Operational simulation

OIL & GAS CONSULTANCY SERVICES
Operational Simulation is used to investigate the operational and economic performance of a development. BMT’s SLOOP software was written specifically for this task.

Operational Simulation is the high level numerical modelling of an operation or process in time, that is used to collect statistics of expected performance, investigate sensitivities, and optimize designs. Since Oil & Gas operations are complicated by many interacting factors, operational simulation is an ideal tool to use to estimate expected performance and likely variability. It is commonly used in pre-construction phases of a project and for life extension projects.

One of the key features that BMT’s SLOOP operational simulation software is designed to model is the impact of the weather. The weather and ocean conditions affect almost all offshore operations and can significantly extend operation times, increase risk and reduce production rates if poor decisions are made without considering its impact. SLOOP has powerful features for investigating the influence of the met-ocean environment on the development and/or operation of a field. Wind, waves, currents, ice or any other property that can be represented by either a continuously varying value, or by a number of discrete states, may be modelled.

SLOOP works by constructing a model of an Oil & Gas field or process and then simulating the operation over time. The simulation is repeated many times using different environment records. Other random events such as equipment failure, resource availability, and vessel delays may also be included in the model. After the simulations are complete, statistical data can then be analysed for all aspects of the simulation. Simulation results can also be directly interfaced into field economic models.

SLOOP can simulate a complete development or just selected aspects of the operation. Additionally, simulations can be ‘snapshots’ of a particular point in the life of the project, or can represent the complete lifetime starting from the initial development. The flexibility of the software means that any aspect or time period of an operation can be assessed.

The “crystal ball” power of SLOOP has helped many of our clients identify economic opportunities through risk minimization that were not obvious even to the most experienced personnel. This observation has resulted in several major oil companies acquiring SLOOP themselves for their concept stage planning of fields. Many of our clients prefer to benefit from our experience and ask BMT to carry out the SLOOP modelling on their behalf. In these cases, we work closely with the project team to ensure all the relevant stakeholders are considered and results delivered are clear, informative and beneficial to the project.

TYPICAL APPLICATIONS

SLOOP can be applied to an almost limitless array of operational assessments because of the software’s versatility. However, some of the more common applications are as follows:

- Platform installation
- Drilling operations
- Vessel spot-hire arrangements
- Shuttle tanker operations
- Planning of production system outages and maintenance
- Intervention and subsea maintenance tasks
- System reliability and weather dependence
- Berth availability
- Offshore & onshore storage capacity optimization

KEY BENEFITS

- Productivity and downtime of a new or modified development
- Influence of weather limitations on the performance of the system as a whole
- Weather limits on loading or discharge
- Weather effects on transit times
- Assess contractual delivery obligations
- Sensitivity of operational performance to uncertainties
- Select robust strategies that deliver high net present value at an acceptable level of financial risk

THE SLOOP SOFTWARE

SLOOP owes much of its development to a Joint Industry Project back in the late 90s sponsored by some of the worlds major Oil & Gas companies such as BP, Conoco, Mobil, Statoil and Total. BMT has continued the development of the software since then to its present form of a mature tool capable of performing a great variety of operational simulation tasks.

SLOOP simulations are defined using its own language called “SAIL” (SLOOP Abstract Input Language). As with many versatile and powerful software tools, a custom language allows the user to have complete control of the simulations and a transparent view of all the details that make up a simulation. However, the user can also opt to use a graphical user interface (GUI) to construct simulations based on supplied templates for a fast and efficient turnaround.

The results of the simulations are stored in a generic database. SLOOP provides tools to explore this database such as report generators and animation tools that help you examine the data efficiently and effectively. The animation tool lets you quickly visualize a simulation set up and identify any anomalies. It is also a great tool to demonstrate a field concept in operation to the project stakeholders.

The SLOOP GUI interface provides a model maker for easy input of data

The SLOOP Animation Module used to visualize your development in operation
APPLICATION EXAMPLES

OFFSHORE DRILLING OPERATIONS
- Estimate drilling time and cost, including likely variability
- Select most appropriate drilling vessels
- Select most appropriate drilling strategy
- Compare different drilling technologies, and justify choice

OFFSHORE OIL AND GAS FIELD OPERATIONS
- Evaluate, compare and optimise concepts
- Maximise NPV
- Estimate average production efficiency and revenue, and natural variability (random and seasonal)
- Develop and optimise subsea intervention strategies
- Assess impact of component reliability on overall system performance
- Ensure vessel specifications fits the need
- Test and refine operating strategies

OIL AND GAS TRANSPORTATION
- Crude and refined oil, LNG, LPG and CNG transportation
- Inform ship design - optimise for route and trade
- Loading / Discharge system specification - minimise downtime (for exposed location terminals)
- Optimise shore terminal facilities - berths, storage, process, liquefaction, regasification etc.
- Inform long-term charter negotiations
- Optimise transport to production and market
- Track failures to meet delivery obligations

FIELD INSTALLATION & DEVELOPMENT OPERATIONS
- Initial Field Installation and Facilities Upgrade
- Determine likely range of installation times.
- Investigate variation of time/cost with season of the year
- Assess risk of weather-induced failure during installation

FINANCIAL MODELLING
- SLOOP interfaces to spreadsheet financial models through a flexible report generator
- Revenue is calculated from oil/condensate/gas delivered
- Variable costs are calculated from drill rig/vessel charter days, demurrage, repair frequencies etc.
- Costs can include penalties for failure to deliver against contractual schedule obligations
- Calculate net revenue per annum (P10, P50, P90) in snapshot mode
- Calculate NPV and cash flow in field life mode

EXPERIENCE
BMT has built up an impressive list of projects over the years since the first version of SLOOP was released. A sample list of some of the projects where SLOOP simulation techniques have been used to support strategic planning for offshore developments is shown below.

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For more details see the SLOOP website at [www.sloop2.co.uk](http://www.sloop2.co.uk)
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