

Company: L-DEO - Lamont - Doherty Earth Observatory  
Vessel: Marcus G. Langseth  
Client: Shillington / NSF

Project: MGL1902

Area: Emperor Sea Mounts / North Pacific  
Start Date: 23-Apr-19

Vessel Sensor Offsets

Towing Offsets

Towing Configuration

Acoustic Overhead

Gun Array Offsets

Streamer Front End

Streamer Tail End

Streamer Complete

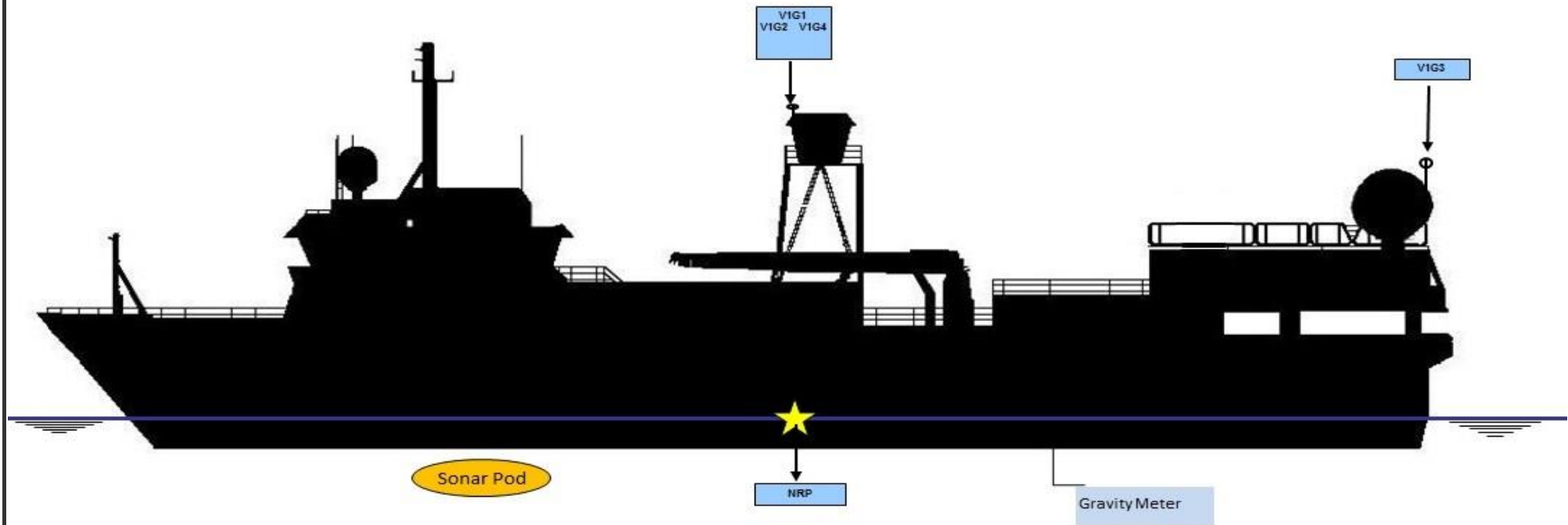
Hydrophone Offsets

Tailbuoy Offsets

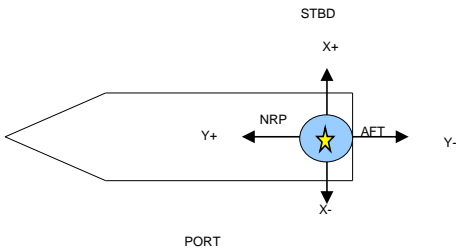
Timing



R/V Marcus G. Langseth - Vessel Sensor Offsets

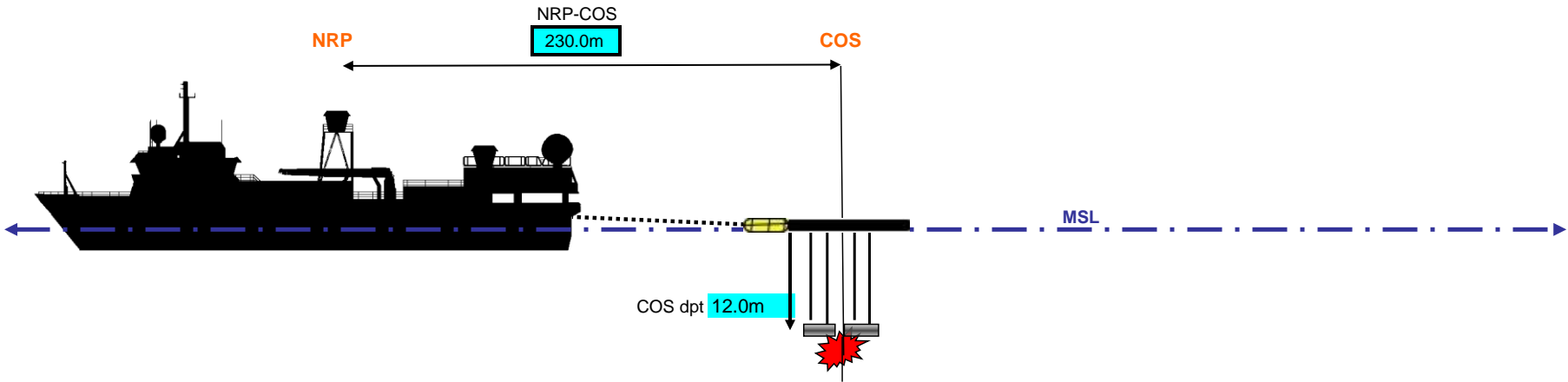


Negative values are above water line  
All measurements in meters



|           |                                       | STBD/PORT (X) | FORE/AFT (Y) | UP/DOWN (Z) |  |
|-----------|---------------------------------------|---------------|--------------|-------------|--|
| NRP       | NAVIGATION REFERENCE POINT            | 0.00          | 0.00         | 0.00        |  |
| V1G1      | C-Nav 3050                            | 0.00          | 0.00         | -16.90      |  |
| V1G2      | SeaPath 200                           | 0.00          | 1.50         | -16.90      |  |
| V1G3      | C-Nav 2000                            | -2.10         | -29.20       | -14.50      |  |
| V1G4      | Pos MV                                | -1.30         | 1.20         | -16.90      |  |
| V1R1      | PosNet                                | -1.30         | 0.00         | -16.90      |  |
| Sonar Pod | EM122 Knudsen ADCP                    | 0.00          | 20.20        | 7.49        |  |
|           | EM122 Center Beam offset (in Spectra) | 0/00          | 13.4         | 7.49        |  |
| MRU       | Seapath MRU                           | 2.30          | 14.16        | -4.30       |  |
| BGM       | Bell Gravity Meter                    | 0.00          | -13.10       | 1.10        |  |

