The Omega Seismic Processing System
Seismic analysis at your fingertips
Omega is a flexible, scalable system that allows for processing and imaging on a single workstation up to massive compute clusters, or from a single 2D line to an immense 3D seismic survey.

Our clients can experience Omega directly through licensed use of the software or through dedicated processing facilities in their offices.

The Omega* seismic processing system from WesternGeco is unequalled in the industry. No other software package offers the breadth and depth of capabilities for solving today’s geophysical challenges. Omega is a flexible, scalable system that allows for processing and imaging on a single workstation or massive compute clusters, or from a single 2D line to an immense 3D seismic survey. Omega accurately and efficiently processes:

- land, marine, and transition zone data
- time and depth data
- 2D, 3D, and 4D surveys
- isotropic and anisotropic (TTI and VTI) velocity fields
- multicomponent data
- reservoir- to basin-scale projects.

In addition, Omega software developers are now producing plug-ins for the Petrel* E&P software platform using the Ocean* application development framework.

The power of the Omega system lies in its four major components.

- **Interactive desktop**—allows geophysicists to easily and intuitively manage seismic projects and data, build workflows, QC processing results, visualize and analyze data, and interactively generate statics and velocity solutions.

- **Omega infrastructure**—allows geophysicists to concentrate on geophysics as a result of a database-driven project model, automated data management, job submission, and detailed history.

- **Geophysical algorithms**—has a robust algorithm base (400+ algorithms) in three packages—Foundation, Time, and Depth. Additional advanced algorithms are available, including Reverse-Time Migration (RTM), Adaptive Beam Migration (ABM), Gaussian Packet Migration (GPM), 3D GSMP* General Surface Multiple Prediction, and Extended Internal Multiple Prediction (XIMP).

- **Omega Windows Desktop**—integrates the compute power of Omega with the Petrel software visualization canvas, providing new, powerful geophysical workflows. Omega Petrel integration is truly realized in the WesternGeco Seismic Velocity Modeling (SVM), Localized Seismic Imaging (LSI), and Prestack Seismic Interpretation (PSI) plug-ins for Petrel software.
The Omega project model allows for integration and data sharing among all desktop applications.

**The Omega System Infrastructure: Project Model**

The Omega system utilizes an Oracle® database to store all project information. The Omega project model (OPM) controls interactions between Oracle and all other Omega applications, making data access very efficient. In this database-driven environment, where all applications are linked, a complete history of the processing project is recorded and is always accessible.

Information requires inputting only once to be available to the entire system from any application. For example, gridding information can be entered once (in Project Manager, the Omega project organization tool) to be recognized and applied in other applications such as the Omega workflow building application, SeisFlow. OPM also allows multiple geophysicists—in a true multiuser environment—to work on the same survey and be productive with numerous processing jobs and hundreds of thousands of datasets at every step of the processing life cycle.
Triggers automate job submission when given criteria are met, including the approval of job run statistics and plot QCs.

Job Analysis checks job statistics as processing jobs complete, allowing Omega to automate QC tasks.

The Omega Project Manager, Stage Jobs Viewer, and Job Monitor allow for tracking and monitoring of processing work on surveys of any size.

Project Management
The Omega Project Manager application allows the geophysicist to define the project hierarchy, i.e., the organizational structure of the seismic processing project. Seismic surveys can be divided into different processing steps (e.g., demultiple, velocity analysis) or different vintages in 4D acquisition. A processing workflow can be easily laid out so that the organizational structure of the work to be performed is clear to all participants. This processing hierarchy, or sequence, is displayed in the Project Manager application where individual jobs are displayed along with any ancillary data.

Additional production management tools include Stage Jobs Viewer, Job Monitor, and Multi-Job Monitor. These allow for the easy monitoring of processing workflows at various levels of detail. The prior usage of any dataset can be quickly tracked using the Dataset History tool, which allows a geophysicist to rapidly understand workflows, algorithm parameters, and velocities that have been used to process a seismic dataset.

Automation
The Omega system is highly automated at both the infrastructure and the desktop levels. Routine tasks such as data management, job submission, and QC are easily automated, allowing the geophysicist to concentrate on geophysics. Nearly all data management tasks, such as selecting seismic files, outputting data to disk, load-balancing disks, and archiving and retrieving data from tape, can be handled automatically by the Omega resource data model (RDM).

Additional automation tools increase geophysicist productivity when managing a project. Tools such as Job Analysis (to check job run statistics), Triggering (automated job submission based on given criteria), and QC sessions in SeisView® software increase throughput during production processing, allowing for detailed QC on even the largest projects.

A robust batch production processing system for bulk processing includes all the tools necessary to schedule and manage large job queues. A geophysicist can quickly submit hundreds or thousands of separate jobs to the batch queue with just a few mouse clicks.

