Wind tunnel testing

OIL & GAS CONSULTANCY SERVICES
Aerodynamics is an important aspect of the safe and reliable design of an offshore installation. BMT operate large in-house wind tunnel facilities to help designers assess wind loads, current loads, and the helideck wind environment.

Wind tunnel testing is widely used in the offshore industry to provide reliable high quality data for design as well as providing a method to quickly investigate remedial and mitigating measures should problems be identified. BMT own and operate a boundary layer wind tunnel that has a test section 4.8 m wide by 2.4 m high and reproduces wind-shear profiles to match the variation in full-scale wind speed with height over the open sea. The wind tunnel can accommodate models of any type of vessel from relatively small supply vessels to 50,000 tonne drilling platforms and 400m plus FPSOs.

Wind and current loads are fundamental design parameters necessary for the stability and structural design of an offshore facility as well as the mooring design. BMT provides consultancy services to accurately determine wind and current loads in support of all stages of the design. Physical and numerical modeling techniques are used to provide vital input to the design process that is accurate and timely.

Employing these methods helps to ensure that conservatism of load estimates that may be derived from analytical methods is reduced and therefore, the cost of the design is reduced. BMT have experience in providing load data for stability, mooring, towing and dynamic positioning.

**KEY SERVICES**

- Wind Loads
- Current Loads
- Helideck Wind Environment
- Pilot Workload Assessment
- Wind Pressures
- Stability and mooring load assessment
- Passenger and Crew Wind Comfort
- Desk-top reviews of platform/vessel concept design

**KEY BENEFITS**

- Assessment of complex vessel arrangements
- Early prediction of limitations on helideck availability
- Interactive working to solve problems quickly
- Identification of hazardous environmental condition for helicopter operators and pilots
- Reduce conservatism of mooring loads and hence price
- Optimization of tug requirements
- Minimise helideck downtime
- Experienced staff to advise on aerodynamics

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HELIDECK WIND ENVIRONMENT

It is inevitable that helidecks installed on the cramped decks of offshore production platforms and vessels will suffer to some degree from their proximity to tall and bulky structures and to gas turbine exhausts and flares. The environmental effects produced will often result in restrictions to helicopter operations, either in terms of payload, or perhaps completely prohibiting operations under certain meteorological conditions.

Pilots undertaking critical landing and take-off manoeuvres are faced with the potential of highly disturbed airflow just above the flight deck which can include severe wind-shear, down draughts and high levels of turbulence.

Pilots are also required to negotiate increased ambient temperatures due to hot exhaust gases particularly from gas turbine generators where release temperatures can be several hundred degrees above ambient.

BMT have been responsible for assessing the helideck wind environment for many offshore platforms and vessels over the last 20 years. Our experience was called on to play a key role in CAA and HSE research to enhance the safety of offshore helicopter operations and this has led to the development of the turbulence criterion for helideck wind flows.

Detailed models of offshore developments are constructed to ensure an accurate representation of the turbulent flow field above the helideck is generated.

High-resolution hot wire probe for measuring turbulence above the helideck

Our world-class wind tunnel facilities are perfectly suited to carrying out helideck wind environment assessments to help designers identify and mitigate hazardous conditions for helicopter operations and to also assess pilot workload.

Wind tunnel helideck assessments are aimed at minimizing helideck downtime and increasing the safety of helicopter operations.
WIND TUNNELS

BMT operates its own large in-house wind tunnel facilities that are supported through state-of-the-art instrumentation and data acquisition systems. The facilities are used to carry out comprehensive studies of steady and unsteady aerodynamic effects on large scale engineering structures.

BOUNDARY LAYER WIND TUNNEL FACILITY

The boundary layer wind tunnel is used for all wind and current load work as well as helideck wind environment work. The test section is large enough to accommodate offshore models with scales ranging between 1:100 to 1:300. The following gives the specifications of the tunnel and the instrumentation:

<table>
<thead>
<tr>
<th>Technical Specification</th>
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<tbody>
<tr>
<td>Type</td>
<td>Closed Circuit</td>
</tr>
<tr>
<td>Operational Wind Speed Range</td>
<td>0.5 m/s – 45 m/s</td>
</tr>
<tr>
<td>Test Section Dimensions</td>
<td>4.8 m wide × 2.4 m high × 15 m long</td>
</tr>
<tr>
<td>Turntable</td>
<td>Automated multiple plate 0.75 m / 2.4 m / 4.4 m</td>
</tr>
<tr>
<td>Traversing Gear</td>
<td>Automated 3 axis</td>
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</tbody>
</table>

INSTRUMENTATION

- 6-component dynamic balance system for unsteady high frequency force measurements
- 1152 channel simultaneous pressure scanning system
- Multi-channel displacement transducers and accelerometers for aeroelastic response measurement
- Dynamic spring / mass / eddy current damper rig for aeroelastic response measurements
- Multi-channel hot-wire and hot film anemometry systems
- Flow visualization facilities
- Digital video recording facilities
- Web-streaming of tests

AERONAUTICAL WIND TUNNEL FACILITY

The aeronautical wind tunnel can be used for a wide range of uniform flow applications including bluff body aerodynamics, bridge deck aerodynamics, and vehicle aerodynamics. Common Oil & Gas applications are aerodynamics loading on stacks and vortex shedding assessments.

<table>
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<tbody>
<tr>
<td>Type</td>
<td>Closed Circuit</td>
</tr>
<tr>
<td>Operational Wind Speed Range</td>
<td>0.5 m/s – 65 m/s</td>
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<tr>
<td>Test Section Dimensions</td>
<td>Octagonal 2.7 m wide × 2.1 m high</td>
</tr>
<tr>
<td>Turntable</td>
<td>0.75 m</td>
</tr>
<tr>
<td>Traversing Gear</td>
<td>Various variable geometry</td>
</tr>
</tbody>
</table>

INSTRUMENTATION

- 6-component dynamic force balance system for unsteady load measurements
- Multi-channel hot-wire and hot film anemometry systems
- Flow visualization facilities
- Digital video recording facilities
- Web-streaming of tests