# Deepwater Mux Subsea BOP Control System & Marine Riser System

***Presented by***

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## Course Module

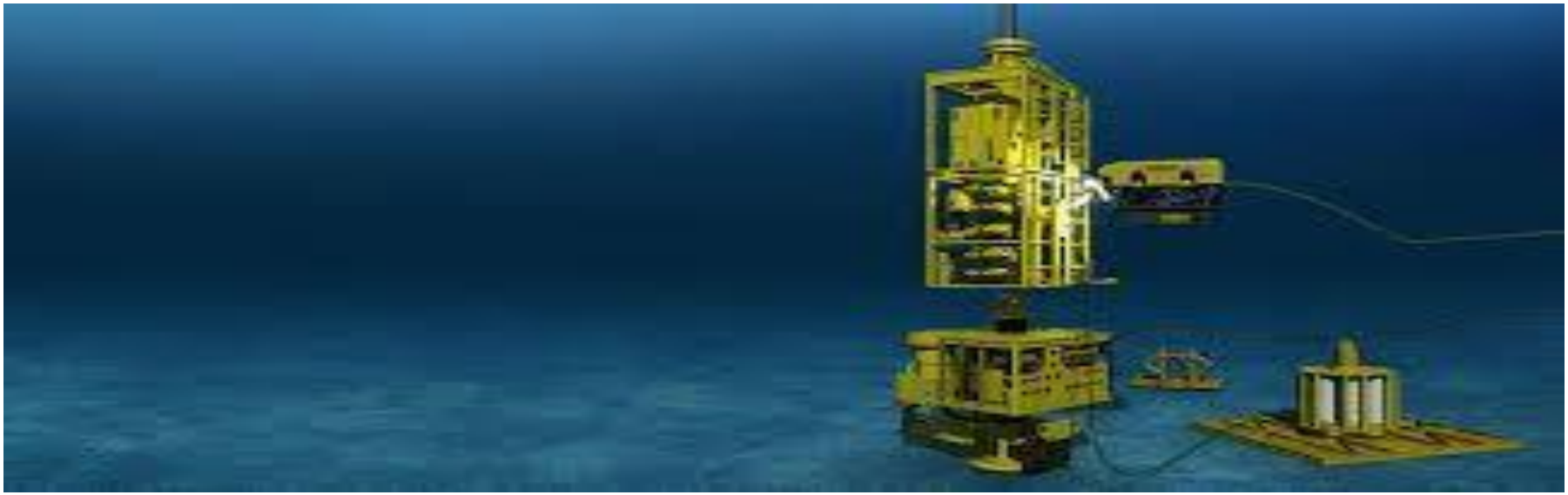
**Lecture 1 : Subsea Multiplex BOP Control System – Operations, Trouble Shooting & Maintenance**

**Lecture 2 : Marine Riser System Inspection & Maintenance**

**Lecture 3 : Testing of Subsea Multiplex BOP Control System**

**Lecture 4 : Recommended Pressure Test Practices, Floating Rig with Subsea Multiplex BOP Control System Stack**

**Lecture 5: Job Safety Analysis for BOP Maintenance and Inspection**



# Lecture 1: Subsea BOP Control Systems, Operations and Trouble Shooting

## Learning Outcome

- ❑ Understand Deepwater Subsea Control System
  - ✓ Hydraulic System
  - ✓ Mux Control System
  - ✓ Acoustic Systems
- ➢ Subsea BOP Control System Configuration
- ➢ Operation Sequence of Subsea BOP Control System
- ➢ Trouble Shooting Subsea BOP Control System

# Introduction to Subsea BOP Control System

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## Introduction

- Each component in a Blow Out Preventer (BOP) assembly is operated hydraulically by either moving a piston up and down or back and forth.

- One of the most important functions of a BOP Control System is to direct hydraulic fluid to the appropriate side of the operating system and to provide a means in which fluid on the other side of the piston can be expelled.

- On land, jack up or platform drilling operations the control of the BOP is easily achieved in a conventional manner by connecting each BOP function directly to a source of hydraulic power situated at a safe location away from the wellhead.

## Introduction

- Operation of a particular BOP function is then accomplished by direct control i.e. directing hydraulic power from the control unit back and forth along two large bore lines to the appropriate operating piston.