The batch production processing system allows for parallelization in two forms: explicitly parallelized algorithms (mainly migration algorithms), and the ability to subdivide a survey and dispatch the data to multiple compute nodes within a cluster. This same system is in daily use at WesternGeco processing centers worldwide and allows WesternGeco to process huge volumes of seismic data efficiently and accurately.
SeisFlow allows the graphical building of the complex workflows needed for today's geophysical challenges.

**Workflow Building**

Omega allows for the intuitive creation of processing workflows with its graphical workflow builder, SeisFlow. Processing workflows are created interactively by selecting and inserting one of 400+ algorithms into the SeisFlow canvas. Each algorithm within Omega is graphically parameterized and contains detailed help documentation for each parameter setting, as well as details of the geophysics behind each algorithm. SeisFlow allows for the construction of a wide range of processing workflows, from simple data input or scaling to extremely complex 3D demultiple or depth migrations.

Omega processing workflows can be submitted to a Linux® compute node in three ways: (1) batch, submitted to a Linux cluster; (2) immediate, submitted to a targeted compute node; or (3) interactive, submitted to a targeted compute node but with the results displayed in SeisView software on the user's workstation without creating an output dataset. Batch submission is commonly used for production processing or parameter testing on complex processing workflows, whereas immediate or interactive submissions are mostly used for parameter testing because of their quick turnaround time.
Analyzing Seismic Data

Omega has multiple applications to analyze seismic data, including SeisView software—a 2D seismic canvas—and Multiple Attribute Display (MAD)—an attribute canvas.

The SeisView software offers a robust 2D canvas for viewing full 32-bit seismic data and true random access, along with graphing and access to trace headers. Data analysis and investigation can be done using a series of interactive SeisView software toolkits (based on Omega algorithms), including spectral analysis, autocorrelation, BP filtering, FK and Tau-P filtering, noise attenuation, muting, and attribute generation. SeisView software can rapidly compare datasets using roll and flip displays, on-the-fly difference plots, linkages between datasets (prestack-to-prestack, prestack-to-stack, and stack-ato-stack) and corendering of displays.

MAD is the Omega QA/QC analysis tool that allows a geophysicist to either interactively view a dataset’s attributes, or view, in real time, attributes generated from multiple production processing workflows on the batch production system. MAD can be easily linked to SeisView software to create an attribute analysis workflow, in which attributes are selected in MAD and the seismic data are visualized in SeisView.

Omega Packages

- **Foundation**—basic QA/QC package includes all Omega infrastructure components and desktop applications plus algorithms for input/output and basic QC and analysis.
- **Time**—most versatile package built on top of the foundation package. Includes a wide array of geophysical algorithms that allow for signal processing, geometry and statics, velocity analysis and picking, demultiple work, multicomponent processing, and time migrations. Time package allows for pre- and poststack 2D and 3D migrations, including Kirchhoff, finite difference, and Stolt algorithms.
- **Depth**—enhances the time package by adding algorithms that allow for pre- and poststack depth migrations (isotropic [TTI] and anisotropic [VTI] velocity models), including Kirchhoff and wavefield extrapolation methods and the support for CIP tomography. Depth package requires the WesternGeco Seismic Velocity Modeling plug-in.
Omega is extremely scalable in terms of both algorithms and compute capability. Multiple packages are available for varying geophysical challenges, including foundation, time and depth, and advanced algorithms.

**Windows Desktop**
Omega is optionally available with an interactive Windows®-based desktop, while retaining the scalability and computational power of a Linux cluster architecture. The Omega Windows Desktop is available for license and preserves all the features, applications, and algorithms of the Linux version, but takes advantage of the power and flexibility of Windows. This option allows for integration with Seismic Velocity Modeling (SVM) from WesternGeco—an advanced interactive velocity model building and depth migration Ocean platform plug-in. Omega Windows Desktop and its integration with SVM offers a seamless processing workflow—from initial data preprocessing (geometry, noise attenuation, demultiple) through advanced depth imaging—on one platform.

**Advanced Algorithms**
Several additional advanced algorithm packages can be licensed to run on the Omega system.

- **3D GSMP General Surface Multiple Prediction**—a full 3D SRME (surface-related multiple elimination) that accurately predicts complex multiples, including diffracted and scattered multiple energy

- **XIMP (Extended Interbed Multiple Prediction)**—a data-driven demultiple algorithm that attenuates interbed multiples

- **RTM (Reverse-Time Migration)**—high-end prestack two-way wave equation migration for accurate imaging in and below areas with great structural and velocity complexity

- **GPM (Gaussian Packet Migration)**—full image gather output depth migration that allows for high resolution of steep dip images in complex environments and high-frequency images in postsalt targets

- **ABM (Adaptive Beam Migration)**—high-end, full Gaussian beam migration for situations demanding outstanding image quality and high interpretation confidence

**Omega Research and Development**
The WesternGeco commitment to research and development ensures that the Omega system benefits from the latest geophysical processing technology, with regular updates and the availability of global expertise and support. A robust Omega Software Developers Kit (SDK) is available.
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