EMERSON™

SeisEarth

Multi-survey Regional to Prospect Interpretation

SeisEarth

Fast and accurate interpretation, from regional to reservoir

We've been experimenting with the newest version of SeisEarth for some time now. The intuitive nature of the user interface has made it very easy to learn and use. We're especially enjoying the customization features that make it easy to save special toolbars for specific workflow needs.

▲ SeisEarth Section

Keeping Up with the Massive Growth in Data

Seismic interpretation in the 21st century requires the same attention to detail, assessment of anomalies and artifacts, and accurate tracking of horizons and faults, as it did years ago. The great change has been in the sheer volume of data that geoscientists are expected to study on a routine basis to provide information leading to successful drilling targets. A modern dataset comprises tens of thousands of 2D sections, numerous 3D surveys, many vintages, attributes, inversion results and prestack data – all of which must be pulled together to produce a reliable set of maps or a detailed subsurface model, calibrated to existing well data.

As the leading technological innovator in the industry, Emerson's E&P Software business has continuously responded to the evolution in data size and diversity. In the SeisEarth™ multi-survey, regional-to-prospect interpretation and visualization suite, Emerson offers a next-generation solution that provides a unique and comprehensive approach to data handling, display, interpretation and mapping.

Working in close collaboration with major energy corporations around the globe, SeisEarth has been designed to address
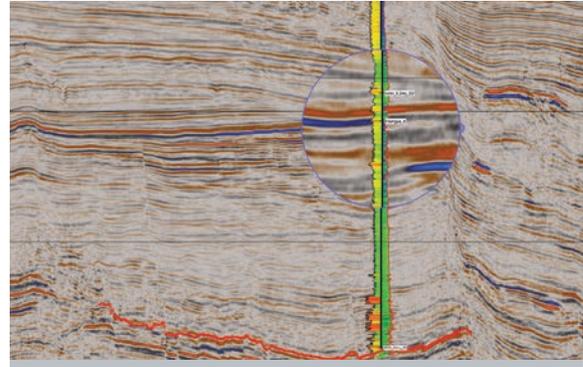
the toughest challenges faced by today's interpreters. In comparative evaluations, users have been uniformly impressed by the technical capabilities of SeisEarth and the clear advantages of a system designed for ease of use and high productivity.

The Ideal Tool for Every Interpretation Job

SeisEarth is a powerful yet flexible interpretation system for projects with single or multiple 2D and 3D seismic surveys and multiple well databases. Its complete scalability allows geoscientists to conduct their interpretation activities in a regional framework, scaling from basin to prospect and reservoir, from exploration to development, and from a single user on a laptop to multi-disciplinary teams of geoscientists, petrophysicists and drilling engineers. It is built to deal with very large seismic surveys, through the use of efficient volume roaming, automatic picking, and high levels of interactivity.

Geobody Interpretation

SeisEarth users have direct access to geobody detection technology using new sub-volume detection workflows, as well as through a seamless connection to VoxelGeo.
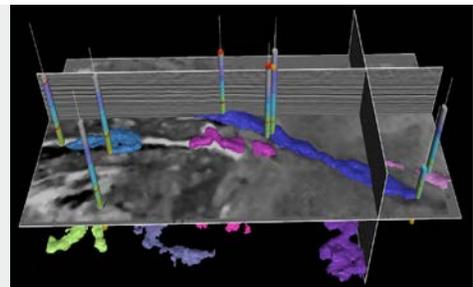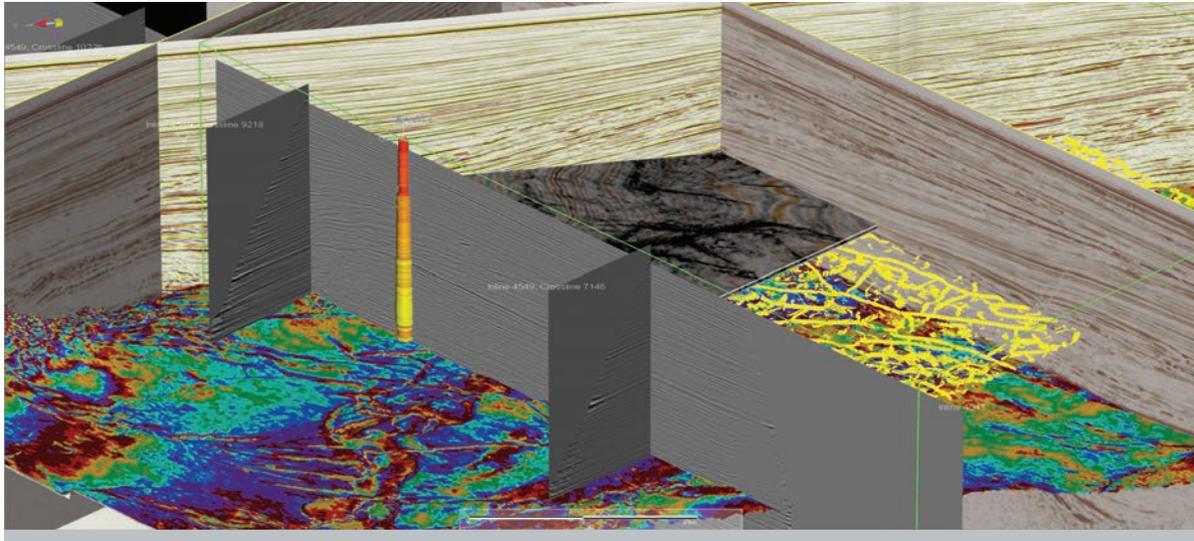
▲ SeisEarth 3D Canvas

