



3D SEISMIC ACQUISITION, DESIGN AND QUALITY CONTROL COURSE OUTLINE

- ❖ **Introduction**
- ❖ **Overview of the 3D Technique**
 - Summary of 2D
 - Swath shooting
 - 3D imaging
 - Basic statistics comparing 2D and 3D
 - Basic aspects of a 3D program and definition of terms
 - Rolling the patch and building the fold
 - Determining 3D fold
 - Geometric imprinting
- ❖ **3D Design Considerations**
 - Overall survey size and shape
 - Cover beyond the anomaly
 - Margin of poor statistics
 - Migration aperture and Fresnel zone
 - Alignment with strike/dip or land boundaries
 - Avoiding migration artifacts
 - Deciding on the desired fold
 - Signal to noise enhancement
 - 3D advantages of migration
 - 3D advantages of offset distribution
 - Is fold our most important parameter?
 - Offset considerations
 - Maximum limits
 - Interference with muted first breaks
 - Moveout stretch
 - Mode conversion
 - Energy loss due to spherical divergence
 - Minimum limits
 - Sufficient moveout for velocity analysis
 - Sufficient moveout for multiple discrimination
 - Refraction analysis
 - Amplitude vs Offset analysis)
 - Source / Receiver line spacings
 - Desired fold within offset limits (fold driven vs bin driven designs)
 - Fold at shallow events
 - Aspect ratio
 - Desired wave field sampling in all domains
 - Trade offs and compromises
 - Bin size
 - As related to surface sampling
 - Aliasing of structural dips
 - Aliasing of lateral velocity changes (diffractions)
 - Aliasing of NMO at far offsets
 - Aliasing of coherent noise
 - Interpretation confidence for small features
 - Advanced Techniques: Bin geometry
 - Fractionated bins
 - Bin balancing – offset intelligence
 - Fractionation of bins by mid-point scattering
 - Skidding and offsetting
 - Velocity and azimuth
 - Statistics and surface consistent algorithms
 - 3D Parameters & land seismic acquisition
 - Offset
 - Fold
 - Group interval
 - Source interval
 - Spread geometry
 - Channels required
 - Source type: dynamite, vibroseis
- ❖ **Trapped Mode and Guided Waves, A common noise problem**
- ❖ **3D Megabin vs Orthogonal Grid**
- ❖ **Analysis of Statistics**
 - SL and RL constant, GI varies
 - Variable RL and SL, GI constant, constant aspect ratio RL/SL
 - Variable aspect ratio RL/SL, fold constant
 - Narrow patch implications
- ❖ **Basic 3D Model Types**
 - Offset grid
 - Fractionated grid
 - Double Brick grid
 - Triple Brick grid
 - Diagonal grid
 - Megabin grid
 - Random grid
 - Planned Random grid
 - When is a Brick Wall Weak?
- ❖ **Spatial Sampling and Aliasing**
 - Seismic record from space
 - F-K plots and geophone interval
 - Geophone arrays as spatial anti-alias filters
 - F-K filtering
 - Filtering of well sampled data
 - Problems of filtering sparsely sampled data
 - Mild filtering to pass all signal
 - Harsh filtering to attenuate all noise
- ❖ **Array Theory**
 - Array Design
 - Simple linear array design
 - Optimizing a two sub-array system
 - Optimizing a three sub-array system
 - Vibrator arrays
 - Estimating signal wavelengths
 - Calculating apparent wavelength vs offset plus frequency
 - 3D Response In Line, Cross Line, Combined
 - Ghosting in the dynamite signature
- ❖ **3D Design Work Example, Integration of Design Concepts and Trade Offs**
 - Patch analysis
 - Crossline summary
 - Fold histogram
- ❖ **Case Histories**
 - 3D Seismic and Horizontal Drilling
 - 3D Seismic Out of Plane Resolution
 - Unnecessary dry holes
 - How little we know about geology