

**VES**

VAUGHN ENERGY SERVICES

Company: Noble Energy  
 Lease/Well: Patriot/B16-18  
 Location: S-16 T-5N R-65W  
 Rig Name: Production  
 State/County: Colorado/Weld  
 Latitude: 40.40, Longitude: -104.56  
 GRID North is 0.61 Degrees East of True North  
 VS-Azi: 0.00 Degrees

**GTI**

GYRO TECHNOLOGIES, INC

## FIELD COPY ONLY (NOT DEFINITIVE)

Depth Reference : Ground Level

## DRILLOG MS GYRO SURVEY CALCULATIONS

Filename: msgyro\_run02-01\_ed.ut

Minimum Curvature Method

Report Date/Time: 12/21/2010 / 19:25

Vaughn Energy Services

Rifle, Colorado

817-741-3610

Robert Davis

Patriot B16-18

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	****
100.00	0.29	32.69	100.00	0.21	0.13	0.21	0.25	32.69	0.29
200.00	0.14	114.66	200.00	0.37	0.38	0.37	0.53	46.28	0.30
300.00	0.46	125.36	300.00	0.08	0.82	0.08	0.83	84.17	0.32
400.00	0.74	149.03	399.99	-0.70	1.48	-0.70	1.64	115.30	0.37
500.00	0.60	175.71	499.99	-1.77	1.85	-1.77	2.56	133.77	0.34
600.00	0.89	186.48	599.98	-3.07	1.80	-3.07	3.56	149.58	0.33
700.00	0.83	200.27	699.97	-4.52	1.46	-4.52	4.75	162.08	0.22
800.00	0.95	199.31	799.95	-5.98	0.94	-5.98	6.06	171.11	0.12
900.00	0.91	192.52	899.94	-7.54	0.49	-7.54	7.56	176.29	0.12
1000.00	0.87	196.24	999.93	-9.04	0.11	-9.04	9.04	179.33	0.07
1100.00	0.76	189.26	1099.92	-10.43	-0.21	-10.43	10.43	181.17	0.15
1200.00	0.81	176.33	1199.91	-11.79	-0.28	-11.79	11.79	181.34	0.18
1300.00	0.87	149.67	1299.90	-13.15	0.15	-13.15	13.15	179.34	0.39
1400.00	0.94	133.51	1399.89	-14.37	1.13	-14.37	14.41	175.51	0.26
1500.00	1.05	129.98	1499.87	-15.52	2.42	-15.52	15.71	171.13	0.13
1600.00	1.25	146.39	1599.85	-17.01	3.73	-17.01	17.42	167.65	0.39
1700.00	1.48	148.27	1699.82	-19.03	5.01	-19.03	19.68	165.24	0.24
1800.00	1.16	141.41	1799.80	-20.92	6.32	-20.92	21.85	163.18	0.36
1900.00	1.34	164.21	1899.77	-22.84	7.27	-22.84	23.97	162.33	0.53
2000.00	1.58	166.91	1999.74	-25.31	7.91	-25.31	26.51	162.65	0.25
2100.00	1.62	158.57	2099.70	-27.97	8.73	-27.97	29.30	162.66	0.24
2200.00	1.57	149.65	2199.66	-30.46	9.94	-30.46	32.04	161.93	0.25
2300.00	1.66	160.60	2299.62	-33.01	11.11	-33.01	34.83	161.39	0.32
2400.00	1.87	154.04	2399.58	-35.84	12.31	-35.84	37.89	161.05	0.30
2500.00	1.84	158.29	2499.52	-38.80	13.62	-38.80	41.12	160.66	0.14
2600.00	1.90	145.65	2599.47	-41.66	15.15	-41.66	44.33	160.02	0.41
2700.00	1.43	148.34	2699.43	-44.09	16.73	-44.09	47.16	159.21	0.47
2800.00	1.01	189.29	2799.41	-46.02	17.25	-46.02	49.15	159.45	0.94
2900.00	1.31	183.21	2899.39	-48.04	17.04	-48.04	50.97	160.47	0.33
3000.00	1.35	167.86	2999.36	-50.33	17.23	-50.33	53.20	161.11	0.36
3100.00	1.48	162.35	3099.33	-52.72	17.87	-52.72	55.66	161.28	0.19
3200.00	1.54	123.80	3199.30	-54.70	19.37	-54.70	58.03	160.50	1.00
3300.00	1.63	121.63	3299.26	-56.19	21.70	-56.19	60.24	158.88	0.11