R/V Marcus G. Langseth - Towing Offsets



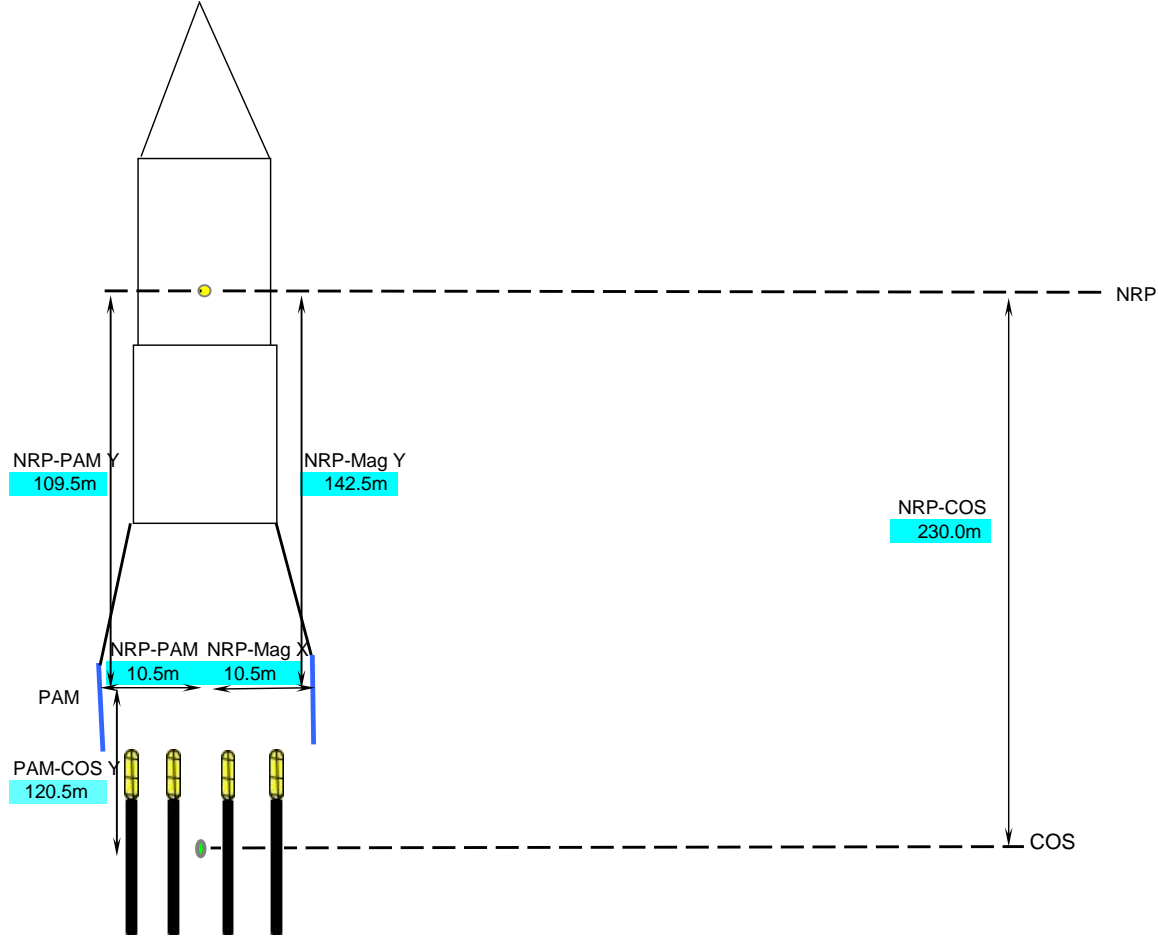
|           |                     |
|-----------|---------------------|
| NRP       | Nav Reference Point |
| COS       | Centre of Source    |
|           |                     |
| CMP       | Common Mid-Point    |
| MSL       | Mean Sea Level      |
| NRP-Sterr | 29.5m               |
| NRP-COS   | 230.0m              |

All measurements in meters

Cell contents referenced from Config\_offsets tab

R/V Marcus G. Langseth - Towing Configuration

| # Streamers        | Length | Channels   | Spacing |
|--------------------|--------|------------|---------|
| # Gun Strings Used | 4      | Vol (in^3) | 6600    |

