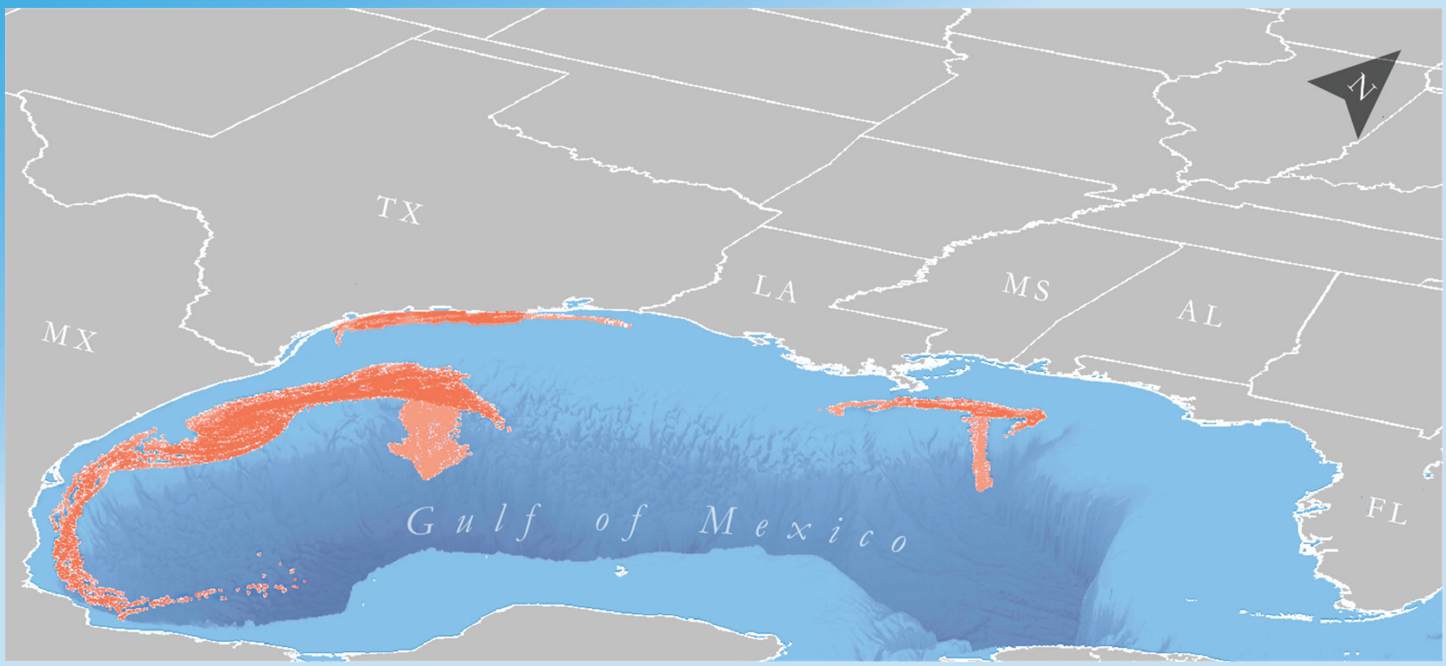
NETL'S BLOWOUT AND SPILL OCCURRENCE MODEL (BLOSOM)



NATIONAL ENERGY TECHNOLOGY LABORATORY

BACKGROUND

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) has created an integrated data and modeling system to support DOE's objective to produce science-based evaluations of engineered and natural systems to ensure sustainable, environmentally responsible access to domestic resources, and help prevent future hydrocarbon spills.

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The Blowout and Spill Occurrence Model (BLOSOM) is an integrated system designed to simulate offshore oil spills resulting from deepwater (>500 feet) and ultra-deepwater (>5,000 feet) well blowouts. BLOSOM assists with risk assessment and can help to prevent future hydrocarbon spills. In addition, BLOSOM serves as a comprehensive tool for response planning. BLOSOM is part of NETL's broader integrated risk assessment and spill prevention research effort in the Offshore Energy Resources research portfolio, which is focused on developing a scientific base for reducing and quantifying potential risks associated with exploration and production in extreme offshore environments.

PROJECT DESCRIPTION

BLOSOM offers a flexible suite of modeling modules designed to work together as a single system to assess the multiple environmental uncertainties associated with deepwater and ultra-deepwater environments, blowouts, and spills. All components are designed to be explicitly three dimensional and use equations best suited for high-pressure environments while maintaining the flexibility to operate with limited or highly uncertain data.

