J P KENNY

MTS SYMPOSIUM
SESSION 9: SEABED ARCHITECTURE

DELIVERS. EVOLVES.

WHOLE LIFE SOLUTIONS FOR PIPELINE AND SUBSEA SYSTEMS

Presentation 2: Controls

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Subsea Control Systems

Type	Advantages	Disadvantages	Typical Distances	Application
Direct Hydraulic	Simple High Reliability	Longer offset – slow response Large Umbilical	Less than 5 miles	Single Satellite Small Fields Short Distances
Piloted Hydraulic	Improved Response Reduced Umbilical High Reliability	Subsea Package Large Umbilical	4 to 12 miles	Satellite trees Short to medium distances
Electro-Hydraulic Piloted	Quick response for chosen valve(s) Some Data Feedback	Subsea Package Large Umbilical	4 to 15 miles	Satellite trees Short to medium distances Minimum Feedback
Mini-Multiplex Electro Hydraulic	Quick Response Data Feedback Small Umbilical	Limited Functions Subsea Equipment Subsea Electrical Connection	3 + miles	Small Fields Longer distances
Multiplex Electro-Hydraulic	Quick Response High Data Feedback Small Umbilical Redundant	Complex Subsea System Subsea Electrical Connections	3 + miles	Long Distances Complex Fields

Direct Hydraulic

Umbilical

1. PWV (USV1)
2. PMV (USV2)
3. SCSSV1
4. AMV (if actuated)
5. AWV
6. XOV (option)
7. CITV
8. Annulus Service Line
9. Chemical Supply

Piloted Hydraulic

Umbilical

1. PWV (USV1)- D/H with P/H valve
2. PMV (USV2) – D/H
3. SCSSV1 – D/H
4. AMV – D/H (if actuated)
5. AWV – D/H
6. XOV – D/H (option)
7. CITV – D/H
8. Annulus Service – Direct
9. Chemical – Direct
10. Pilot Line – D/H to Pilot Valve

Pilot can-be one per P/H control valve or can-be ganged to multiply P/H control valves

Electro- Hydraulic Piloted

Umbilical

1. **LP Supply w/ 2 E/P Valves**
   - PWV (USV1)
   - PMV (USV2)
2. **SCSSV1 – D/H**
3. **AMV – D/H (if actuated)**
4. **AWV – D/H**
5. **XOV – D/H (option)**
6. **CITV – D/H**
7. **Annulus Service – Direct**
8. **Chemical - Direct**
9. **4 conductors (Quad or 2TP)**

TP per each E/P function

Mini-Multiplex Electro Hydraulic (Mini Mux)

Umbilical

1. **LP - Supply**
   - PWV (USV1)
   - PMV (USV2)
   - AMV
   - AWV
   - XOV
   - CITV
2. **SCSSV1 – HP**
3. **Annulus Service Line**
4. **Chemical Supply**
5. **4 conductors (Quad or 2TP)**
   - 1 TP – Comms-on-power
   - 1 TP – DHPT direct connect

Multiplex Electro-Hydraulic

Umbilical

1. **LP - Supply**
   - PWV (USV1)
   - PMV (USV2)
   - AMV, AWV
   - XOV
   - CIDV, MIDV1, MIDV2, MITV
   - PCV-O, PCV-C
2. **HP – Supply**
   - SCSSV1
   - SCSSV2
3. **Annulus Service Line**
4. **Chemical Supply**
5. **Hydrate Inhibitor Supply**
6. **8 conductors (2 Quads)**
   - 2 TP – Comms-on-power
   - 2 TP – DHPT direct connect

Multiplex Electro-Hydraulic - System

- Master Control Station (MCS)
- Hydraulic Power Unit (HPU)
- Topside Umbilical Termination Assembly (TUTA)
- E/H Umbilical
- Subsea Umbilical Termination Assembly (SUTA)
- Hydraulic Flying Leads (HFL)
- Electrical Flying Leads (EFL)
- Control Pod or Subsea Control Module (SCM)

Umbilicals

Hydraulic Lines

- Synthetics
- Steel Tubes (Super Duplex, 19D, Carbon steel, etc.)

