Tranche 6
Jetting Operations
West of Shetland

Vic Estes
Mobil North Sea Limited
High Current Drilling Basins

Norwegian Continental Shelf
Draugen
W_s = 40 m/s
H_G = 16.0 m

Northern North Sea
Troll
W_s = 41 m/s
H_G = 15.0 m

UK Atlantic Frontier
Foinaven (BP)
W_s = 40 m/s
H_G = 17.0 m

Norwegian Continental
Slope
Helland-Hansen
W_s = 38 m/s
H_G = 17.5 m

Vøring Plateau
Gjallar Ridge (Saga)
W_s = 41 m/s
H_G = 18.0 m

UK Atlantic Frontier
Tranche 6 (Mobil)
W_s = 40 m/s
H_G = 18.0 m

UK Atlantic Frontier
Tranche 61 (Mobil)
W_s = 40 m/s
H_G = 18.0 m

Water Depth, meters

C_S - Surface current
C_B - Seabed current
W_s - Wind speed (1 hour)
H_G - Significant wave ht
T_S - Max sea surface temp
T_B - Min sea bottom temp

40 m/s
41 m/s
40 m/s
38 m/s
41 m/s
40 m/s
40 m/s

16.0 m
15.0 m
17.0 m
17.5 m
18.0 m
18.0 m
18.0 m

18.0 °C
16.5 °C
18.8 °C
16.2 °C
15.0 °C
12.0 °C
12.0 °C

0.9 m/s
2.5 m/s
1.7 m/s
1.4 m/s
1.0 m/s
0.5 m/s
0.5 m/s

18.0 °C
16.5 °C
18.8 °C
16.2 °C
15.0 °C
12.0 °C
12.0 °C

6.0 °C
6.0 °C
6.0 °C
-1.5 °C
-1.0 °C
-1.0 °C
-1.0 °C

0.9 m/s
0.6 m/s
1.2 m/s
1.0 m/s
0.5 m/s
0.6 m/s
0.5 m/s

0.9 m/s
0.6 m/s
1.2 m/s
1.0 m/s
0.5 m/s
0.6 m/s
0.5 m/s
Open Water Operations

Jet 36” / Drill Ahead

Run & Cement 20”

Run BOP Stack
**Previous Jetting in Area**

**Mobil 214/17-1 ~ April 1998**
- **Rig:** RB Falcon *Jack Bates*
- **Water Depth:** 3,832’ MSL
- **Conductor:** 195’ x 36” x 1½” X56 D90

**Mobil 213/23-1 ~ July 1998**
- **Rig:** RB Falcon *Jack Bates*
- **Water Depth:** 3,985’ MSL
- **Conductor:** 195’ x 36” x 1½” X56 D90

**Esso 214/28-1 ~ April 1984**
- **Rig:** Sedco 472
- **Water Depth:** 2,142’ MSL
- **Conductor:** 116’ x 30” x 1½” A36 ‘ALT’

[Map and Diagram of Tranches 6, 7, 8, 60, 61 showing locations and details of the jetting activities]
Esso 214/28-1 Jetting Summary

- **Competent Soil**: 13’ BML
- **Footage Jetted**: 116’
- **Average ROP**: 94.4 FPH
- **Wellhead Height**: 7’ AML
- **Current Speed**: N/A
- **Final Deviation**: <½°
- **Soak Time**: Unknown

*Couldn’t un-jay after 1st jetting attempt. GRA subsided ±14 while cementing the 20” casing in place.*

- **ROP, Feet / Hour**
- **Weight on Bit, kips**
- **Pump Output, gpm**

- **1st Attempt**
- **2nd Attempt**

**Graphs**:
- 1st vs 2nd
- ROP vs Penetration Depth
- Weight on Bit vs Penetration Depth
- Pump Output vs Penetration Depth

**Tools**:
- Vetco GRA with TGB
- Vetco Double ‘J’ Drill Ahead Tool
- Vetco Double ‘J’ Drill Ahead Tool
- 26” Welded Blade Stabiliser
- 3 Joints 30” x 1 ½” Wall A36 ALT
- Float Sub
- Crossover
- Sii 12” DynaDrill Delta 500 Slick Motor
- 26” HTC OSC 3AJ w/ 3 x 20’s (bit spaced 11” inside 30” shoe)
## Conductor Analysis - 30” versus 36”

