Computational Fluid Dynamics

OIL & GAS CONSULTANCY SERVICES

London  |  Hong Kong  |  Houston  |  Kuala Lumpur  |  Abu Dhabi  |  Dubai  |  Shanghai
Design challenges facing the Oil & Gas industry are frequently associated with fluid flow problems in exploration, production, refining and process equipment. Computational Fluid Dynamics (CFD) is a tool that has become the key to solving many of these problems.

Fluid flows are inherently complex and governed by equally complex equations. This is certainly the case for many fluid flow problems seen in the Oil & Gas industry. The rapid acceleration of computer technology in recent decades has resulted in computer hardware and software that is now capable of numerically solving these equations and problems to time scales that fit within project schedules. The science of using computer programs to solve fluid flow problems is known as Computational Fluid Dynamics (CFD).

BMT are specialists in the use of CFD for Oil & Gas applications. We are backed by our own high-performance computing facility, wind tunnel facilities that we use for validation, and most importantly, a very experienced team of engineers who deliver clear interpretations and explanations of the results as well as recommendations for improving design.

We use CFD to model gas, liquid, particulate flow and interactions of these flows with solid bodies through force and heat transfer. The versatility of the tool and the unprecedented ability to visualize and quantify the flows has meant that CFD has become an indispensable tool whenever practical analysis and engineering design work involving fluids is required. Benefits such as maximizing process efficiency, lowering production costs and meeting environmental concerns are all typical outcomes of using BMT’s CFD consulting team.

KEY SERVICES
- Consequence Analysis: ventilation, dispersion, fire, radiation, smoke & blast
- Numerical towing tank: towing loads, current loads, slam loads, green water, drag and added masses calculation
- Flow assurance: erosion, cavitation, flow efficiency, multiphase slug flow and hydrates & wax formation conditions evaluation
- Separator analysis including sloshing
- Helideck environment assessments
- Complex flows involving multiphase, mixing, combustion, heat transfer, and radiation

KEY BENEFITS
- State-of-the-art CFD resources, and extensive experience in applying them to Oil & Gas problems
- Complementary experimental and numerical modelling, offering an integrated service
- Physical understanding of flow characteristics and visualization
- Efficient and high-quality project team providing answers that meet project requirements and deadlines
- Over 25 years of experience providing consulting services to the Oil & Gas sector

HYDRODYNAMICS

The marine environment is associated with some unique problems that require specialist knowledge in naval architecture and hydrodynamics to ensure high performance and low risk design. BMT has assisted designers of marine systems for over 25 years in the areas of current & wave loads, wave response analysis, subsea installation hydrodynamics and wind loads.

The prediction of current and wave loading is a key component of engineering design for offshore structures for station keeping, mooring design, vessel stability, structural integrity and safety. BMT’s specialist knowledge and experience in numerical modeling of wave loads and vessel response, software development and physical model testing provides an unrivalled analysis and consultancy capability. With the rapid advancement of CFD, BMT now operate “numerical tow tank” facilities to carry out studies that were otherwise limited to physical testing.

Subsea installation requires accurate hydrodynamic load calculations to assess the behavior of the equipment during installation and the requirements of the equipment undertaking the installation. Recognizing the trends of exploration into deepwater, BMT initiated and managed the Deepwater Installation of Subsea Hardware (DISH) JIP to aid the development of installation technologies for installing hardware in ultra-deep water. Through this project, BMT have gained an understanding of the issues facing our clients in deepwater exploration and production and developed CFD modeling techniques to resolve those issues.

Towing subsea equipment or production platforms to site presents unique challenges when determining hydrodynamic resistance for towing vessel requirements. BMT has performed numerous resistance CFD studies for towing operations of submerged equipment and offshore structures resulting in successful and safe towing campaigns.
**CONSEQUENCE ANALYSIS**

Ventilation, flammable gas & liquid dispersion, fire, smoke propagation, and explosions are important considerations for the safe operations of Oil & Gas facilities both on and offshore. BMT Fluid Mechanics is a leading specialist in the use of CFD for the analysis of upstream & downstream hydrocarbon hazards to optimise design, minimise commercial risk and maximise safety.

BMT has a long history of working in the O&G sector providing Consequence Analysis services for a vast array of assets across the world over the past 25 years or so. A notable historic achievement was BMT Fluid Mechanics’ involvement in the Piper Alpha incident inquiry where expert advice was provided that resulted in radical changes to the North Sea safety regulations. Through this experience, we can provide safety engineers and structural designers insightful and timely advice on design in accordance with global regulations and guidance from concept and FEED through to detailed engineering.

**FLOW ASSURANCE AND EQUIPMENT DESIGN**

Reliable downhole and subsea equipment is crucial to the safe operation of offshore infrastructure. Flow assurance, including erosion control, minimization of hydrates formation and wax deposition is of major concern. BMT has extensive expertise in using CFD for the analysis of erosion caused by formation sand, as well as evaluation of conditions that could lead to the development of hydrates and wax. Typical projects include flow assurance assessments on downhole liners, and subsea equipment comprising valves, regulators and trees.

BMT has in-depth experience using CFD tools to evaluate different equipment designs, or compare performance for different operating regimes. Frequently in the design process of equipment, CFD is the only tool that can provide detailed performance information for hazardous operating conditions, such as in the presence of toxic materials and high pressure or temperature environments, where it is not feasible or safe to build full-scale physical models.

CFD is equally valuable when trouble-shooting existing installed equipment where it is not always possible to diagnose problems without having a complete understanding of the flow conditions affecting the equipment performance. Full scale CFD models can be constructed to provide clear and comprehensive flow visualizations that help you get to the root cause of problems quickly, and to test alternative solutions efficiently.