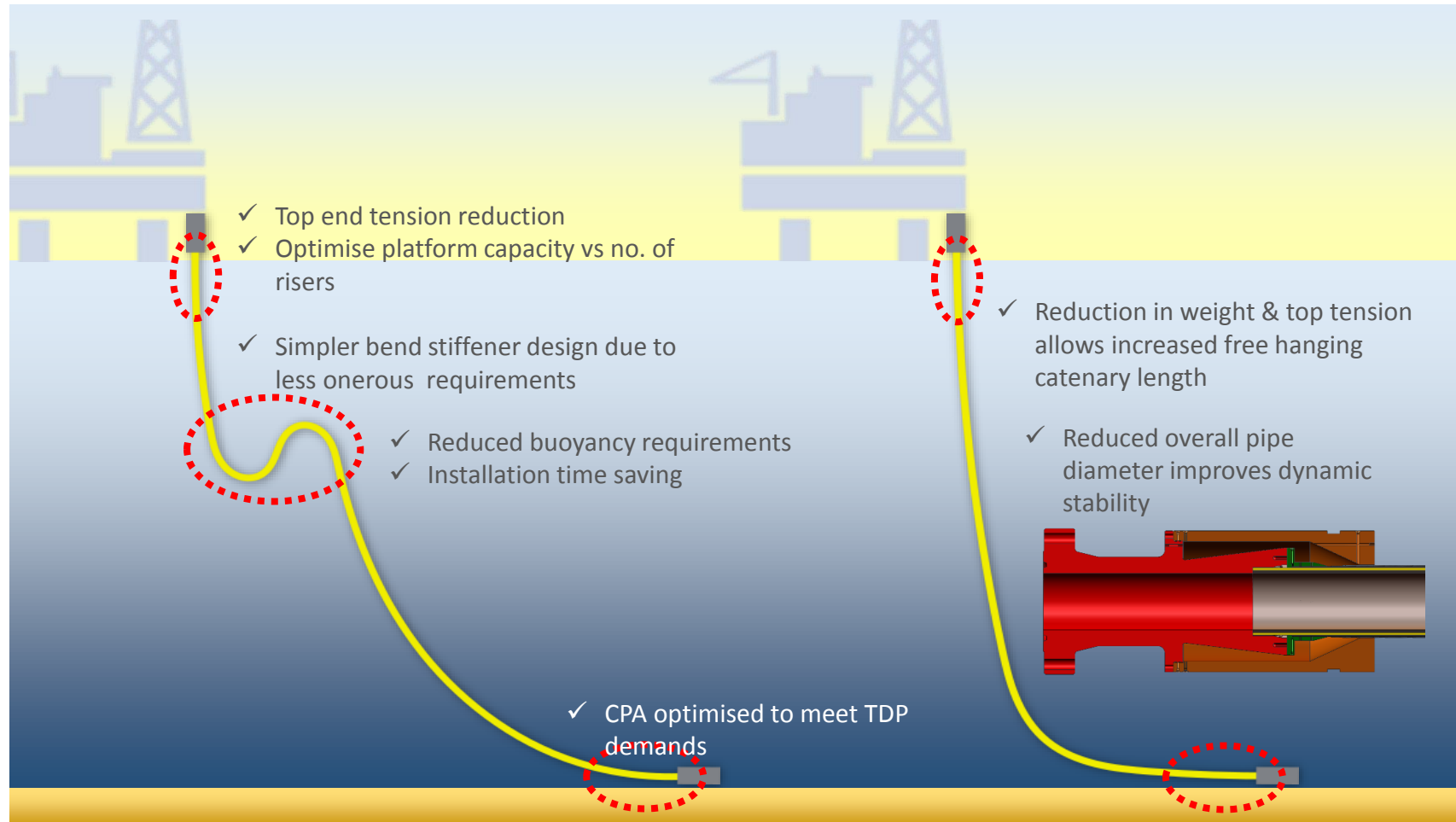


# Composite Product - Program Timeline





# Deepwater Riser System Optimisation



## CONVENTIONAL



30% INCREASE IN REEL  
CAPACITY

REDUCED MOBILISATION  