A Modern Design for a New Generation

SeisEarth has been designed to work with modern workstations, in which high-speed 3D graphics, very large memory, and multiple CPUs, GPUs and cores are the norm. Multiple 2D sections and 3D surveys, wells and their logs, horizons, faults, T-surfaces and many other data objects all display interactively. Section, map and 3D views share the same data, enabling the user to choose the best views for the task at hand. Standard interpretation tools such as horizon flattening and correlation polygons are available in both 2D and 3D environments.

Accessibility and collaboration are optimized through support for SeisEarth running on the Cloud. This gives users another way to access the application, and makes it easier than ever for remote teams to work together.

Easy Usability, Low Learning Curve

A simple, intuitive user interface and a highly ergonomic design make SeisEarth easy to learn and even easier to use. The interactivity and consistency of use between the main system viewers accelerate the interpretation process and enable interpreters to easily perform comprehensive analyses involving many datasets. Contextual menus, object identification and pie menus minimize button clicks and hand movements, reducing user fatigue and stress.

Machine Learning Boosts Interpretation Confidence

Emerson E&P Software is a pioneer in implementing advanced, proven and reliable machine learning solutions, that can process and integrate huge amounts of information which cannot be completed in a reasonable amount of time, if at all, using traditional methods.

Embedded add-ons to SeisEarth include state-of-the-art machine learning-based technologies in automated, guided workflows, that include:

- An unsupervised and semi- supervised waveform classification algorithm that excels at pattern recognition, for seismic facies analysis.

- A supervised rock type classification algorithm that finds relationships between facies defined at wells and seismic data (prestack, poststack and attributes) to create facies volumes and their probability of occurrence.

- Attribute clustering: An unsupervised classification algorithm for prestack, poststack and attribute seismic data that can be used to calculate facies volumes, do AVO analysis or identify anomalies in the data.

Seismic Facies Classification / Rock Type Prediction / Attribute Clustering

Advanced machine learning methodologies for seismic facies interpretation, rock property prediction, and attribute clustering analysis are available to SeisEarth users through embedded guided workflows, as well as through a seamless connection to Stratimagic.
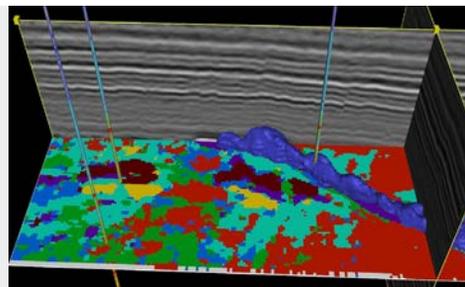
We are using the Seismic Propagator on new and old 3D surveys to map events in a significantly shorter time than using more conventional tools. The power and accuracy of the Propagator's correlation-based event tracker, along with the visualization capabilities of SeisEarth, make a powerful combination and significantly reduce the time needed to understand an area and identify prospective features. It would be very inefficient to attack a new large 3D survey without these tools.
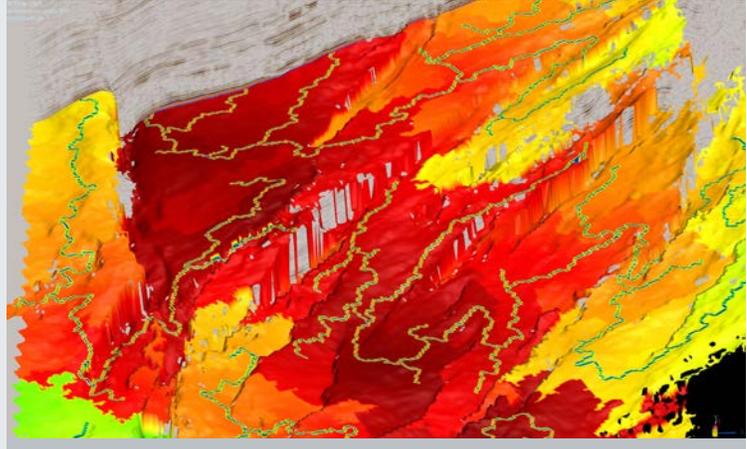
▲ Seismic Propagator