Measured Depth FT	Incl Angle Deg	Drift Direction Deg	TVD FT	+N/-S FT	+E/-W FT	Vertical Section FT	Closure Distance FT	Closure Direction Deg	Dogleg Severity Deg/100
3400.00	1.94	119.52	3399.21	-57.78	24.39	-57.78	62.71	157.11	0.31
3500.00	1.52	106.82	3499.17	-58.99	27.13	-58.99	64.93	155.30	0.57
3600.00	1.89	106.15	3599.12	-59.83	29.98	-59.83	66.92	153.39	0.38
3700.00	1.87	103.91	3699.07	-60.68	33.15	-60.68	69.15	151.36	0.08
3800.00	2.25	116.96	3799.00	-61.97	36.48	-61.97	71.91	149.51	0.60
3900.00	1.63	126.51	3898.94	-63.71	39.38	-63.71	74.89	148.28	0.70
4000.00	1.51	128.94	3998.91	-65.38	41.55	-65.38	77.47	147.56	0.14
4100.00	1.13	179.73	4098.88	-67.19	42.58	-67.19	79.55	147.64	1.18
4200.00	0.81	154.53	4198.87	-68.81	42.89	-68.81	81.08	148.07	0.52
4300.00	0.75	149.41	4298.86	-70.01	43.52	-70.01	82.44	148.13	0.09
4400.00	0.34	185.58	4398.86	-70.87	43.83	-70.87	83.33	148.27	0.52
4500.00	0.56	155.55	4498.85	-71.60	44.00	-71.60	84.04	148.43	0.32
4600.00	0.82	80.90	4598.85	-71.93	44.91	-71.93	84.80	148.02	0.86
4700.00	0.78	78.82	4698.84	-71.69	46.28	-71.69	85.33	147.16	0.04
4800.00	0.79	101.68	4798.83	-71.70	47.63	-71.70	86.07	146.41	0.31
4900.00	0.75	97.82	4898.82	-71.93	48.95	-71.93	87.00	145.76	0.07
5000.00	0.94	105.92	4998.81	-72.24	50.38	-72.24	88.07	145.11	0.23
5100.00	1.20	108.74	5098.79	-72.80	52.17	-72.80	89.56	144.38	0.26
5200.00	1.38	82.30	5198.77	-72.98	54.36	-72.98	91.00	143.32	0.61
5300.00	1.81	116.07	5298.73	-73.51	56.97	-73.51	93.00	142.23	1.02
5400.00	1.91	126.99	5398.68	-75.21	59.72	-75.21	96.04	141.55	0.37
5500.00	1.33	110.19	5498.64	-76.62	62.14	-76.62	98.65	140.95	0.75
5600.00	1.22	122.96	5598.61	-77.60	64.12	-77.60	100.66	140.43	0.30
5700.00	0.79	125.50	5698.60	-78.57	65.58	-78.57	102.34	140.15	0.44
5800.00	0.82	131.64	5798.59	-79.45	66.67	-79.45	103.71	140.00	0.09
5900.00	0.94	118.96	5898.58	-80.32	67.92	-80.32	105.19	139.78	0.23
6000.00	1.12	120.91	5998.56	-81.22	69.48	-81.22	106.88	139.46	0.18
6100.00	1.10	141.42	6098.54	-82.47	70.91	-82.47	108.76	139.31	0.39
6200.00	0.99	140.01	6198.52	-83.88	72.06	-83.88	110.58	139.33	0.11
6300.00	1.48	128.33	6298.50	-85.34	73.63	-85.34	112.72	139.21	0.55
6400.00	1.55	151.80	6398.47	-87.34	75.29	-87.34	115.31	139.24	0.62
6500.00	1.30	148.56	6498.44	-89.50	76.52	-89.50	117.75	139.47	0.27
6600.00	1.02	112.69	6598.42	-90.81	77.93	-90.81	119.67	139.36	0.76
6700.00	1.20	131.31	6698.40	-91.85	79.55	-91.85	121.50	139.10	0.40
HORIZONTAL DISPLACEMENT IS 121.50 FEET AT 139.10 DEGREES									