COST & TIME

REDUCED SHIPPING  
COST

REDUCED INSTALLATION  
TIME & ANCILLARIES

PLATFORM  
OPTIMISATION & FHC

## COMPOSITE



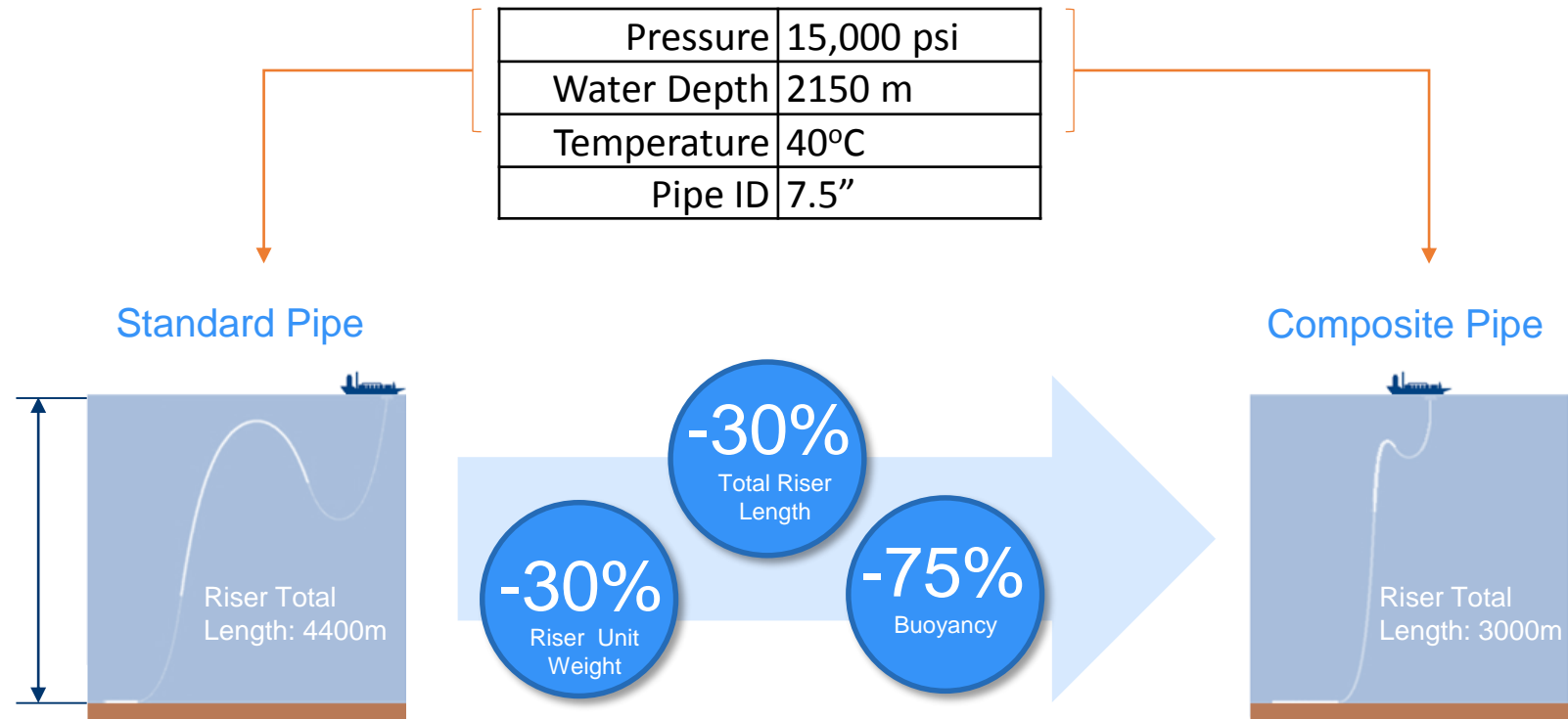
**20% reduction in total installed cost**

