Convite da Palestra

SUT (Society for Underwater Technology),
SOBENA (Sociedade Brasileira de Engenharia Naval) e
UK BRAZIL Centre of Ocean Engineering
convidam para a palestra:

Soluções com Pipeline Bundles

a ser proferida por
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Diretor de Operações da Subsea 7

Dia 23 de agosto de 2005 às 18 horas
no Fórum de Ciência e Cultura da UFRJ
Palácio Universitário da Praia Vermelha
Av. Pasteur 250 - Salão Moniz de Aragão
Urca - RJ - RJ

Após a palestra será oferecido um
coquetel aos participantes.
1 - BUNDLE PRODUCT

What do we mean.

Some History
A pipeline bundle is a “package of subsea well or step out field development facilities. Typically pipelines control umbilicals and manifolds.
The Manifold facility is integrated into the tow head
The Bundle is towed to location using CDTM
The Long Trek West

1978

1980
Aerial View - Wester Fabrication Facility
By controlling the depth at which the bundle is towed, the pipeline system is not subjected to wave and surface current effects. This allows acceptable level of fatigue within the bundle system.

Tow durations of 6 days have been successfully achieved.
A data highway runs the length of the bundle and allows acoustic commands made at one end of the bundle to be implemented at the other, for example for valve actuation or acoustic spool metrology.
Controlled Depth Tow Method (CDTM)
3 – BASIC ENGINEERING PRINCIPLES
**Controlled Depth Tow Method**

- Chains attached at regular intervals along the bundle.
- Ensures accurate weight control to approximately 0.5%.
- Weight of chain links on seabed is submerged weight of bundle.
- Chains can be easily cut by ROV to trim bundle for tow if required.
Anchor Chains

With typically 3” chain, a tow speed of 4 knots produces an uplift force of 50N/m
4 – EVOLUTION OF THE BUNDLE PRODUCT
## BUNDLE LENGTH

| The length of Bundles towed and installed by Subsea 7 is a function of the fabrication site length. Beach tie in has been performed but not recommended in North Sea. | The site at Wick has been developed from 2km to 8 km. However, the Subsea tie back length is not restricted. Viz Mobil Skene. 2 off 7.5km bundles with a mid point tie in structure. |
Why consider a Bundle?

A Bundle may be as simple as a pipe in a pipe, or may contain many lines.

MCP-01 Bypass bundle - 2.4km pipe-in-pipe

Gullfaks 01
High Levels of Thermal Insulation
Shell Gannet U=0.75W/m²K
5 - Bundle Design

Typical Cross Section
BASIC PRINCIPLES

- Constructability & Economics
- Engineering
- Service Requirements
Bundle Cross Section

Heat Transfer

Low Cof G
BUNDLE CROSS SECTION

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>DIMENSIONS</th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CARRIER PIPE</td>
<td>(20&quot;) 736.8mm O.D. x 14mm W.T.</td>
<td>API 5L, GRADE X52</td>
</tr>
<tr>
<td>2</td>
<td>PRODUCTION PIPE</td>
<td>481.2mm O.D. x 12.0mm W.T.</td>
<td>22% CR DUPLEX</td>
</tr>
<tr>
<td>3</td>
<td>INSULATION</td>
<td>10mm THK</td>
<td>EPMW</td>
</tr>
</tbody>
</table>
6 - BUNDLE CONSTRUCTION AT WICK
Material Handling & Weight Control

- All materials subject to initial inspection
- Identification numbers checked and recorded
- Materials quarantined if required
- Weekly checks on long term storage carried out

- Permanent works are carefully weighed and dimensionally checked
- Information input into PRABOS for resultant buoyancy calculations
Shop Welding
10 inches Double Jointing at Fabrication Shop
Production Welding

- Pipelines are normally 100% Tig welded.
- Automatic welding now is Economic & Reliable.
- Shop conditions allow welding of exotic material.
- 13Cr, 22Cr, Inconel lined pipe have been used extensively in Bundles.
**Configuration & Insulation**

- Fabricated in lengths of 700m to 7.5km
- Configuration to allow attachment of spacers
- Polypropylene and polyurethane field joints
- Low density polyurethane half shells inside sleeve pipe
Tube & Cable Installation

- Installation of:
  - Hydraulic Tubes
  - Chemical Injection Tubes
  - Power and Signal Cables

- Utilises on site deployment system
- Coated or uncoated
- Various material types
- Final pre-tensioning if required
Semi automatic and Automatic processes are normally used for carrier pipe welding.
Inner Bundle assembled showing spacer pitch

Carrier pipe sleeved, ready for closing welds
7 - TOWHEADS & TRANSPORTATION
Tow Heads

Bouyancy Force in shallow water
Tow Heads

Integrated buoyancy 8 Slot Manifold
Tow Heads
Offloading Tow Head in Wick Harbour
Tow Heads

There are however designs to avoid
Tow Heads

Mud Mats & Detachable Buoyancy
Tow Heads

Integrated buoyancy can be flooded or grouted to create gravity based stability. Obviating piling means control modules can be pre-installed and commissioned on site.
Tow Heads

Oil & Gas Development presents challenges!
Tow Heads

Planning and preparation have allowed this to be performed more than 40 times.
Towhead Delivery/Tie-In

- Large structures by sea to Wick Harbour
- Smaller towheads by road
- Final towhead alignment and bundle tie-in
8 - BUNDLES LAUNCH
Launch way transition from site to sea
Launch
9 – TYPICAL TOW FLEET
Not Vessel Specific

- Currently specialised pipelay vessels have full schedules
- Bundle installation is not tied to a specific vessel
10 – SPECIFIC ADVANTAGE of the BUNDLE PIPELINE SYSTEM
Removes need for separate CP of each pipe

- Carrier pipe anodes protect the whole pipeline system.

- Inside bundle there is a biocide protected oxygen free environment. No coatings, no corrosion.

- Within pipe-in-pipe systems, the pipeline material and insulation is in a dry air environment.

- CP design for materials susceptible to damage by CP system e.g. 13% Cr is much simpler with less design risk.

- Anode procurement and installation time minimised.
Subsea 7 has experience of a wide range of materials optimised for a wide range of fluids

Subsea 7 has installed bundles with the following pipeline materials

- Carbon steel (HFI and Seamless)
- 22% Cr Duplex stainless steel
- 25%Cr Super duplex Stainless Steels
- 13% Cr Steel
- 316L lined pipes
- 904L Lined pipes
- Alloy 825 Lined pipes
- Plastic liners

Lined pipes offer the cheapest solution to corrosive field conditions, and can be installed by CDTM without risk of internal buckling
Prior to launch, all electrical and hydraulic interfaces can be tested

Full Site Integration testing with Christmas tree can be undertaken

All Manifold valves can be installed and tested prior to launch

Multiphase Flow Meters can be installed prior to launch if towhead/manifold is not piled

Hydrotesting is completed onshore with only leak testing required offshore

Structures up to 380 Tonnes have been installed, including SCM’s, Chokes and MFM’s.
11 – BUNDLE APPLICATIONS
Chevron Alba Caisson. Obviates the need for heavy lift vessel
Kerr Mcgee Leadon Field

- Infield construction. Schedule very short.
- Very narrow pipeline. Corridor suits turret moored FPSO.
- Mid point riser structure for both well sites

- No trenching.
- On botton stability achieved by flooding the carrier pipe
12 – S7 BUNDLE INSTALLATIONS