Summary
This course provides an introduction to modern seismic depth imaging methods for seismic interpreters and project leaders. It provides non-specialists with the understanding needed to direct and contribute to seismic processing projects, where integration between interpreters and processors is vital to achieving project objectives. It addresses how interpreters can add value through initial design and input data considerations, velocity model-building, pros/cons of various migration algorithms and quality control.

Learning Outcomes
Participants will learn to:

1. Distinguish the fundamental differences between time and depth migration.
2. Differentiate between commonly used imaging algorithms including ray and wave-equation techniques.
3. Determine seismic imaging challenges for specific projects and select appropriate imaging workflows to satisfy project requirements.
4. Monitor the data conditioning stage of the initial processing sequence.
5. Establish the appropriate interpretation inputs to the velocity model building process, and verify that the form of the velocity model is appropriate for the geology of the project.
6. Generate an optimized seismic/well tie database that can be used as a constraint for velocity modeling and the determination of anisotropy parameters.
7. Establish project Q/C milestones with imaging specialists, monitor the outcomes, and approve transitions to subsequent project stages.

Duration and Training Method
A three-day classroom course comprising of training conducted in a classroom setting using a combination of lectures, demonstrations, case histories, and hands-on practical work exercises.

Who Should Attend
This course should be of interest to all seismic interpreters planning to incorporate depth imaging into their exploration and/or exploitation projects.

Prerequisites and Linking Courses
Participants should be familiar with the fundamentals of the seismic method and have some interpretation experience before attending this class. Participants can fulfill these prerequisites by first attending Nautilus course N085 (Introduction to Seismic Interpretation) or N080 (Geophysics for Subsurface Professionals), or equivalent training.

Since velocity modeling is at the heart of seismic depth imaging, participants should also consider taking courses such as N002 (Velocities for Depth Conversion), or N172 (Depth Conversion: Methods and Pitfalls) beforehand.

Participants in this course (N317) wanting to learn more about the theory underlying the various algorithms should consider taking N217 (Seismic Imaging and Velocity Model-Building Techniques):
Concepts, Examples and Pitfalls), which is targeted at processing specialists and interpreters with a higher level of previous experience in the practice of depth imaging.

Course Content

The course addresses how and where in an imaging project an interpreter can add value and ensure project objectives are met. It provides guidance on the questions that an interpreter needs to ask themselves and others, such as: What workflow elements are most important to focus attention on for a good end result? How can a non-specialist effectively QC the adequacy of the job at each stage, without having the in-depth knowledge that the processors have? What deliverables should they receive (interim and final products) and how might they each be used?

Participants are encouraged to bring data examples to the class for general discussion, and time will be provided during the course for an open forum discussion of client-provided project examples.

The course content is divided into 10 chapters, through which the basic foundations are covered, and the various elements of imaging workflows are explained, all illustrated with plenty of synthetic examples and real case histories.

DAY 1: Foundations

1. What is a seismic image?
   - The seismic experiment
   - Wave propagation
   - Reflection and the reflection coefficient
   - Velocity fields for imaging
   - What is seismic anisotropy?

2. Four key imaging challenges: definition and examples
   - To see reflectors: detection, illumination, signal/noise
   - To see details of the reflectors: resolution
   - To get the "true" reflection coefficient: amplitude fidelity
   - To get reflectors at their correct location in depth: image distortion, accuracy

3. Overview of seismic imaging methods and workflows
   - Data acquisition and organization: binning, "Naz" versus "Waz"
   - Concept of migration: principles of Kirchhoff migration in depth and tie
   - A short overview of other migrations: The various Beam migrations, WEM, Reverse time migration

DAY 2: Workflows and Imaging Options

4. Well-to-seismic ties
   - Scale issues
Vertical time and the synthetic seismograms
The Time-Depth curve
Pitfalls in synthetic seismograms

5. Pre-processing

- Noise
- Near surface anomalies; statics
- Multiples

6. Migration options and their respective merits

- Time versus depth migration
- Kirchhoff versus Beam migrations
- When are Wave equation-based methods necessary
- WEM versus RTM

7. Acquisition considerations

- Broadband seismic
- Narrow azimuth; multi-azimuth; wide azimuth

DAY 3: Velocity Model Building; Imaging Strategies

8. Understanding Ray-based Velocity Model Building (Tomography)

- Model description
- Residual Move-Out
- The PreSDM - Model update loop
- When and how to include anisotropy: getting Velocity, epsilon and delta
- The key role of Interpreters in VMB

9. Examples of imaging strategies

- What can justify reshooting
- Moving from Time- to Depth Imaging

10. A recap of Imaging methods