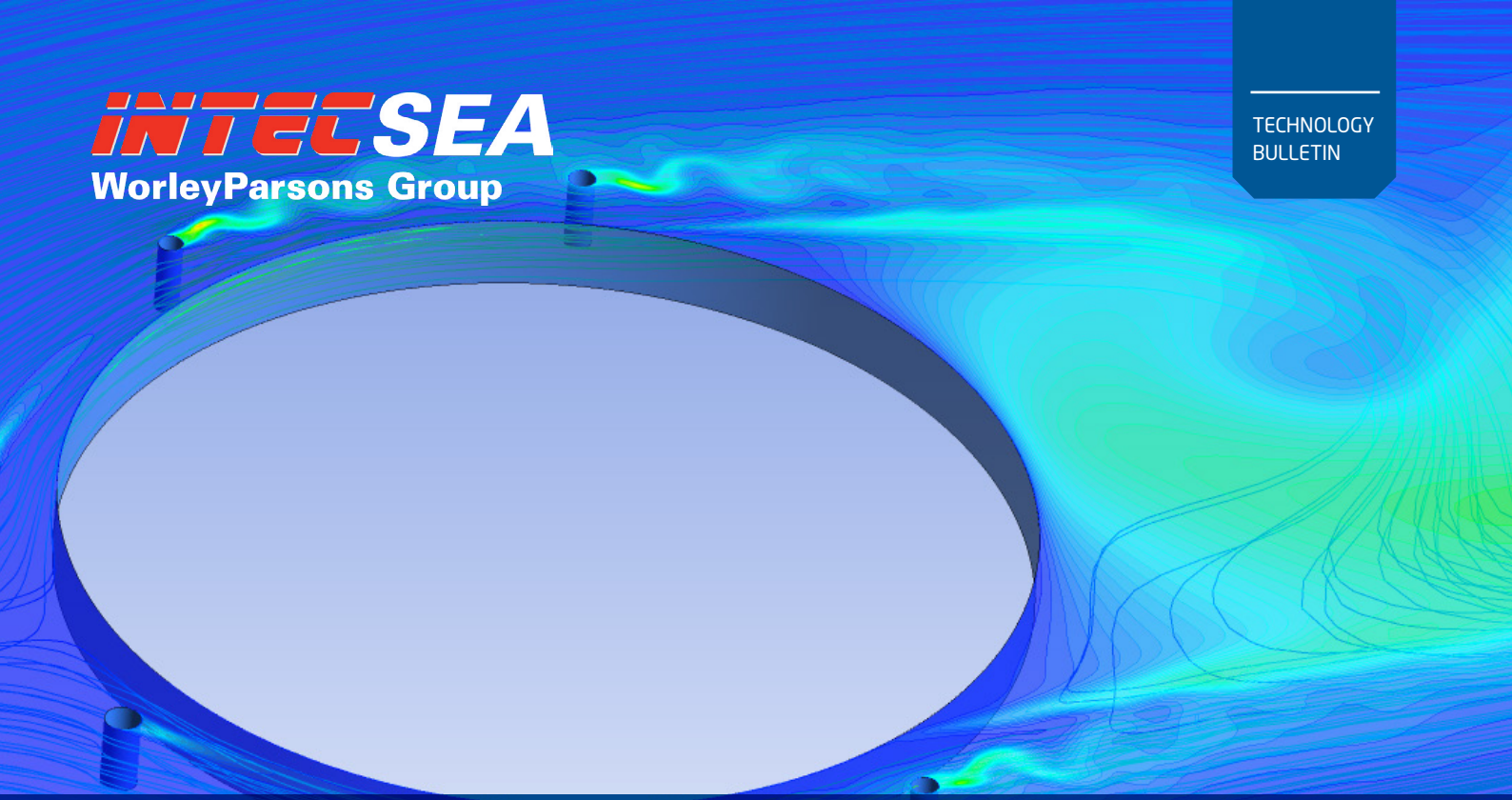
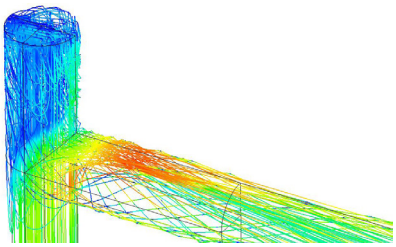
INTECSEA
WorleyParsons Group

TECHNOLOGY BULLETIN



Computational Fluid Dynamics (CFD)



Customer Benefits

- Identify cost savings thanks to optimisation of components and designs at early stages of projects
- Fosters innovation by shortening the product development process through virtual modelling
- Reduce risk by predicting the performance of systems incorporating complex geometry
- Ensure equipment integrity, safety and reliability through detailed analysis
- Meet design challenges that are outside industry codes and standards

Introduction

The wide range of Advanced Analysis services provided by INTECSEA includes Computational Fluid Dynamics (CFD).