<table>
<thead>
<tr>
<th>Measure</th>
<th>30” 1½” X65</th>
<th>36” 1½” X56</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor Penetration By Own Weight, feet</td>
<td>46</td>
<td>44</td>
</tr>
<tr>
<td>Maximum Moment, kip-in</td>
<td>60,460</td>
<td>60,050</td>
</tr>
<tr>
<td>Location of Maximum Moment, feet BML</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Maximum Stress, ksi</td>
<td>66</td>
<td>45</td>
</tr>
<tr>
<td>Conductor Lateral Deflection at Mudline, in</td>
<td>34</td>
<td>20</td>
</tr>
<tr>
<td>Ultimate Vertical Capacity of Conductor, kips</td>
<td>452</td>
<td>542</td>
</tr>
</tbody>
</table>

Assumes 160 feet of conductor jetted into intermediate strength soil. Intermediate soil is defined as normally consolidated clay with linearly increasing shear strength with depth at a rate of 10 psi/ft. This is the soil strength recommended by Fugro-McClelland in their 1993 Geological Appraisal Report of Tranche 6.
214/17-1 Jettability Test

Objectives

- Determine if any boulders or course gravel are present that might prevent the jetting of the 36” casing string.
- Confirm that mudline conditions are the same as used in conductor analysis, i.e. firm enough to provide proper support & stability to casing/wellhead/BOP’s.

Procedure

- Position rig ±100 feet down-current from proposed location.
- TIH with 28” bit on rotary assembly. Establish competent bottom with 5000 lbs WOB.
- Jet ahead with minimum GPM, slowly rotate as required. Increase pump rate as required to 1200 GPM. Stop at ±250 feet penetration.
- If objectives are not met, move rig 50 feet towards location and repeat. If objectives are still not met, move over location and drill/set 36” casing conventionally.
214/17-1 Jetting Summary

- Competent Soil: 10' BML
- Footage Jetted: 195'
- Average ROP: 52.3 FPH
- Wellhead Height: 6' AML
- Current Speed: 0 - ¼ kts
- Final Deviation: 0°, ¼°, 1.1° MWD
- Soak Time: 4 hours
- Weight of 36"/20": 259 kips
- Vertical Capacity: 490 kips (Design)
- Final Status: Stable
- Test
- RPM
- Jet

- 8” DC’s (6 Total)
- Dril-Quip GGB with 0 - 2° and 0 - 5° Slope Indicators
- Dril Quip CADA Tool
- 9 ½” x 15’ PC
- 9 ½” Drilling Jars
- 9 ½” NMDC
- 28” Welded Blade Stabiliser
- Halliburton 9 ⅛” HDLI-L MWD-GR
- Float Sub
- 28” Welded Blade Stabiliser
- Jet Sub w/3 x 16’s
- Halliburton 9 ⅛” D200 Slick Motor (no nozzle or dump valve)
- 28” STC MDGHODc w/ 4 x 18’s (bit spaced 7” inside 36” shoe)
213/23-1 Jetting Summary

Competent Soil: 17' BML  
Footage Jetted: 195'  
Average ROP: 53.2 FPH  
Wellhead Height: 6' AML  
Current Speed: ½ - ¾ kts

Final Deviation: ¾°, 1°, 0.6° MWD  
Soak Time: 6 hours  
Weight of 36”/20”: 259 kips  
Vertical Capacity: 542 kips (Design)

Final Status: Stable

ROP, Feet / Hour  
Weight on Bit, kips  
Pump Output, gpm

Penetration Depth, Feet

0 20 40 60 80 100 120 140 160 180 200
0 50 100 150 200

0 50 100 150

8” DC’s (6 Total)  
Drill-Quip GGB with 0 - 2° and 0 - 5° Slope Indicators  
Dril Quip CADA Tool

9 ½” Drilling Jars  
9 ½” NMDC  
9 ½” NMDC  
28” Welded Blade Stabiliser  
Halliburton 9 ¾” HDL1-L MWD-GR  
28” Welded Blade Stabiliser  
Halliburton 9 ¾” F2000S w/ 28” Stab Sleeve (no nozzle or dump valve)  
28” STC MDGHODc w/ 4 x 18’s (bit spaced 9” inside 36” shoe)
214/4-1 Optimisation

- Hydraulics to be optimised for 1,300 gpm rather than 1,200 gpm.
- Halliburton 9 5/8” F2000S motor to be configured with 1° fixed bend and 27 3/4” bearing housing stabiliser. Expect negligible effect on jetting operation but will aid in deviation control of 28” interval.
- Bit moved closer to conductor shoe to aid in jetting ROP.