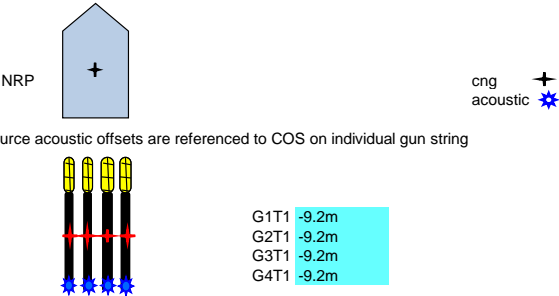


CNG

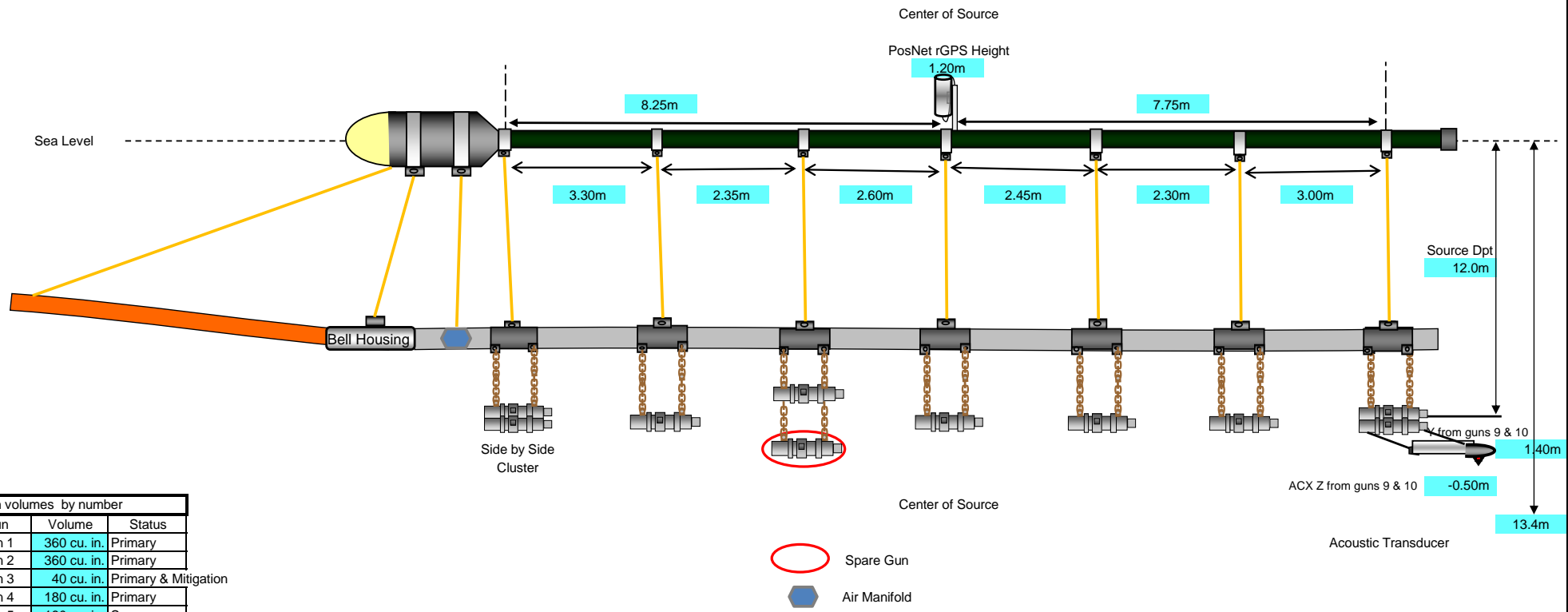
NOT to Scale

Cell contents referenced from Config\_offsets tab

R/V Marcus G. Langseth - Acoustic Offsets



## R/V Marcus G. Langseth - Gun Array Offsets



| Gun volumes by number |             |                      |
|-----------------------|-------------|----------------------|
| Gun                   | Volume      | Status               |
| Gun 1                 | 360 cu. in. | Primary              |
| Gun 2                 | 360 cu. in. | Primary              |
| Gun 3                 | 40 cu. in.  | Primary & Mitigation |
| Gun 4                 | 180 cu. in. | Primary              |
| Gun 5                 | 180 cu. in. | Spare                |
| Gun 6                 | 90 cu. in.  | Primary              |
| Gun 7                 | 120 cu. in. | Primary              |
| Gun 8                 | 60 cu. in.  | Primary              |
| Gun 9                 | 220 cu. in. | Primary              |
| Gun 10                | 220 cu. in. | Primary              |

Array total volume (without spares) is 6600 cu. in. Total volume/string (without spare) 1650 cu. in.

