

# **EXCLUSIVE 3D SEISMIC REFLECTION SURVEY**

**N.E.B. Authorization # 9229-C131-7E**  
**Mackenzie Valley Land and Water Board Land Use Permit # N 1998B0934**

**Report Date: May 9 229 - C 131 - 7 E**

**Work Period: June 4<sup>th</sup>, 2001 to August 1<sup>st</sup>, 2001**

**FINAL REPORT  
FOR  
FT LIARD AREA  
BLOCK EL - 363  
NORTHWEST TERRITORIES**

**LOCATION:**

**Latitude: 60°25' to 60° 45' N**

**Longitude: 123°35' to 123° 45' N**

**Block Operator:  
Canadian Forest Oil Ltd.**

**Project Operator:  
Canadian Forest Oil Ltd.  
600, 800-6<sup>th</sup> Ave S.W.  
Calgary, Alberta  
T2P 3G3**

**Acquisition Contractor:  
Veritas DGC Land**

**Project Supervisors:  
Canadian Natural Resources Ltd.  
Veritas DGC Land**

**Interest Owners:  
Canadian Forest Oil Ltd.  
Canadian Natural Resources Ltd.**

**Report Prepared by  
Canadian Natural Resources Ltd.**

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## **ENCLOSURES**

**LOCATION MAPS**

**DIGITAL SHOT POINT LOCATION DISC (SEG-P 1)**

**FINAL SEISMIC SHOTPOINT BASE MAP**

**MIGRATED UNINTERPRETED PAPER COPIES OF EVERY CROSS AND IN-LINE  
OVER THE 3D AREA**

**WEST-EAST AND SOUTH WEST- NORTH EAST MIGRATED LINES, ACROSS  
P66A BOTTOM HOLE, INTERPRETED WITH PROCESSING SEQUENCE LABEL,  
IN NORMAL AND REVERSE POLARITY**

**MAPS OF NAHANNI TIME STRUCTURE AT 1: 50,000 AND 1 : 25,000 FOR  
ENTIRE 3D AREA**

**SYNTHETICS FOR P66, P66A AND E54 IN MEASURED DEPTH**

## INTRODUCTION

This is our final report on our seismic acquisition program performed in the summer of 2001.

This Ft Liard area project site is know "in house" as Ft Liard 01-I-3D. This program is located 40 kms North of the community of Ft Liard N.W.T.

The seismic program was conducted in the summer of 2001. Canadian Forest Oil Ltd. handled the application and approval process for Mackenzie Valley Land and Water Authority and the N.E.B. Canadian Natural Resources Ltd. supervised the field operations. Veritas DGC Land conducted the geophysical field acquisition. Canadian Forest Oil Ltd. was the Block Operator and the geophysical survey was for the exclusive use of Canadian Forest Oil Ltd. and Canadian Natural Resources Ltd.

The work period was from June 11, 2001 to August 1, 2001. There were approximately 110 people involved in all phases of the operations.

Kim Hartzell of Veritas was the crew manager. He was situated in the Beaver Enterprises Base Camp in Ft Liard. Don Tarr of Eagle Surveys handled the GPS control and Line clearing/slashing operations and Justin Newman of Bertram Drilling handled the drilling operations.

The entire crew was housed in the Beaver Enterprises Base Camp in Ft Liard.

All line clearing was done by Beaver Enterprises and Deh Cho Helicopters did all helicopter work.