Guided, Repeatable Workflows Enhance Interpretation Productivity

Taking advantage of the SeisEarth integrated platform, guided workflows take the user step-by-step through data selection, process parameterization, and result display. Saved workflows enable auditability and repeatability. Examples of embedded workflows include:

- Subvolume detection, including geobody detection and data sculpting, for advanced stratigraphic interpretation.

- Automated attribute workflows for Dip Steered Enhancement (dip controlled lateral smoothing filter) and Spectral Decomposition, with previews in 3D Canvas for parameter validation.

Efficient Data Management

Every interpretation project starts with the task of collecting all the relevant seismic, well positioning and cultural data. The Epos™ data management and interoperability framework enables data loading and export in industry-standard data formats, and also offers connectivity to different proprietary and third-party databases, such as Petrel (*a mark of Schlumberger*), OpenWorks®, GeoFrame®, RESQML and Recall™, so that projects can be started quickly with only minimal preparation. Time that used to be wasted searching and copying data can now be dedicated to the interpretation process. The WAM Epos browser can be used to browse multiple Epos and third-party databases, and locate relevant data.

A Framework for Secure and Effective Collaboration

SeisEarth offers full support for simultaneous multi-user interpretation and data sharing. Regional projects can be created using seismic data and interpretation from many smaller surveys, directly, with no need to create copies.

Alternatively, independent interpretation teams throughout the organization can choose to share seismic and well data while maintaining separate interpretation databases. Users are able to work in a secure environment with different levels and granularities of data access control.

Automated Picking Tools Deliver Superior Results with Minimal Effort

The Seismic Propagator, the best event tracker in the industry, operates on both 3D volumes and 2D sections. Its accurate waveform tracking algorithm produces reliable results quickly, avoiding the need for extensive user editing. The combination of user control and automation offers the optimal mix to
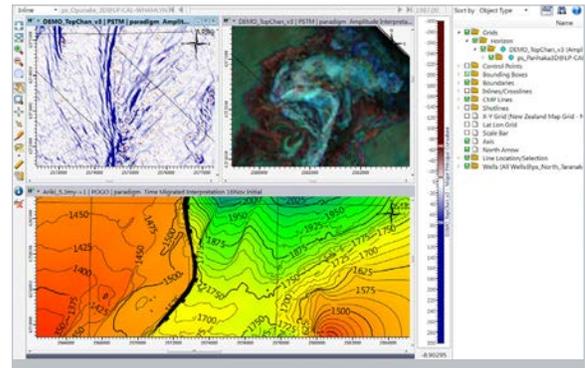
▲ Multi-panel, multi-attribute

Seismic Illumination Viewing - Illuminator

The Illuminator is a collection of tools aimed at improving understanding of interpreted data. Launched from the SeisEarth 3D Canvas window, it uses an advanced, interactive ray tracing technology that highlights problems in subsurface illumination caused by model complexity and insufficient acquisition data, and provides information about the quality of the migrated seismic image. The results are displayed in a clear visual manner.
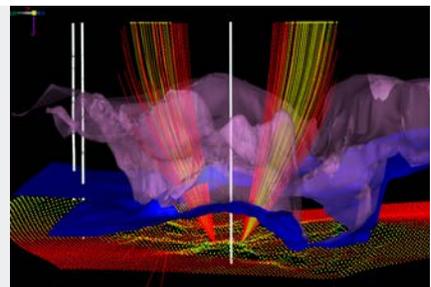
Our innovation has a purpose. We focus on delivering improved accuracy, greater productivity, more comprehensive insight into data, and better visualization capabilities.

the interpreter. Other advanced automation tools, such as FaultTrak™ and Automatic Fault Extraction (AFE), facilitate the interpretation of surveys containing complex faulting with minimal manual effort.