Guns (1 & 2) & (9 & 10) in a horizontal cluster. Guns (5 & 6) in a vertical cluster but #6 is spare only

Gun clusters have 0.75m between guns and hang 0.95m from center of hanger

Horizontal Clusters are 1m from gun port to gun port

Single guns hang from hanger 1.15m

All gun volumes, numbering, locations, and offsets were inspected and verified by Chief Source Mechanic.

All measurements in meters  
NOTE: drawing not to scale

Cell contents referenced from Config\_offsets tab

# R/V Marcus G. Langseth - Gun Configuration

ACX = Acoustic

Center of Source



Spare Gun

Gun Clusters

Guns 1 & 2 horizontal array

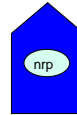
Guns 4 & 5 vertical - lower gun is spare only

Guns 9 & 10 horizontal array

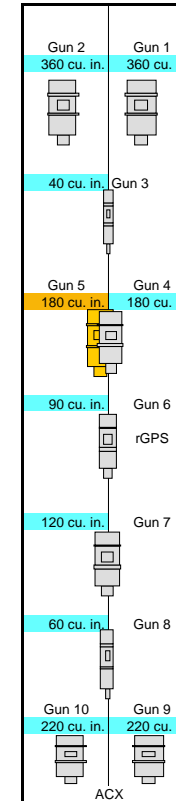
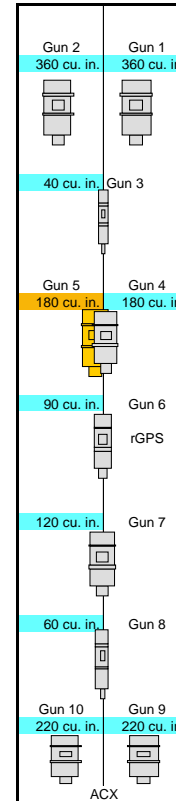
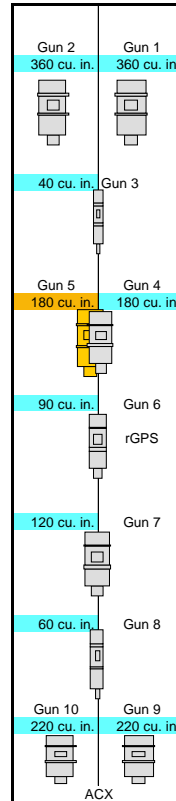
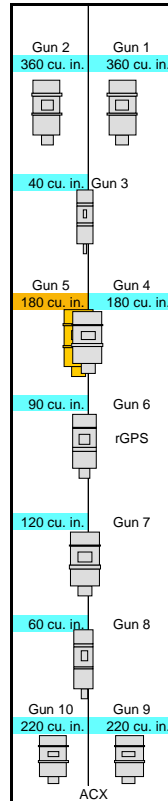
Gun Offsets relative to Center of String

|        | X      | Y      |
|--------|--------|--------|
| Gun 1  | 0.50m  | 8.31m  |
| Gun 2  | -0.50m | 8.31m  |
| Gun 3  | 0.00m  | 5.03m  |
| Gun 4  | 0.00m  | 2.60m  |
| Gun 5  | 0.00m  | 2.60m  |
| Gun 6  | 0.00m  | 0.00m  |
| Gun 7  | 0.00m  | -2.74m |
| Gun 8  | 0.00m  | -5.09m |
| Gun 9  | 0.50m  | -8.21m |
| Gun 10 | -0.50m | -8.21m |

