Deep Water Seabed Intervention

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Van Oord Offshore

Offshore and EPC Contractors
Subsea Rock Installation

Rock installation in deep and shallow water
- Pre lay support for subsea pipelines, cables and structures
- Post lay support for the stabilization of subsea pipelines and cables
- Scour protection around structures
- Ballasting

Equipment
- Flexible Fall Pipe Vessels (FFPV)
  For deep water installation up to 1500 meters
- Side Stone Dumping Vessels (SSDV)
  For shallow water installation to 30 meters
Deep water seabed intervention using excavation techniques

How deep?

Two projects:
1. Nothern Scarp Australia – 625m / 657m
2. Polarled, Norway – 115m / 375m
Northern Scarp Australia

Scope of Work
Preparation of the Jansz Field pipeline route

Client
Chevron Australia Pty Ltd

Location
Australia, Gorgon/Jansz Field
Northern Scarp Australia
Northern Scarp Australia

Profile of the northern scarp crossing project

8 m to be removed

-/- 657 m !!
Northern Scarp Australia

Soil conditions

- CPT = 2.5 – 3.5 MPa.
- Hard Silt
- Su = 80 – 200 kPa
Northern Scarp Australia

**Primary approach:**
- Flexible Fall Pipe Vessel Tertnes
- Equipped with FPROV
- And High Pressure Jetting Device (Clay Cutter)
Northern scarp Australia

Key elements of the Primary Approach

- Pumps at deck level
- Composite coiled tubing in combination with Fall Pipe ROV
- Higher accuracy of controlling excavation tools (Fall Pipe ROV)
- Back up / alternative tool – Clamshell Grab
- Option to install rock
Northern Scarp Australia

**Primary approach:**

- Unfortunately, the “hose” failed.

And then????

We have listed a few situations which could reduce the capacity of the proposed system. For every situation we have come up with a contingency solution, contained within the offered proposal.

<table>
<thead>
<tr>
<th>No</th>
<th>Variation</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Soil &gt;80 but &lt; 150 kPa</td>
<td>Within ClayCutter-X Standard Excavation capacity</td>
</tr>
<tr>
<td>2</td>
<td>Soil &gt; 150 kPa</td>
<td>Engage ClayCutter-X pump 2</td>
</tr>
<tr>
<td>3</td>
<td>Pre cut debris</td>
<td>Use SeaVator to clear the area</td>
</tr>
<tr>
<td>4</td>
<td>Post cut debris</td>
<td>Use SeaVator or ClayCutter-X cannons</td>
</tr>
<tr>
<td>5</td>
<td>Failure main pump</td>
<td>Engage spare pump</td>
</tr>
<tr>
<td>6</td>
<td>Over-excavation</td>
<td>Install rock material</td>
</tr>
<tr>
<td>7</td>
<td>Failure CCX</td>
<td>Mechanical Grab</td>
</tr>
</tbody>
</table>
Northern Scarp Australia

**Primary approach:**
- Flexible Fall Pipe Vessel Tertnes
- Equipped with FPROV
- And High Pressure Jetting Device (Clay Cutter)

**Alternative approach:**
- Clamshell Grab or
  
  Deepwater Excavation System (DES)
Northern Scarp project

Plan B – Deep Excavation System
Northern Scarp project

Plan B – Deep Excavation System (movie)
Northern scarp Australia

As built main trench
Northern scarp Australia

Client satisfaction

“I would like to express my gratitude and admiration for the crew of the Tertnes that has done all the hard work.

It has been a bit of a difficult start, but with the grab as an add-on to the FPROV all of you have once again demonstrated the outstanding ability and agility of Van Oord and Tertnes to achieve the extraordinary.”
Polarled Norway

**Scope of Work**
Removal of high peaks on the Polarled Route by FFVP Tertnes in deep excavation mode at 115 – 375 m waterdepth

**Client**
Statoil

**Location**
50 locations along the Polarled pipeline route Norway
Figure 3. Example of the dredging process optimisation

To be removed
Polarled Norway

10,000 m³ of excavation saves 350,000 m³ of rock
Polarled Norway

Soil conditions

- Soft Clay
- $Su = 10 - 50$ kPa
- Risk of some Hard Clay and Cobbles/Boulders
Polarled Norway

Corals
Polarled Norway

Dedicated disposal area’s
Polarled Norway

Offshore and EPC Contractors
Polarled Norway

Location

LONGITUDINAL PROFILES at OFFSET 0.0m: HORIZONTAL SCALE 1 : 100 VERTICAL SCALE 1 : 100
Conclusions

- Two projects have been very successfully executed
- Two very happy clients
- Combination of Grab with FPROV gives good positioning control
- Good control of deposited material
- Grab Excavation System gives very limited turbidity (Coral)
- Van Oord has a patent on Deep Excavation System.