Electrical Elements (Power & Signal)

- Twisted Pairs
- Quads
- Triads

Fiber Optic Elements (Data)

Fillers

Sheathing

Armor (if required for protection and stability)

Umbilicals

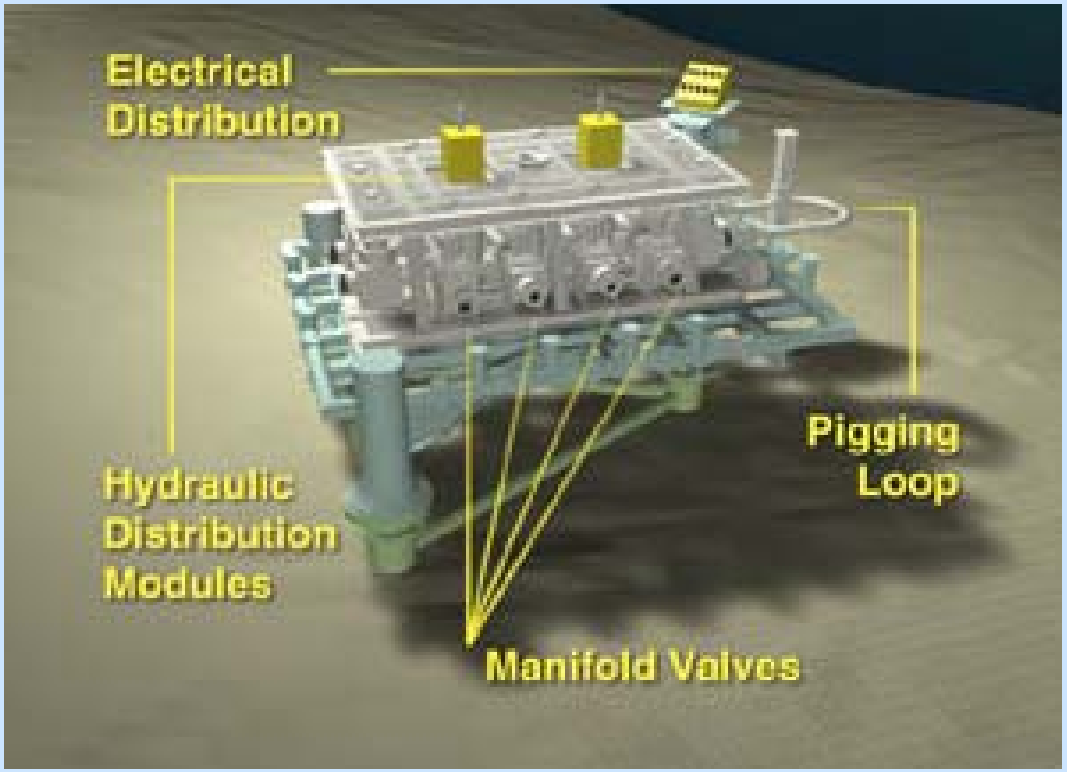
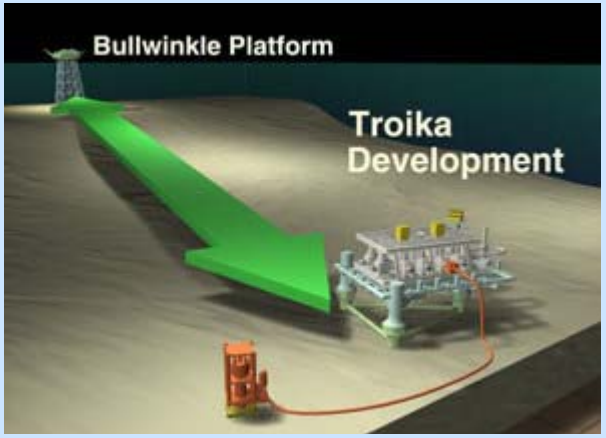
Subsea Umbilical Termination Assembly (SUTA)

Flying Leads

Hydraulic Flying Leads can be synthetics (hose) or steel tubes

Electrical Flying Leads can be segregated (4 pin) or combined (8 pin) comms and power

TROIKA



McPac System used to provide control from the manifold to the tree functions