
The Hibernia oil platform.

Microclimate forecasts assist drill operations

The capability to accurately forecast the weather down to a 100-200 m window is assisting in the scheduling of heavy lift and other weather-sensitive operations for the Hebron Project in St John's, Newfoundland, Canada, observes writer and communications consultant Andrew Safer.

The Hebron oil field is located offshore Newfoundland and Labrador in the Jeanne d'Arc Basin, some 350 km southeast of the Newfoundland capital of St John's. It is estimated that the site contains between 660 million and 1.1 billion barrels of recoverable crude oil.

The Hebron field will be developed using a standalone reinforced concrete gravity-based structure (GBS) designed to withstand sea ice, icebergs, and extreme meteorological and oceanographic conditions.

Cranes, jacks and self-propelled modular transporters will be used in the construction, assembly, integration and eventual tow-out of the massive GBS and its topsides over the next four years at the Bull Arm primary construction site.

Keeping a careful weather eye on the whole process is a microclimate forecasting system developed by AMEC of St John's, Newfoundland. This focuses on the wind and sea states, as well as the currents and water levels, which are variable in the fjord-like Bull Arm location due to wind and water interaction (seiche effect). The forecasting system uses computational fluid dynamics techniques based on a digital elevation model to generate high-resolution weather forecasts.

"Most places are content to forecast with a mesoscale resolution of 2.5 km," said Terry Bullock, AMEC weather centre manager. "We have pushed it down to 100 m for diagnostic analysis and 200 m for applications in the operational setting."

He added that microscale modelling is typically used for design and analysis, and that using it for operational forecasting is in its infancy.

> **Most places are content to forecast with a mesoscale resolution of 2.5 km. We have pushed it down to... 200 m for applications in the operational setting.**
>
> – Terry Bullock, AMEC

Bullock was involved in the provision of weather forecasting services at the Bull Arm site for the Hibernia Project in the 1990s. He explained that the topography at Bull Arm causes localised weather variations over short distances. Steep hills on both sides of the water cause the wind to channel down the valleys. Atmospheric stability conditions determine whether the wind reaches the site.

"These funnelling effects would not be captured in large-scale atmospheric modelling," said Bullock. He pointed out that a sea breeze is one weather event that can affect heavy lift operations.

"When a module is being lifted by a crane," noted Bullock, "as it gets higher, the centre of gravity keeps getting higher and it becomes more unstable." A sea breeze of 15 km per hour is sufficient to halt operations.

Shift change

When the Sea Rose floating storage, production and offloading vessel was being fabricated in Marystown, Newfoundland, Bullock recalled that the work shift was changed to night time hours to capitalise on the acceptable weather window during that time.

"They completed the work ahead of time and saved millions of dollars by working with mother nature," he reported. For the Hebron Project, Bullock's 25-person team provides short and extended forecasts in support of schedule maintenance. "You do not make money waiting on the weather," he said. Heavy lift operations are scheduled to begin at Bull Arm in 2014.

High-resolution forecasting was unheard of 15 to 20 years ago when the Hibernia GBS was being built, observed Bullock. The difference between then and now is a massive increase in computer processing power. In the 1990s, the 400-processor computer cluster AMEC used to run high-resolution atmospheric models would only have been available to large government agencies. "Over the past five years," Bullock said, "our computing resources have increased by a factor of 25 due to advances in technology."

He added that the next step-change will involve the use of graphics processing units (GPUs) that have evolved from the gaming industry, and projects a hundredfold increase in computing power over the next five years. HLPFI