Embedded Voxel Rendering in a Common Interpretation Canvas

Voxel rendering technology is directly embedded in SeisEarth 3D Canvas. Through the use of graphics processing units (GPU's) where hundreds of cores are deployed to carry out seismic volume rendering, this enhanced visualization process removes artifacts, revealing subtle details of the actual geology while dramatically accelerating refresh speed. By deploying this technology in the 3D Canvas, interpreters are able to conveniently carry out regional-to-prospect scale interpretation activities without the need to move from one application to another.

Convenient Time-to-Depth Conversion

SeisEarth includes a collection of useful tools for performing time-to-depth conversion. 2D/3D seismic, interpretation and well data can be scaled from different surveys and well databases belonging to a project, in a single action. SeisEarth enables the creation of multiple velocity models, based on input from a variety of velocity sources, including well and seismic velocities. The user may then choose a preferred model for the scaling.

▲ Crossplot

Advanced Mapping

In SeisEarth, the outcome of every interpretation project is a quality map, with rich capabilities for gridding, contouring and analyzing anomalies. The BaseMap visualization window is central to any interpretation session. It may be configured with multiple panels in one window, and supports posting of line and well locations with associated interpretations for multiple seismic surveys and well databases. A dynamic, interactive plotting preview utility makes it easy to create high-quality hard copies.

Unique Seismic-to-Well Calibration

Dedicated workflows are available in the main visualization window for synthetic modeling in time or depth. Multi-attribute seismic and synthetics are automatically matched with one mouse click. Comprehensive calibration capabilities include zero and non-zero offset elastic modeling for generating synthetic seismograms and synthetic gathers, with multi-well processing capabilities and easy-to-use QC calibration tools.

Well Log and Seismic Data Crossplotting

SeisEarth contains an easy-to-use crossplot utility with sophisticated capabilities for multi-data analysis and integration.

▲ SeisEarth BaseMap mapping window

QSI for Interpreters

The integration of early Quantitative Seismic Interpretation (QSI) tools into SeisEarth is one of the most effective methods for reducing uncertainty in the long term. This integrated offering provides a way to interpret prestack data and run quantitative seismic interpretation, in order to characterize reservoirs while interpreting.
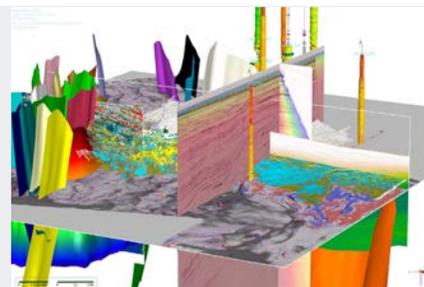
▲ Display in 3D Canvas of prestack and poststack data

A growing number of national and international energy companies are adopting Emerson's E&P Software business as their subsurface software provider of choice. Their main motivation is to obtain more information out of existing data, and more confidence in their understanding of their prospects and reservoirs. The outcome is measurable: Fewer and better wells are drilled.

The Crossplot tool includes advanced features for analyzing data in crossplot space and for interaction between the crossplot and data spaces. These interactions are facilitated and enhanced by a variety of crossplot color coding schemes, which are designed to analyze multi-attribute data, and to integrate different data types, such as seismic and well data, in crossplot space.

Extensive Multi-Attribute Capabilities

Seismic attributes can be calculated in batch or on-the-fly, in order to perform rapid investigation of geological features. The unique multi-attribute environment in SeisEarth includes many advanced capabilities for performing attribute visualization and interpretation, including blending, merging, comparing and crossplotting. Together, they enable the interpreter to extract more value from data. Advanced spectral analysis tools further enrich the data analysis process.