All measurements in meters



Sub array #4      6.0m      Sub array #3      6.0m      Sub array #2      6.0m      Sub array #1



Center of Source

From COS

3.30m

2.35m

2.60m

2.45m

2.30m

3.00m

-7.75m

From COS

[illegible]

| Descrete CDFs (Estimates)              |          |
|--|----------|
| MRP in CMP                             | 155.880  |
| COS-CNG                                | -140.375 |
| CNG-CFG                                | 0        |
| MRP-Mag Y                              | 142.935  |
| MRP-Mag X                              | 10.5     |
| MRP to last busy RGPS                  | 259.935  |
| Total Length of Streamer/<br>inactions | 0        |
| PAM-COS Y                              | 120.5    |
| PAM-COS X                              | 10.5     |
| MRP-PAM Y                              | 109.935  |
| MRP-PAM X                              | 10.5     |
| MRP-CNG                                | 89.9     |
|  |          |
|  |          |

| Derived Offsets (Rounded)                  |        |
|--|--------|
| Towing Offsets Tab                         |        |
| NRP-COS                                    | 230    |
| NRP-CNG                                    | 89.7   |
| NRP-CMP                                    | 109.85 |
| COS-CNG                                    | -146.3 |
| CNG Channel #                              | 0      |
| NRP-Stem                                   | 29.55  |
| Distance from Head of first section to CNG | 7.8    |
| Source Depth                               | 12     |
| Streamer Depth                             | 0      |
| Front End Length                           | 39.95  |

| Twining Configuration TAB |  |        |
|---------------------------|--|--------|
| MRP-COS                   |  | 230    |
| MRP-CNG                   |  | 89.5   |
| CDS-CNG                   |  | -140.3 |
| MRP-Proble CNG            |  | 0      |
| CDS-Proble CNG            |  | 0      |
| In-Cable Streamer Sep     |  | 0      |
| MRP-PAM Y                 |  | 109.5  |
| MRP-PAM X                 |  | 70.5   |
| PAM-COS Y                 |  | 120.5  |
| PAM-COS X                 |  | 50.5   |
| # Gun Strings             |  | 4      |
| gun volume                |  | 5900   |
| Gun separation            |  | 6      |
| # 2D Streamers            |  | 0      |
| 2D Streamer Gun Spacing   |  | 12.5   |
| Number 2D Channels        |  | 0      |
| 2D Streamer -CNG          |  | 0      |
| 2D Streamer -COS          |  | 0      |
| MRP-MAG X                 |  | 10.5   |
| MRP-MAG Y                 |  | 142.5  |

| Desired Offset        |          |
|-----------------------|----------|
| Acoustic Overhead TAB |          |
| G1T1                  | -8.15    |
| G2T1                  | -9       |
| G3T1                  | -8.15    |
| G4T1                  | -9.15    |
| S1T1                  | -16.95   |
| S1T2                  | -167.28  |
| S1T3                  | -7820.88 |
| S1T4                  | -7970.56 |
| S1T5                  | -1       |
| S1T6                  | 0        |
| S1T7                  | 0        |
| S2T1                  | 0        |
| S2T2                  | 0        |
| S2T3                  | 0        |
| S2T4                  | 0        |
| S2T5                  | 0        |
| S2T6                  | 0        |
| S2T7                  | 0        |
| S3T1                  | 0        |
| S3T2                  | 0        |

