Size Does Matter (Part I): Controlling Factors in the Costing, Design and Implementation of Large 3D Data Sets in Western Canada.

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Summary

We have analyzed a generic 3D design and simulated a number of scenarios by varying, bin size, survey size, line spacing and patch size in an effort to determine which factors or combination thereof has the greatest impact on the cost of a survey. The combination of factors has then been translated in to an equation for use in determining the cost effectiveness of a 3D survey. In each scenario we have provided a reference to the cost of recording equipment required to complete the project.

Introduction

With the advent of large 3D data sets (greater than 50 square kilometers) over the past few years (in Western Canada), we set out to identify the key factors that control the cost of a survey. Historically the Western Canadian Sedimentary Basin (WCSB) has been covered by 2D data sets and small (less than 50 square km) 3D data sets. With improved technology (delta-sigma, telemetry systems) the ability, availability and flexibility in today's recording systems has made small 3D programs relatively easy operationally and very cost effective. Concurrently the new technology has increased the natural ability to record larger 3D data sets as indicated by recent crew counts and channel counts which show a decrease in the number of crews (year over year) but an increase in the channel count per crew (year over year).

We believe the perception has been that the transition from small to large should be easy and have limited effect on the cost per square area of seismic programs. Although true in many cases, this paper will provide information that a number of operational efficiencies/inefficiencies and liabilities exist that can result in increased price per square area of larger surveys. These increased costs have not traditionally been realized within industry and are required in order to sustain the technical advances required to enhance Geoscientists ability to characterize the reservoirs industry covets.

Methodology

In order to provide a realistic scenario for comparison, the following assumptions were made; 1) the survey was to be designed to image both shallow and deep targets, 2) shot hole depth and charge size would remain constant, and 3) the use of blended rates for all advance work (line clearing, drilling etc). Following these assumptions, fourteen versions of an orthogonal survey were simulated by varying six different parameters (including; program dimensions/size, bin size, source and receiver line intervals and patch size) as identified in Table 1 below. In each scenario a generic cost estimate was completed for comparison to the respective parameter changes.

Table 1: (All distances are in meters)

Program Size			Line & Bin Parameters			Patch Size			
Inline Size	Crossline Size	Total Size	SLI	RLI	Bin Size	# Lines	#channels	Channels in Patch	Max Patch
9600	9600	92.16	320	240	20	22	136	2992	6000
9600	9600	92.16	320	240	20	12	136	1632	3600
9600	9600	92.16	300	240	30	22	92	2024	4000
9600	9600	92.16	300	240	30	12	92	1104	2400
9600	9600	92.16	240	160	20	32	136	4352	8400
9600	9600	92.16	240	180	30	32	82	2624	5600
9600	9600	92.16	480	300	30	16	90	1440	3040
9600	9600	92.16	480	320	20	16	140	2240	4560
4800	9600	46.08	320	240	20	22	136	2992	3000
4800	9600	46.08	320	240	20	12	136	1632	1800
4800	9600	46.08	300	240	30	22	92	2024	2000
4800	9600	46.08	300	240	30	12	92	1104	1200
4800	9600	46.08	240	160	20	32	136	4352	4200
4800	9600	46.08	240	180	30	32	82	2624	2800

Conclusions:

Based on evaluation of the given models, traditional methods of assessing 3D costs based on the relationship of *"cost per square to shots per unit area"* or *"cost per square to receivers per unit area"* or the combination of *"cost per square to (shots*receivers) per unit area"* are ineffective when survey size increases above past certain limits. A more effective way of analyzing costs is related to the following factors; shots per unit area, receivers per unit area, survey size and patch size. Further enhancement to efficiencies that may change this current cost analysis model require the realization of equipment costs in order to maintain technical research.

Stay tuned at the convention for the new equation for improved valuation of 3D costs and maximizing value from parameter selection.