Integrated Inversion

Inversion, which has traditionally been performed by experts using dedicated tools, is fully accessible to interpreters through its integration with SeisEarth. Interpreters can choose from a broad offering, depending on the scope of their analysis. The selection includes a fast colored inversion and a poststack amplitude inversion for creating acoustic or elastic impedance volumes. For detailed analysis, a simultaneous prestack inversion is also available, which can produce a broad set of attributes, including P and S impedances, elastic impedance, $\lambda*\rho$ and $\mu*\rho$, Poisson's Ratio, and density. It has a wide range of preconditioning tools for on-the-fly enhancement of input data quality, as well as tools and QC to help optimize preconditioning and inversion parameters. Machine learning inversion technology is also available for estimating log properties from seismic data away from the wellbore.

Interpreting Prestack Data in a Poststack Environment

SeisEarth offers easy-to-use capabilities for fast access and visualization of prestack data, in the standard poststack interpretation environment. The interpreter can view multiple gathers and lines in a 3D perspective, adding new information into the interpretation workflow and optimizing the QC process.

A broad portfolio of prestack data QC, interpretation and analysis tools can be embedded in SeisEarth. These include interactive mute picking, 3D propagation on gathers, visualization of residual moveouts, interactive AVO plots, trace header displays, and other functionalities that, when embedded in the 3D environment, become convenient tools for the user.

Prestack visualization is supported by flexible data loading capabilities, with no need to re-format or replicate data, so that even very large datasets can be efficiently accessed, viewed and interpreted.
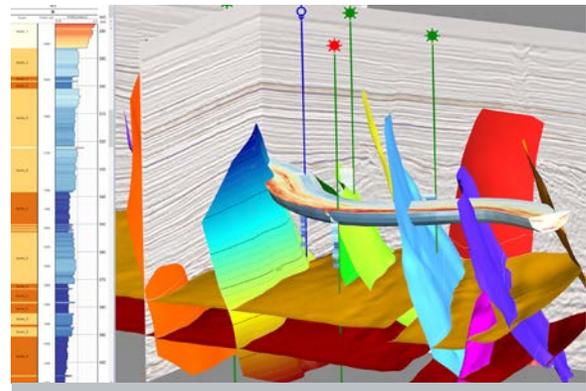
▲ SKUA model

Correlation and Cross-Section - StratEarth

Lines of section and well traverses can be defined in SeisEarth, and sent seamlessly to StratEarth for cross-section construction and well correlation. The associated data can be directly accessed from Epos databases, and the correlation results can be returned to the same repositories.
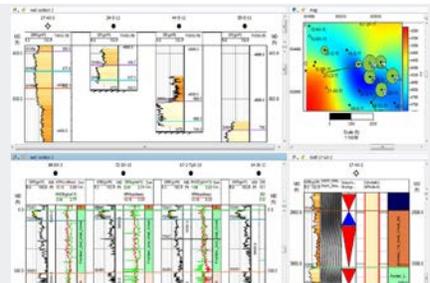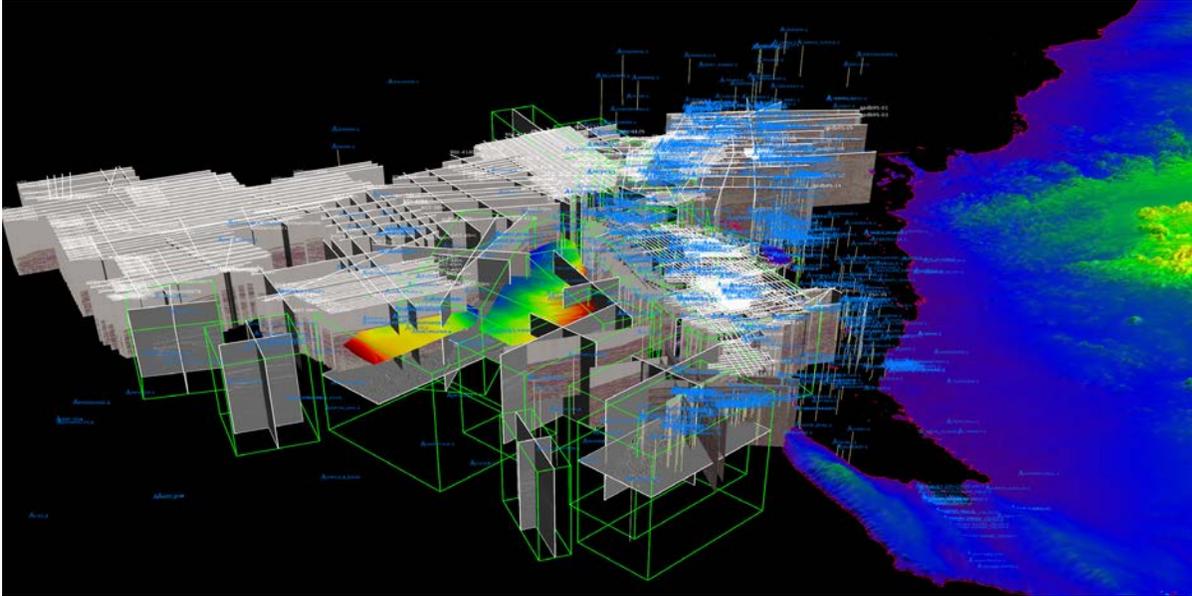
▲ 2D and 3D seismic data and wells, with structural interpretation in one integrated display (data courtesy of