| Overall Cluster Summary |       |  |
|-------------------------|-------|--|
| Data entry sheets       |       |  |
| Worksheet database: 1-2 | 9     |  |
| Worksheet database: 3-3 | 3.3   |  |
| Worksheet database: 3-4 | 2.35  |  |
| Worksheet database: 4-5 | ***   |  |
| Worksheet database: 5-6 | 2.65  |  |
| Worksheet database: 6-7 | 2.1   |  |
| Worksheet database: 7-8 | 3     |  |
| Source:SPSS-Cluster V   | -0.47 |  |
| GS2 - Accuracy V        | -0.47 |  |
| GS17 height above water | 1.2   |  |
| GS1 Volume              | 360   |  |
| GS2 Volume              | 360   |  |
| GS3 Volume              | 40    |  |
| GS4 Volume              | 180   |  |
| GS5 Volume              | 180   |  |
| GS6 Volume              | 50    |  |
| GS7 Volume              | 120   |  |
| GS8 Volume              | 65    |  |
| GS9 Volume              | 200   |  |
| GS10 Volume             | 200   |  |
| GS Depth: 1             | 0.99  |  |
| GS Depth: 2             | 0.99  |  |
| GS Depth: 3             | 1.05  |  |
| GS Depth: 4             | 1.05  |  |
| GS Depth: 5             | 0.96  |  |
| GS Depth: 6             | 1.15  |  |
| GS Depth: 7             | 1.15  |  |
| GS Depth: 8             | 0.95  |  |
| GS Depth: 9             | 0.95  |  |
| GS Depth: 10            | 0.95  |  |
| GS10 to Axis Z          | 14    |  |
| Surface to Axis         | -15.4 |  |
| Per Iteration to CGS    | 8.25  |  |
| Per Iteration to CGS    | 8.25  |  |
| Alt Iteration to CGS    | 7.75  |  |

| Downstream Offsets                         |         |
|--|---------|
| Streamline Front End                       |         |
| Stream-<br>tripoint at sea                 | 0       |
| Isopoint at sea<br>to end of lead-in       | 10      |
| SHS<br>Length                              | 8       |
| river length                               | 17.5    |
| HAUSITU<br>Length                          | 6.4     |
| HEISA<br>Lgh                               | 10      |
| Feed Coil to<br>Hd to Coil                 | 100     |
| Feed to<br>Head WX                         | 7.5     |
| Feed Coil to<br>CNG                        | -16.423 |
| Head to<br>Feed Coil                       | 34.223  |
| Tail to Aft<br>Coil                        | 25.777  |
| CNG<br>Channel #                           | 0       |
| Center of<br>streamer to Ace<br>transducer | -0.2    |
| First<br>Section #                         | 1       |
| # channels                                 | 0       |
| section<br>length                          | 0       |
| # sections                                 | 0       |
| channel<br>spacing                         | 12.5    |
| First to<br>last                           | -12.5   |
| HEISA<br>Head to aft<br>coil               | 6.40    |

| Demand Offsets                      |         |
|-------------------------------------|---------|
| Steamer Tail End                    |         |
| Head to First Coil                  | 24.223  |
| Tail to AR Coil                     | 20.777  |
| Head to CFG                         | 145.3   |
| Coil to Coil                        | 100     |
| TAPU Length                         | 0.45    |
| Tail Stretch Length                 | 50      |
| Travel Length                       | 0.3     |
| STC Length                          | 150     |
| Last active                         | 0       |
| # channels                          | 0       |
| # sections                          | 0       |
| total section length                | 0       |
| First to last                       | -12.5   |
| Stretch Coil                        |         |
| Center of steamer to Ace transducer | -0.2    |
| channel window                      | 12.5    |
| CFG #                               | 0       |
| First coil to CFG                   | 121.077 |
| CFG to TBRRGPS                      | 205.95  |
| Stretch head to first coil          | 2.5     |

| Derived Objects      |       |
|----------------------|-------|
| Streamer complete    |       |
| #Sections            | 0     |
| # Channels           | 0     |
| First to last        | -12.5 |
| Total section length | 0     |