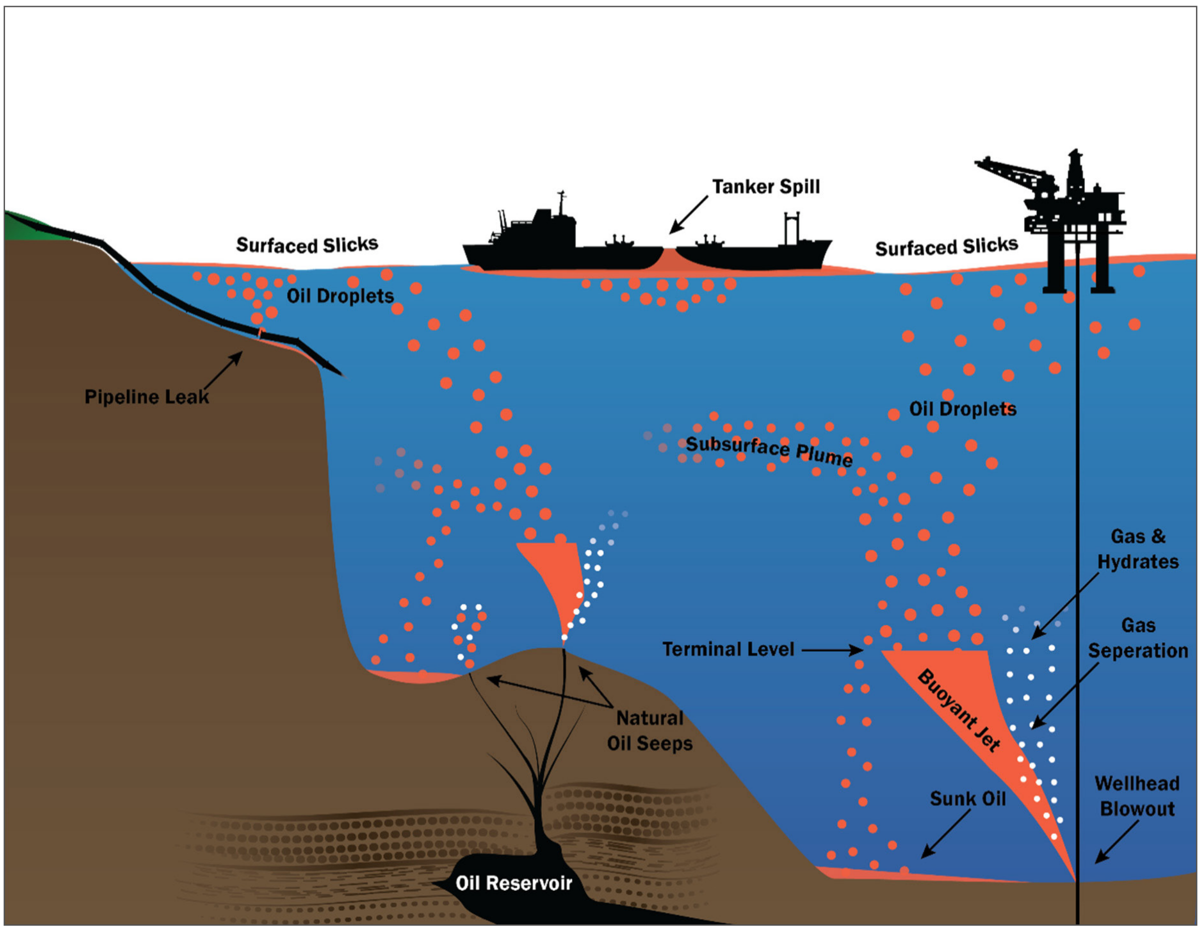

Figure 1. A hypothetical marine cross-section displaying BLOSOMs capabilities, including the simulation of uncontrolled hydrocarbon release events, such as surface spills and subsurface blowouts, throughout the water column.

