

# Fundamentals of Seismic Processing (G071)



## Tutor(s)

[Rob Hardy](#): Director, Tonnta Energy Limited.

## Overview

This course will provide participants with fundamentals needed to liaise with specialists and discuss workflows for seismic data acquisition and processing. Using modern case histories and basic theory, the course covers fundamentals, established workflows and advanced technology. Participants will use interactive processing tools to improve their understanding of the latest techniques, learn how to apply them effectively and efficiently to meet their objectives.

## Duration and Logistics

**Classroom version:** A 2-day in-person course, comprising a mix of lectures with examples (90%), laptop-based exercises and discussion (10%). The manual will be provided in digital format and participants will be required to bring a laptop or tablet computer to follow the lectures and exercises.

**Virtual version:** Four 3-hour interactive online sessions presented over 4 days, comprising lectures, discussion and interactive exercises using case histories to illustrate the basic theory and impact of the techniques discussed. The participants will use a series of web-based software modules to experience the processing options available and learn how to combine the basic tools to build a flow which meets objectives. A digital manual and exercise materials will be distributed to participants before the course. Some reading and several exercises are to be completed by participants off-line.

## Level and Audience

**Fundamental.** This course is aimed at geoscientists who wish to understand the fundamentals of seismic acquisition techniques and processing methods and to aid more effective liaison with specialists. We start from first principles, but it is helpful if participants have a basic knowledge of seismic acquisition and processing terminology and are actively working with seismic data.

## Objectives

You will learn to:

1. Discuss the most common seismic acquisition and processing techniques used in seismic exploration and production, and become more proficient in the terminology used to describe them.
2. Outline how survey design, earth model building and selection of migration algorithm can affect accuracy of interpretation in depth.
3. Recognize seismic processing parameter selection for specific objectives, such as amplitude interpretation for exploration and reservoir characterization.
4. Discuss a typical seismic processing workflow covering data preparation, parameterization, noise and multiple suppression, velocity model building and the imaging process.
5. Become aware of newer acquisition and processing techniques alongside their potential benefits and

pitfalls.

## Course Content

### Session 1: Workstation based workflow - objective setting

- Seismic refresher, including a brief overview of basic wave theory, noise suppression, velocity model building, stacking, imaging and resolution
- Basic techniques, such as convolution, sampling, aliasing and regularization
- Simple data conditioning techniques, including trace scaling, automatic gain control and frequency and dip filtering

### Session 2: Survey design, signal processing and noise suppression workflow

- Basic survey design workflow and rules of thumb for orientation and azimuthal coverage and designing surveys for both shallow and deeper targets
- Wavelet processing including designature and deghosting
- Noise: types, suppression and quality control in marine and land seismic data
- Multiple suppression techniques, examples and quality control
- Modern case histories from land, shallow and deepwater environments

### Session 3: Imaging and earth model workflow

- Basic migration, prestack time migration and gather generation
- Correcting for velocity variation and complex sub-surface: prestack depth migration
- Near surface techniques, such as statics and full waveform inversion (FWI)
- Tomography techniques and role of interpreter in velocity model building and quality control, featuring recent case histories from North Sea and Atlantic margins

### Session 4: Post-migration data enhancement and introduction to specialized processing

Case histories featuring post-migration data enhancement, survey merging and gather conditioning

Specialized processing: single sensor, node, elastic and 4-D concepts

Meeting objectives, acquisition and processing methods for the future

## **Additional topics and material**

The following additional sections are included online:

- Seismic data formats: seismic and navigation formats
- Workstation data loading: including common pitfalls
- Processing tenders overview

The following optional resources can be made available:

- Customization of training modules and exercises based on client data
- Self-paced learning modules provided online in advance of in-person workshop-based sessions