| Channel Offsets    |         |
|--------------------|---------|
| Hydrophone Offsets |         |
| Channel 1          | 7.825   |
| 2                  | 20.325  |
| 3                  | 32.825  |
| 4                  | 45.325  |
| 5                  | 57.825  |
| 6                  | 70.325  |
| 7                  | 82.825  |
| 8                  | 95.325  |
| 9                  | 107.825 |
| 10                 | 120.325 |
| 11                 | 132.825 |
| 12                 | 145.325 |
| # channels         | 12      |
| # Active's         | 0       |
| Total Channels     | 0       |

| Derived Offsets         |      |
|-------------------------|------|
| Tailbuoy offsets        |      |
| RGPS height above water | 1.3  |
| TB length               | 2.85 |
| TB height               | 1.83 |
| RGPS-ACX                | 9    |
| Bridge-RGPS             | 2.25 |
| Top Leg                 | 1.55 |
| Bottom Leg              | 1.8  |
| STIC                    | 150  |
| ACX below water line    | 1.3  |

[illegible]

| Acoustics referenced to CNG or CDS |           |
|------------------------------------|-----------|
| G21T1                              | -9.55     |
| G22T1                              | -9.15     |
| G23T1                              | -9.15     |
| G45T1                              | -9.55     |
| G17T1                              | -16.95    |
| G17P2                              | -167.28   |
| G17T3                              | -17620.80 |
| G17T4                              | -17970.56 |
| G17P3                              | 0         |
| G17P6                              | 0         |
| G17P7                              | 0         |
| G21T2                              | 0         |
| G22T2                              | 0         |
| G23T2                              | 0         |
| G24T2                              | 0         |
| G25T2                              | 0         |
| G26T2                              | 0         |
| G27T2                              | 0         |
| G28T2                              | 0         |
| G29T2                              | 0         |
| G30T2                              | 0         |
| G31T2                              | 0         |
| G32T2                              | 0         |
| G33T2                              | 0         |
| G34T2                              | 0         |
| G35T2                              | 0         |
| G36T2                              | 0         |
| G37T2                              | 0         |
| G38T2                              | 0         |
| G39T2                              | 0         |
| G40T2                              | 0         |
| G41T2                              | 0         |
| G42T2                              | 0         |
| G43T2                              | 0         |
| G44T2                              | 0         |
| G45T2                              | 0         |
| G46T2                              | 0         |
| G47T2                              | 0         |
| G48T2                              | 0         |
| G49T2                              | 0         |
| G50T2                              | 0         |
| G51T2                              | 0         |
| G52T2                              | 0         |
| G53T2                              | 0         |
| G54T2                              | 0         |
| G55T2                              | 0         |
| G56T2                              | 0         |
| G57T2                              | 0         |
| G58T2                              | 0         |
| G59T2                              | 0         |
| G60T2                              | 0         |
| G61T2                              | 0         |
| G62T2                              | 0         |
| G63T2                              | 0         |
| G64T2                              | 0         |
| G65T2                              | 0         |
| G66T2                              | 0         |
| G67T2                              | 0         |
| G68T2                              | 0         |
| G69T2                              | 0         |
| G70T2                              | 0         |
| G71T2                              | 0         |
| G72T2                              | 0         |
| G73T2                              | 0         |
| G74T2                              | 0         |
| G75T2                              | 0         |
| G76T2                              | 0         |
| G77T2                              | 0         |
| G78T2                              | 0         |
| G79T2                              | 0         |
| G80T2                              | 0         |
| G81T2                              | 0         |
| G82T2                              | 0         |
| G83T2                              | 0         |
| G84T2                              | 0         |
| G85T2                              | 0         |
| G86T2                              | 0         |
| G87T2                              | 0         |
| G88T2                              | 0         |
| G89T2                              | 0         |
| G90T2                              | 0         |
| G91T2                              | 0         |
| G92T2                              | 0         |
| G93T2                              | 0         |
| G94T2                              | 0         |
| G95T2                              | 0         |
| G96T2                              | 0         |
| G97T2                              | 0         |
| G98T2                              | 0         |
| G99T2                              | 0         |
| G100T2                             | 0         |