**MOVING FROM LAZY WAVE CONFIGURATION TO FREE-HANGING CATENARY**



# Live Case Study: GoM HP Water Injection Riser

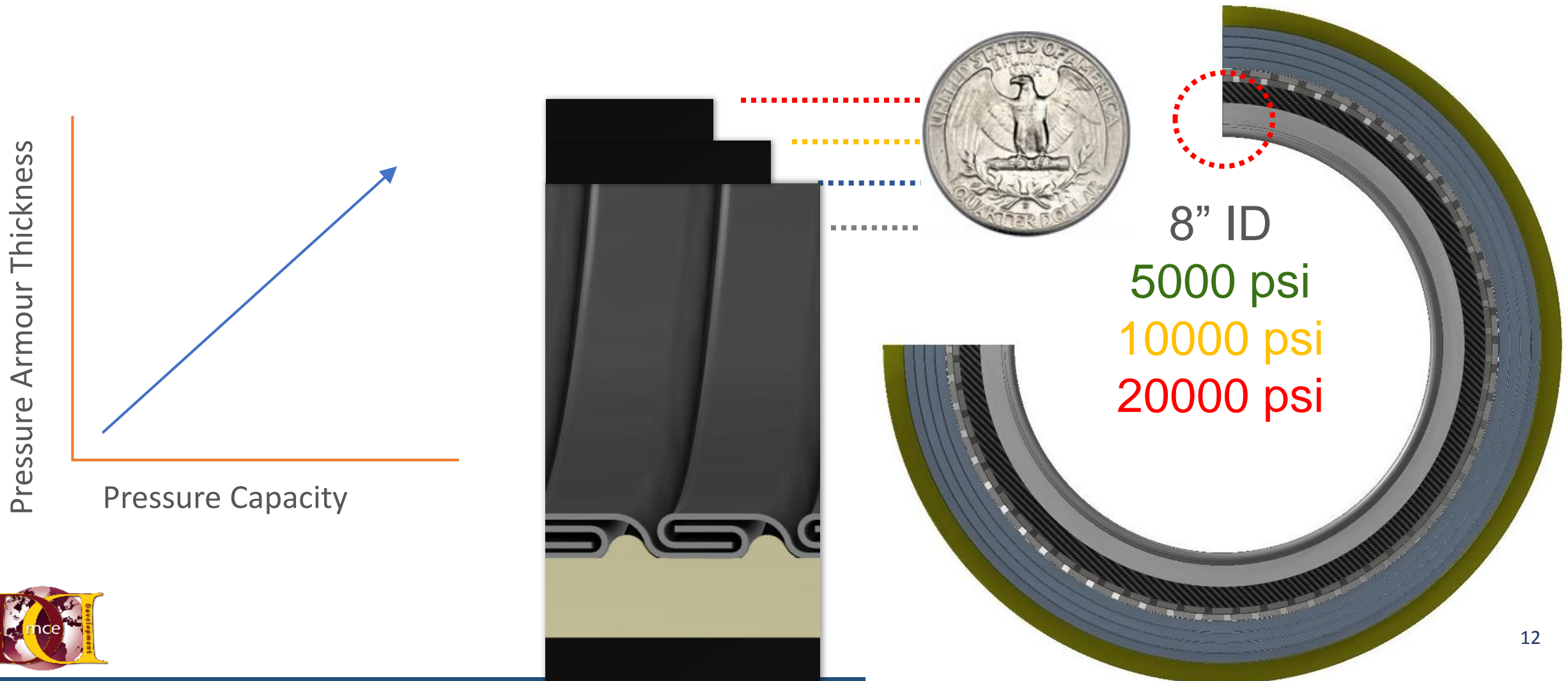
*Global Analysis for customer to determine benefit of improving flexible pipe solution with GE composite designs*



