GEOP 501
Fall 2008
Homework assignment # 4
Design of 3-D Land Seismic Survey

(Due date: 25/1/2009)

The following is a list of the input information from known geologic and equipment factors:

- existing 2-D data of good quality have 40 fold
- steepest (and target) dip = 30°
- shallowest depth of interest = 600 m
- target depth (Z) = 2500 m
- target two-way time (T_0) = 1.5 s
- V_{RMS} to the target horizon = 3000 m/s
- V_i at the target horizon = 4500 m/s
- f_d at the target horizon = 30 Hz
- f_{max} at the target horizon = 60 Hz
- target size = 100 m
- T_d = 2.5 s.
- The allowed stretch factor S_{NMO} = 0.5
- Assume that the near-surface layer is a multiple-generating layer whose thickness is H_1 = 100 m and velocity is V_1 = 1500 m/s.

(1) Calculate the recommended bin size (B). Assuming a square bin, calculate the recommended RI and SI.
(2) Calculate the recommended range of X_{min}.
(3) Using the minimum value of X_{min}, calculate the recommended RLI and SLI assuming a square box.
(4) Compute the X_{max} according to the target depth rule.
(5) Compute the X_{max} according to the maximum allowable NMO stretch rule.
(6) Compute the X_{max} according to the NMO discrimination rule.
(7) Compute the X_{max} according to the multiple cancellation rule.
(8) Compute the X_{max} according to the AVO effects rule.
(9) What is your selected value (or range) for the X_{max}?
(10) Assuming rectangular patch, calculate the recommended NRL and number of receivers per receiver line.
(11) Calculate the number of channels for this survey?
(12) Calculate the inline, crossline dimensions, actual X_{max}, and the aspect ratio of your patch.
(13) Calculate the recommended range of the 3-D total fold (F).
(14) Calculate the recommended inline (F_I) and crossline (F_X) folds using the average value of F.
(15) Calculate the recommended fold taper in the inline and crossline directions.
(16) Calculate the recommended migration aperture.
(17) Calculate the recommended record length (T_R).
(18) Show a scaled sketch of a patch showing the receiver and source lines, arrangements of receivers and sources at edges, X_{max}, and the inline and crossline dimensions.
(19) Show a scaled sketch of a box showing the receiver and source lines, arrangements of receivers and sources, X_{min}, and a CMP bin (showing 4 source-receiver pairs associated with this bin).
(20) Assuming a swath shooting method, show a scaled sketch of 2 adjacent swaths showing the receiver and source lines, several patches, several salvos, and show the acquisition movement direction and the inline and crossline rollovers.