In the past decade, the need for complex reservoir studies has escalated due to increased energy demands and the depletion of easy-to-produce oil. Planning the optimal development of a reservoir is more critical than ever to reduce field costs and maximize production, and it requires accurate models for both the history matching and prediction phases of reservoir simulation workflows. Reservoir engineers now must assess the deliverability of hydrocarbons from one or more reservoirs to the point of sale. This requires engineers to model not only the flow within the reservoir to the wells, but also the flow through the surface. The effect of pressure feedback on the reservoir caused by the surface facilities can only be captured accurately by modeling the reservoir, wells and surface facilities as a single integrated system. Poor development plans and sub-optimal production are the results of ignoring pressure feedback during simulation prediction runs.

Nexus® next-generation reservoir simulation software provides users the integrated modeling tool needed to solve today’s challenging problems. Reservoirs, wells, and surface facilities can be included in Nexus models at the level of detail required to understand the behavior of the asset. The flow models are coupled across the surface and subsurface with an implicit pressure solution, ensuring a robust and accurate accounting of physical effects within a single application. Competing solutions use multiple applications that are loosely coupled; this limits their performance and stability.

Recent improvements in algorithms and physical modeling techniques included in Nexus software provide significant performance improvements over prior generation reservoir simulators. With its combination of speed, accuracy, and usability, Nexus software gives reservoir engineers a single tool that can solve their most challenging field management problems—while remaining easy to use for everyday work like reserves estimation.
BENEFITS

Optimize hydrocarbon delivery to the sales point
In deepwater reservoirs, where the platform might be miles away from the wells, the risers and platform facilities can constrain production to levels significantly below what the wells themselves could produce. For this reason, flow assurance is a key influence on proper field planning. The integrated surface/subsurface predictions provided by Nexus software allow engineers to design development plans for deepwater assets that ensure optimal facilities design.

Identify bottlenecks in multi-field shared facilities
When independent reservoir units are coupled through shared surface facilities, each of these units influences the production of the others. Nexus software treats the reservoirs and facilities as a single entity and determines the pressure distribution throughout the model in an implicit fashion, giving the highest accuracy solution in a robust manner. The multi-reservoir capability in Nexus software allows the individual reservoirs to be modeled independently, with the multi-reservoir case using the same reservoir input data as the individual cases—only the shared surface facilities need to be added to the multi-reservoir input. The reservoir engineer can then optimize the multi-reservoir model by modifying surface network configurations that inhibit production.

Increased scenario exploration or reduced time to decision: user’s choice
The ease with which a Nexus software user can build and run a parallel simulation model greatly decreases the time to solution for the reservoir model, as does the software’s improved performance relative to previous generations of reservoir simulators. Customer workflows that previously required overnight computing are often completed in an hour or less. Users and asset managers can either propose a solution to a reservoir production problem in less time or expand the scope of the scenarios explored by their simulation engineers without extending a project’s time to decision.
FEATURES

Surface-subsurface coupled simulation
Nexus software solves the surface network equations simultaneously with the subsurface equations as a part of the same system. This tightly coupled approach is unique in the industry and provides a more accurate representation of the total asset while improving robustness and performance. The Nexus® SurfNet™ software provides a schematic view of the surface network, allowing users to validate their network structure and analyze the simulated results from Nexus software. This analysis can include history matching comparisons to observed data and determination of flow bottlenecks in prediction runs.

Complex well modeling
The Nexus surface facilities algorithms extend into wellbores, providing accurate determination of flow within even the most complex wellbores. Branched wellbores, tubing-and-annulus configurations, and downhole control devices such as Inflow Control Devices (ICD) and Inflow Control Valves (ICV) can easily be created in a Nexus model. The well’s interaction with the reservoir is accurately determined due to the implicit coupling of the surface facilities model with the reservoir model.
Multi-reservoir simulation
The Nexus simulator allows users to combine several independent reservoirs with a common surface network (for example, an offshore production platform), while maintaining the integrity of the individual models. This enables asset teams to divide the reservoir modeling work among multiple engineers, each of whom is responsible for a particular reservoir unit. Input describing the shared surface network is added to the collection of individual reservoir models without altering the individual model input files, ensuring that the models that arise from matching the histories of the individual reservoirs are exactly replicated in the multi-reservoir model.