Our engineers have extensive experience in fluid dynamics and develop numerical models using the ANSYS CFX software to help customers meet their engineering challenges and deliver innovative design solutions.

INTECSEA has applied Computational Fluid Dynamics to the design and verification of subsea pipelines, structures and risers. Through the realistic simulation of complex flow patterns, INTECSEA has helped customers to reduce the conservatism and the cost of traditional design solutions without compromising safety and reliability.

Modelling Capabilities:

- Internal and external flows
- Single-phase and multiphase flow regimes
- Solid particle tracking and erosion prediction
- Steady-state and transient flows
- Turbulent and laminar flows
- Coupled thermal and fluid dynamics simulations
- Fluid-structure interaction
- Performance prediction of multi-stage pumps

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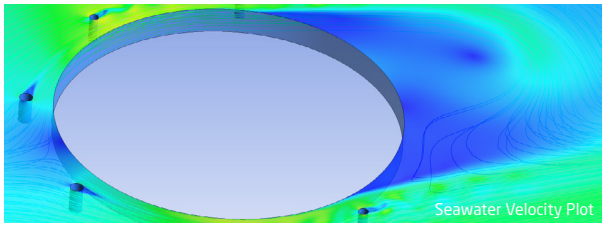
The application of Computational Fluid Dynamics to all stages of oil and gas projects has allowed our customers to effectively manage the integrity and reliability of their assets where a detailed knowledge of the flow behaviour is required.

Deepwater Hybrid Exchangeable Riser Tower

Project: TOTAL Angola Block 32

The hydrodynamic loadings acting on the deepwater riser tower were estimated early in the concept stage via CFD. The turbulent vortex shedding around the structure components was predicted realistically through a transient simulation for different current directions. Drag and lift coefficients were calculated for risers, tendon and buoyancy tank and were used as input to a global structural analysis.

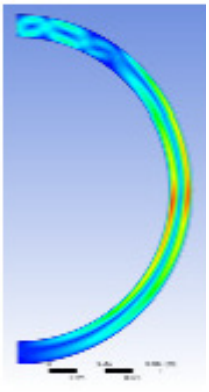


Seawater Velocity Plot

Offshore Pipe-in-pipe Partially Insulated Field Joint

Project: BP Angola Block 31

Partial insulation at field joints could arise "cold spots" that might affect the thermal performance of the pipe-in-pipe system. A transient coupled thermal-fluid dynamic simulation was set up to estimate the fluid temperature at the end of the cool-down process. The predicted minimum fluid temperature was compared against the temperature of hydrate formation and the thermal performance of the partially insulated field joint was ensured.



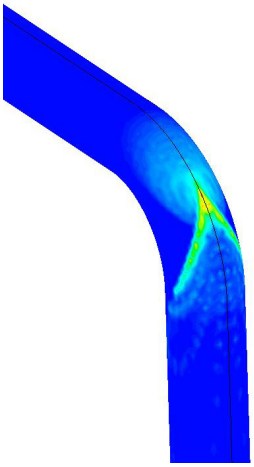
Air Velocity within Annulus

Piping Erosion due to Sand Particles

Project: BP West Nile Delta

Multi-phase CFD simulations were undertaken to estimate the rate of erosion due to sand particles transported within the production fluid. The prediction of internal material loss over the field life helped ensure the integrity of subsea piping through optimisation of material and wall thickness selection for critical components such as bends, tees and valves.

Trajectories of Sand Particles



Contour Plot of Erosion Rate

Publications

ISOPE 2012-TPC-0424: Computational Fluid Dynamics Analysis of a Novel Open Bundle Riser Tower System
Shulong Liu, Dan Lee, Luca Chinello, Neil Willis

OMAE 2013-10812: Cool-down Time Estimation Through Numerical Analysis for Partially Insulated Offshore Pipe-in-Pipe Field Joints
Luca Chinello, Philip Cooper, Ramon de Haas, Helen Boyd

OTC 2013 24114-MS: Advances in Multiphase Flow CFD Erosion Analysis
Deng-Jr Peng, Afshin Pak, Luca Chinello, Terry Wood, Andrew Low

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