Integrated Modeling

The tight integration between SeisEarth and the SKUA-GOCAD™ modeling technology closes the traditional gap between interpretation and modeling. Through its ability to create a 3D model, no matter how complex the geology and how many faults control the structure, the SeisEarth - SKUA-GOCAD application suite enables concurrent interpretation and modeling, with no loss of information. It simplifies many workflows, such as mapping, fault analysis, restoration, and reservoir modeling. This solution enhances teamwork, significantly improves interpretation quality, reduces cycle time, and delivers structurally consistent prospect maps, as well as stratigraphic and reservoir models.

Leadership in Interpretation and Visualization

Emerson's E&P Software business has emerged as the industry's innovator, building on years of design and development, including the implementation of a new framework to support iterative, multi-disciplinary workflows, a strong foundation in petrophysics, seismic imaging and characterization, and comprehensive visualization technologies. Collaboration with some of the most respected thinkers in international and national energy companies has resulted in a unique, powerful system engineered for the toughest challenges facing the oil and gas E&P industry, today and in the future.

SeisEarth has a number of configurations with different combinations of add-ons and companion products described in this brochure. Seismic Attribute Calculation, Quantitative Seismic Interpretation (Inversion), Subvolume Detection, Rock Type Prediction, and Prestack Interpretation are add-ons to SeisEarth packages.

For details, please contact your sales representative.

Well Planning - Sysdrill Designer

Sysdrill Designer is fully embedded in the BaseMap and 3D Canvas visualization windows, enabling well plans to be created and displayed in SeisEarth, together with geological data. Geological well targets can be defined and edited, and well paths can be constructed, assisted by drilling constraints.
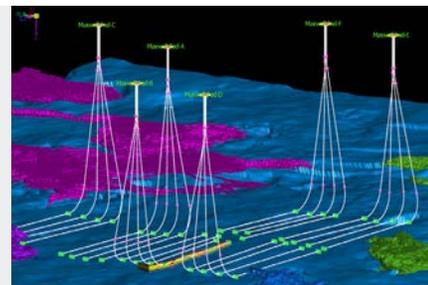
Features

- A simple, intuitive user interface
- Ergonomic design
- Support for large 3D and 2D seismic datasets, multiple seismic surveys, and multiple well databases
- Industry-leading horizon auto-picker
- Interactive attribute generation
- Multi-survey mistie correction for time, phase and amplitude
- Support for both poststack and prestack seismic data
- Optimized multi-resolution disk roaming for seismic data
- A single entry point for viewing, creating and managing all interpretation data objects in a project
- A single entry point for viewing and manipulating all well data assigned to a project
- Full support for multi-user interpretation
- Data security

Interoperability

All Epos™-based applications enable interoperability with third-party data stores, including:

- RESQML 2.0.1
- OpenWorks® R5000.10
- GeoFrame® 2012
- Petrel* 2019 & 2018
- Recall™ 5.4.2

(*is a mark of Schlumberger)

System specifications

- Microsoft® Windows® 7, 8.1 and 10
- 64-bit Red Hat® Enterprise Linux® 6.8 and subsequent minor releases, and 7.1 and subsequent minor releases

The Emerson Advantage

- Regional-scale interpretation allows insights that are not possible from multiple separate surveys.
- Complete visual integration enables informed, collaborative decision-making.
- Operates on a highly agile data management system designed specifically for oil and gas data.
- Designed to exploit the high-speed graphics, large memory and fast connectivity of modern computers.
- Prestack data, geological correlation and advanced modeling tools are accessible with a mouse click.

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