Data integration with Earth Modeling
Nexus software uses the same grid data format as the Landmark DecisionSpace® Earth Modeling software, so grids from DecisionSpace® Geosciences can be used without requiring an import process. Both DecisionSpace Earth Modeling and the SimConvert™ modeling, a part of the Nexus software package, allow users to import grids from a variety of other earth modeling packages, using the RESCUE format, which is then converted into the Landmark native grid format. The Nexus grid arrays computed during simulation can be directly read by the DecisionSpace Geoscience software, so users can see the simulated flow overlaid atop the earth model grid.
**Fast and scalable performance**

Nexus software provides a stable and robust solution with almost no tuning required. Black oil simulations often run three or more times faster than other industry simulators. The performance of Nexus software enables users to run many more scenarios for asset development, helping them to find the optimal exploitation plan without extending the asset team’s time to decision.

![Intelligent upscaling using PowerGrid™ software.](image)

**Intelligent upscaling**

PowerGrid™ software, included in the Nexus software installation but licensed separately, applies gridding and upscaling techniques to earth models, generating grids which are ideal for fast reservoir simulation and still maintain important geologic features. Local grid refinements can be created around wellbores, faults, and channels, to determine the flow behavior in high resolution in those areas where rapid changes are expected. The upscaling algorithms in PowerGrid software are implemented in Landmark’s DecisionSpace® Earth Modeling software, which enables engineers and geoscientists to collaborate as they design simulation grids which accurately capture geology without sacrificing simulation performance.
Streamlines and allocation factors
Nexus® StreamCalc™ software, included in the Nexus software installation but licensed separately, is a streamline analysis module that computes streamlines based upon a full-physics Nexus simulation run. Unlike streamline simulation, the methods used in the StreamCalc application do not require simplifications that reduce the accuracy of the predicted flow. StreamCalc software can be used to determine the sweep efficiency of an injection pattern, to compute the flow between injector-producer pairs, and to understand recovery mechanisms. Users can view the resulting streamlines in either the Nexus View or DecisionSpace Geoscience applications and, based on their analysis, make recommendations to modify injection rates or the composition of injected fluids to optimize the volumetric sweep of injected fluids and maximize oil production.

Streamline visualization and analysis with StreamCalc™ module.
System and Software

SOFTWARE REQUIREMENTS

RedHat® Enterprise Linux® Workstation 5.3 (or later 5.x or 6.x versions), 64-bit

Windows® 7, 64-bit

OpenText® Exceed®/Exceed 3D™ 14 recommended on Windows

Usability

The Nexus® SimDataStudio™ application, included in the Nexus software installation but licensed separately, provides a graphical user interface through which both simple and complex models can be created. Grid-based data, table data, and surface network configurations can all be built within the software or imported from files. Users can import well trajectories from DecisionSpace Well Planning software or from earth models created in DecisionSpace Geoscience software and perforate the wells in the gridblocks they intersect. SimDataStudio software also converts VIP® simulation models to Nexus models.

Post-processing tools in the Nexus suite include Nexus SurfNet and Nexus View applications, as well as SimResults™ software, which can provide 2D plots of time dependent data and 3D display of grid-based arrays. All the pre- and post-processing applications included in a full Nexus installation can be invoked from the Nexus Desktop application. Users also can submit Nexus simulation jobs from the Nexus Desktop application, and specify whether the model should be run on the local workstation, or on a back-office cluster.
Nexus software helps oil and gas companies to maximize the long-term value of their reservoirs by enabling reservoir engineers to make better field development decisions more quickly. Nexus software is the only commercially available reservoir simulation software that can model oil and gas production from the reservoir pore space through the surface facilities to the point of sale.

*Landmark offers solutions to help you deliver on your business strategies. For questions or to contact your Landmark representative, visit us at www.landmark.solutions.*