## **FINAL PLAN STATISTICS**

**PROSPECT:** FORT LIARD 01-I-3D

**CLIENT:** C.N.R.L. **LAND USE PERMIT #:** N1998B0934

**GEOPHYSICAL CONTRACTOR:** VERITAS DGC

**GOEGRAPHICAL AREA:** FORT LIARD

**GRIDS OR NTS MAP SHEETS:** 95 B 12

Line	Km's	Width EX	Width NC	Hectares	Line	Km's	Width EX	Width NC	Hectares
R1	5.82		1.7	0.989	S4	0		0.0	0.000
R3	5.88		1.7	1.000	S6	0.89		1.7	0.151
R5	6.06		1.7	1.030	S8	1.91		1.7	0.325
R7	6.12		1.7	1.040	S10	3.05		1.7	0.519
R9	6.12		1.7	1.040	S12	4.33		1.7	0.736
R11	6.12		1.7	1.040	S14	5.60		1.7	0.952
R13	6.00		1.7	1.020	S16	6.62		1.7	1.125
R15	5.88		1.7	1.000	S18	6.49		1.7	1.103
R17	5.58		1.7	0.949	S20	6.49		1.7	1.103
R19	5.64		1.7	0.959	S22	4.97		1.7	0.845
R21	5.64		1.7	0.959	S24	4.58		1.7	0.779
R23	5.70		1.7	0.969	S26	3.31		1.7	0.563
R25	5.70		1.7	0.969	S28	2.55		1.7	0.434
					S30	1.27		1.7	0.216
					S32	0.51		1.7	0.087
<b>TOTAL: 76.260</b>				12.964	<b>TOTAL: 52.57</b>				8.937

**LINE TOTAL:** 128.8

**HECT TOTAL:** 21.9

**JOB AREA:** 34.20 SQUARE/ KM

## **Weather & Terrain**

Weather condition for this program was in the range of +5° to +25° Celsius throughout the course of the operations. Delays were encountered throughout the duration of the program due to fog, rain and low cloud cover.

This project area was primarily small spruce and willows. The terrain was extremely hilly with some large vertical cliffs.

## **Logistics & Summary**

The Base staff in Ft Liard arranged personnel movements, purchased fuel, and other essential supplies from the local merchants. All personnel stayed at the Beaver Enterprise base camp in Ft Liard.

Shift change personnel were flown to Ft Nelson and Transported to Ft Liard by Vehicle.

Local Helicopter ( Deh Cho) was used for supporting the crews.

The drill crews / Survey Crews and the Recording crew personnel come from the South. All of the slashing personnel were local residents supplied by Beaver Enterprises.

## **Safety, Health & Environment**

Environmental concerns were addressed in a meeting on Feb 14, 2001 with Mr. Donald Antoine, manager of Nahendeh Land and Environmental Services. No concerns were expressed.

On June 1, 2001 a meeting was held prior to start-up with Chief Judy Kotchea, Mr. Shane Parrish ( Beaver Enterprises), Mr. Donald Antoine and Mr. Johnny Klondike (Trapper) to discuss any concerns prior to start-up June 4, 2001. No concerns were expressed and the program was approved to start cutting.

All new cut lines were hand cut 1.7 meters wide.

All necessary First Aid supplies plus an ambulance equipped with a mobile radio to communicate with each crew.

Radio check in was required from each crew on an hourly basis. Helipads were located at strategic locations to facilitate medivacs ( if required).

Due to the steep cliffs, a qualified mountain climbing crew was brought in to install geophones on the cliffs.

Copies of weekly reports, Safety meetings, Audits etc. were forwarded to the National Energy Board by Veritas DGC.

## **Line Clearing Operations**

Hand cutters did all the line clearing. Mr. Don Tarr, of Eagle Surveys, was the cat push handling the day-to-day field operations of establishing the line locations physically in the field.

The program consisted of new cut line. The debris was bucked and slashed.

All slashers were flown in and out by helicopter. The helicopter landing sites were located in natural clearings.

## Surveying Operations

Mr. Don Tarr of Eagle Surveys was the head surveyor in the field responsible for the line location and survey. Mr. Greg Nobert of Eagle Surveys was the surveyor responsible for the chaining and GPS survey on the prospect.

A chaining crew placed flagging at the geophone station intervals and identified the shot points. Chaining notes were prepared every evening for the field operations and a final copy forwarded to survey Audit Company and seismic data processor at the completion of the project.

A survey crew recorded the point locations by GPS. A Novatel GPS system was used to establish the control and survey the locations of the lines and access. Control was based upon Geodetic Survey of Canada benchmarks.

All survey work was performed in the metric system.