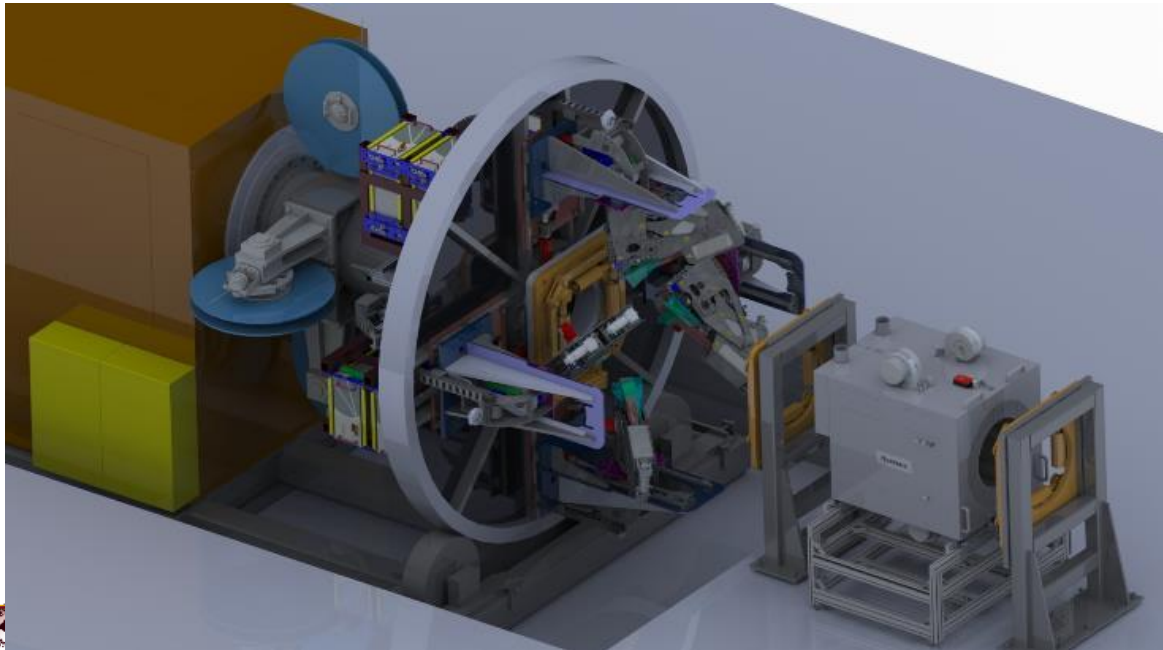
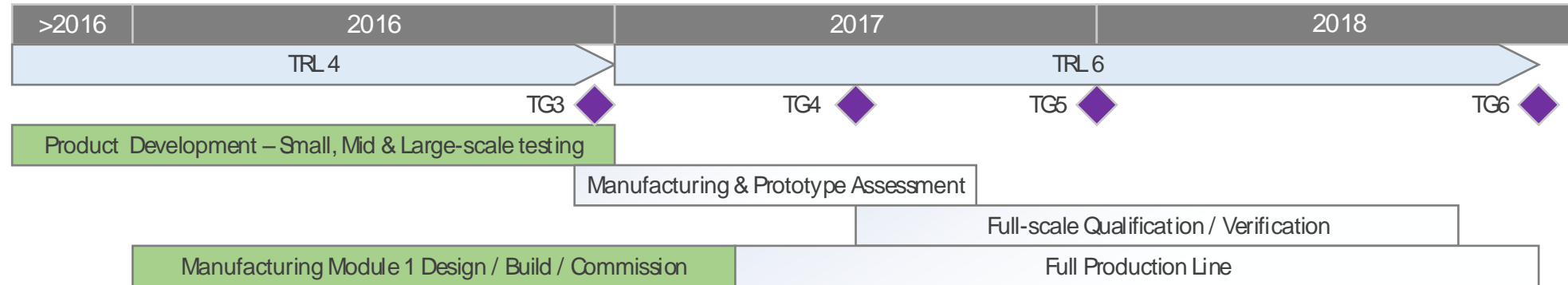
**Key Technical Impact – delivers 30% Hardware cost reduction**

# Efficient Pressure capacity

Single material qualification to cover entire pressure range



# Manufacturing Readiness & Timeline





# Next Generation Composite Flexible Risers

## GE Oil & Gas Wellstream Flexibles

- ✓ **30% lighter**
- ✓ **20% savings on total installed cost**
- ✓ Deeper water and higher pressures
- ✓ Free-hanging catenary in 3000m water depth

*Carbon fibre reinforced thermoplastic pressure armour is an efficient replacement for the traditional shaped armour wires. This high-performance material equips our pipes with a superior strength to weight ratio, delivering benefit from manufacture through installation to operation*

### Benefits

- Top end tension reduction
- Reduced buoyancy requirements
- Installation time saving
- Optimised platform capacity vs. number of risers

### Collaboration

- Team have been working closely with major O&G operators globally, to enhance the robust tools developed for design and qualification

### Technology

- High pressure capacity
- Well-known and trusted materials
- State-of-the-art manufacturing
- Simplified design
- Flexible and fatigue resistant
- Mature and proven end terminations



Cheaper faster installation, more pipe per trip, wider range of vessels





# Thank you.