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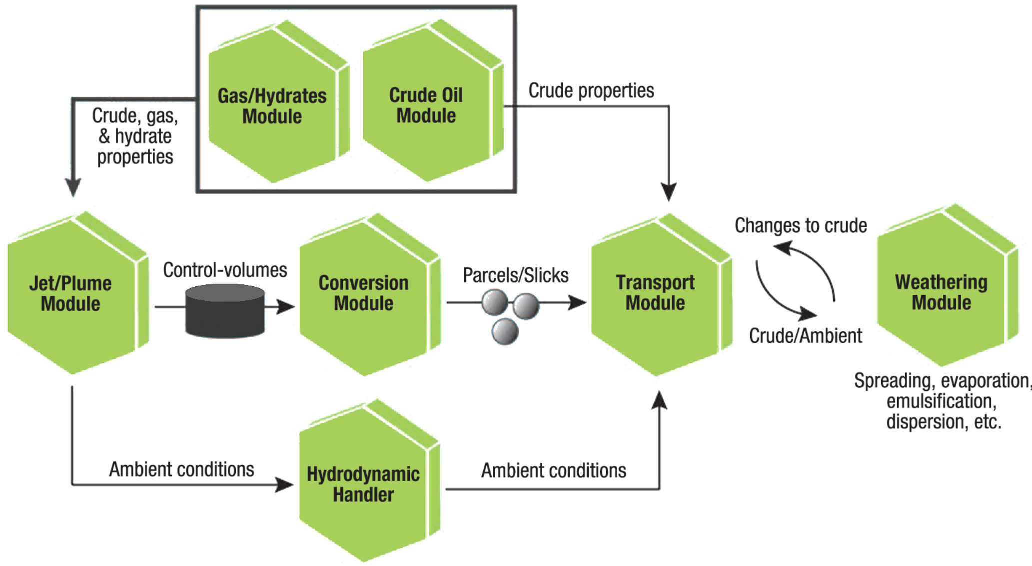

Figure 2. Interaction diagram of BLOSOM's simulated processing modules.

BLOSOM incorporates into one tool the capabilities of several modules:

- **Jet/Plume Module** simulates the initial oil and gas jet rising from the wellhead during an underwater blowout discharge. This module tracks the blowout's physical properties, including the crude oil, gases, and water within a conceptual control volume, until it reaches a terminal level at which point the plume is converted into individual oil particles.

- **Transport Module** simulates the long-term fate and transport of the spill. Beaching and sinking events are also monitored. Surface spills can be simulated using the Transport Module.

- **Conversion Module** transfers elements from the Jet/Plume and Transport modules and amalgamates the two contrasting approaches in each, while converting control volumes of mixed fluids into particles. This model also appropriately distributes oil droplet sizes to best capture subsurface plume formation, optionally simulating the direct application of dispersants at the source of the blowout (a practiced impact mitigation technique).

- **Weathering Module** simulates oil weathering and degradation processes, including spreading, evaporation, emulsification, and dispersion. Other processes, such as biodegradation, dissolution, photolysis, sedimentation, and surface application of dispersants are planned for future incorporation.

- **Crude Oil Module** simulates changes to the oil's physical and chemical properties in high-pressure environments like the deep ocean. This module also simulates changes to the oil due to degradation using a pseudo-components approach. The components may be built with detailed crude information or interpolated from more readily obtainable crude assay data.

- **Gas/Hydrates Module** simulates gas properties, dissolution, and the formation and decomposition of hydrates for a variety of gases that may be present in an oil or gas well blowout.

- **Hydrodynamic Handler** handles ocean data for use in the other modules and is capable of providing its own correlations and interpolations from the available data. It is designed to be flexible with multiple file formats and output types.

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This comprehensive suite of tools is designed to track an oil spill anywhere in the water column and follow the fate of the hydrocarbon until beaching, sinking, or complete degradation.

ACTIVITIES

In 2014, BLOSOM participated in a model intercomparison study on plume dynamics and droplet sizes, particularly in the presence of dispersants, hosted and led by the American Petroleum Institute (API). The effort evaluated a wide variety of blowout modelers to determine the strengths of each model and identify areas of larger uncertainties.[1]

As of 2017 BLOSOM is being integrated into a web-accessible common operating platform (COP), which will allow a number of simulation tools to be run in combination with one another to assist with oil spill prevention activities. Other existing NETL risk assessment tools to be incorporated with the COP include Spatially Weighted Impact Model (SWIM), Cumulative Spatial Impact Layers (CSIL), and Variable Grid Method (VGM).

BENEFITS

BLOSOM complements NETL's existing Offshore capabilities, enhances several other NETL oil spill risk assessment tools, and aids in risk assessment and response planning in deepwater and ultra-deepwater conditions. Ultimately, BLOSOM helps to predict, assess, and prevent well blowouts in these challenging environments.

ENERGY DATA EXCHANGE

Energy Data eXchange (EDX) is NETL's online collection of data and tools, including the BLOSOM website. EDX contains information on the tools' backgrounds, relevant resources, publications, presentations, and tutorials. In addition, the BLOSOM EDX website provides news and media sources that have featured BLOSOM, including *E&P Magazine* and *Offshore Technology Focus.*

For more information on BLOSOM's background, capabilities, and accomplishments, check out the BLOSOM EDX page using the URL or QR Code below.

edx.netl.doe.gov/blosom/

[1] This work was published in a paper, "Intercomparison of Oil Spill Prediction Models for Accidental Blowout Scenarios with and without Subsea Chemical Dispersant Injection." *Marine Pollution Bulletin* 2015, 96, 110–126.

Partners

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