## Recording Operations

Instruments	Sercel 408
Number of Traces	1286
Geophone Type	OYO- CT30
Geophone Frequency	10 Hz
Geophone Array	6 geophones over 20 meters (spacing)
Sample Rate	2 milliseconds
Record length	6 seconds
Anti-Alias Filter (high cut)	150-200 Hz
Low Filter Cut	OUT
Receiver Line Spacing	480 meters
Receiver Interval (group interval)	60 meters
Source Line Spacing	900 meters
Source Interval (vibrator shot point)	127.28 meters
Bin Size	30 meters * 63.4 meters
Extra Source Points	NIL
Fold	3000%
Spread	ALL LIVE
Roll in	ALL LIVE
Source	DYNAMITE
Source Array	SINGLE HOLE

The recording crew removed all flagging, lath and survey markers upon completion of their operations on the project.

## **Dates of Operations**

Advance Personnel Mobilized	June 4, 2001
Advance Personnel Released	July 15, 2001
Line Clearing Commenced	June 4, 2001
Line Clearing Demobilized	July 12, 2001
Surveying Commenced	June 22, 2001
Surveying Demobilized	July 15, 2001
Recording Commenced	July 9, 2001
Recording Demobilized	July 31, 2001

## **Recording Production Summary**

Total Kilometers Surveyed	128.80 KM
Number of Shot Points	430 Shot points
Number of Stations	1286
Number of Recording Days	24 Days
Kilometers Recorded per Day	1.425
Days Mobilized / Demobilized	2 Days
Hours Lost Due to Weather	75 Hours

## Personnel

<b>Recording Camp</b>	1	Party Manager
	2	Observers
	1	Jr. Observer
	2	Trouble Shooters
	21	Line Crew Helpers
	1	Mechanic
<b>Drill Crews</b>	20	Drillers
	2	Mechanics
<b>Recording Camp</b>	1	Paramedic
	1	Client Rep.
<b>Surveying</b>	1	Advaqnce Manager / Cat Push
	2	Surveyors
	2	Chainers
	4	Survey / Chainer Helpers
<b>Slashing</b>	44	Hand Cutters
<b>Helicopter Pilots</b>	5	
<b>Total Personnel</b>	<b>110</b>	

## Equipment

<b>Recording</b>	1	Recorder Unit
	5	Cable Line Truck Units
<b>Source Crew</b>	10	Portable Drills
<b>Recording Camp</b>	1	Mechanical Unit
	1	Ambulance
	2	P.M. Units
<b>Helicopters</b>	5	

## **TECHNICAL DISCUSSION AND INTERPRETATION**

### **1- Data quality and Parameter Selection**

The source lines were shot on a diagonal and receiver lines were East-West to minimize the CDP scatter in the bins (45m\*30m). Wind noise was minimal, as good data was required to interpret the primary prospective Nahanni structure. High fold was required to image the steeply dipping Nahanni over thrust and obtain reflection energy through the complexly deformed and stratigraphically varied upper beds from surface to the Nahanni.

### **2- Processing**

Static's solutions were extensively tested along with velocities before migration to maximize the data signal/noise and properly image the Nahanni. Deconvolution and filtering were used to clean the data up and balance the frequency spectrum. Pre-stack Kirchhoff migration velocities and alias parameters were interactively selected by the processor and interpreter.

### **3- Reflection identification and velocity control**

The 3D went over the P66, P66A and E-54 wells that synthetics were used to identify seismic markers. Velocity information from these synthetics was also used to guide the velocities used in processing the seismic data.

### **4- Interpretation**

The primary zone of interest is the Nahanni over thrusted fractured dolomite. The P66 well missed the over thrust by drilling too far East. The P66A well intersected the Nahanni at -2230m TVD and produced gas before watering out. The 3D seismic shows the over thrust Nahanni rising 45msec., approx. 85m elevation to the East of P66A well bottom hole and an area of closure above the gas / water line [ Red on time structure map]. The Nahanni is mapped to plunge South along the thrust until raising to the West of the E-54 well and still raising at the South end of the 3D survey.