**Note:**

On land, jack up or platform drilling operations – **BOP system uses the minimum number of controlling valves to direct the hydraulic fluid to the required function.**

**It also enables the returning fluid to be returned to the control unit for further use.**

## Introduction

- For subsea drilling operation, direct control cannot be applied due to the fact that the resulting control line connecting the BOP to the surface will be prohibitively large to handle.

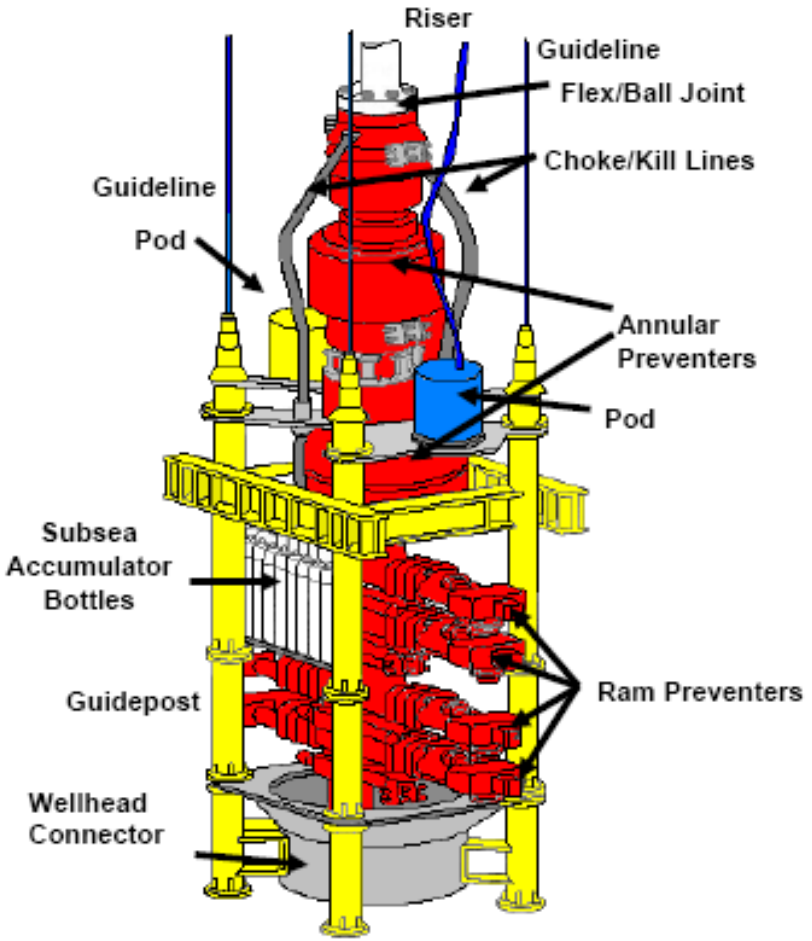
- Reaction time would also be unacceptable due to the longer distances to the BOP functions and the consequent pressure drop.

- **In order to overcome these problems indirect operating systems have been developed.**

# Introduction

There are three types:

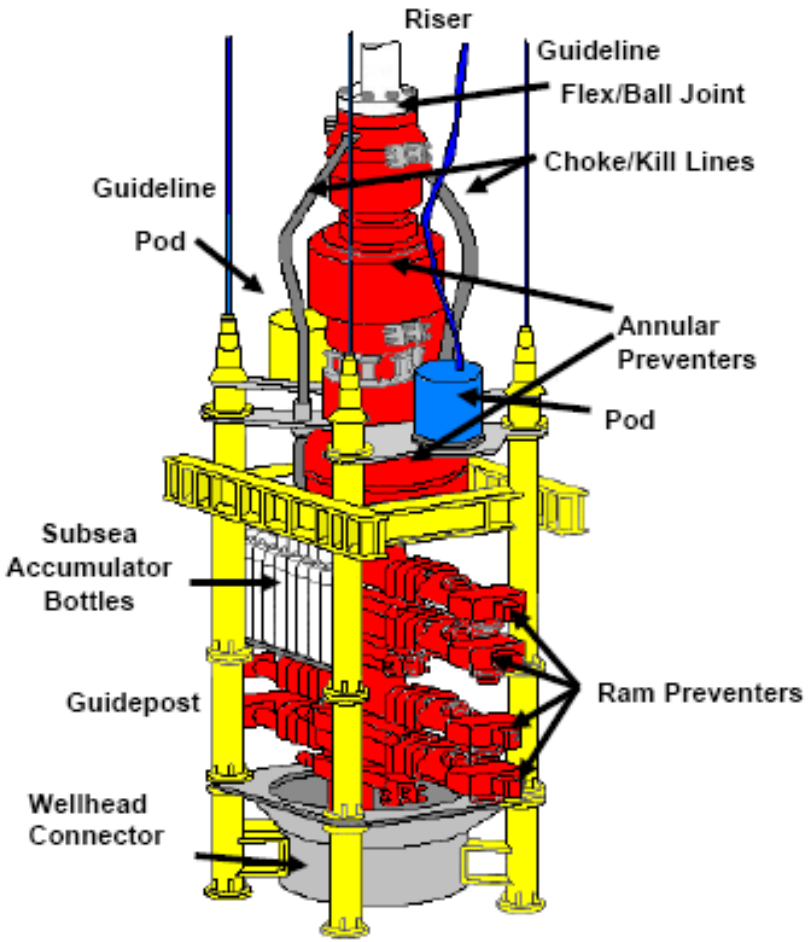
1. Hydraulic System
2. Multiplex Electro-Hydraulic System.
3. Acoustic Systems



# Hydraulic System

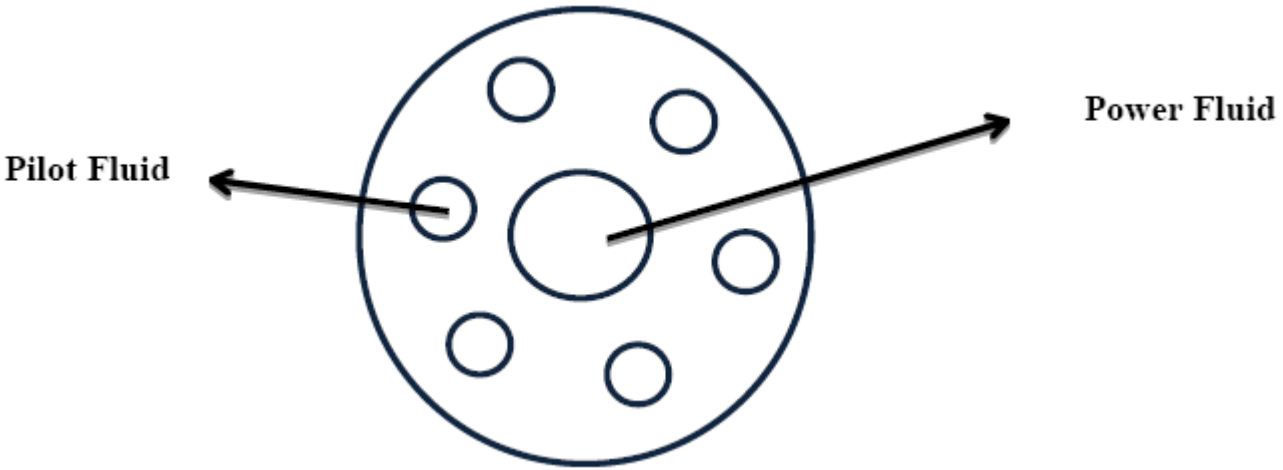
- For indirect hydraulic system, the size of the control umbilical is reduced for deepwater application as the hydraulic control function (hydraulic lines) is split into two:

  I. Hydraulic line that transmits hydraulic power (power fluid) to the BOP down a large diameter line located at the center of the control umbilical.



# Hydraulic System

II. Hydraulic lines that transmit hydraulic signals (pilot fluid) down smaller lines to pilot valves.



# Subsea Mux BOP Control System

- In deeper and ultra deep waters the problems of umbilical handling and reaction time to transmit pilot fluid and power fluid to there respective functions became more significant due to the long step out.

- In order to overcome this change, hydraulic lines transmitting the pilot fluid to the pilot valve were replaced with electrical cables which operate solenoid valves.

**Thus; hydraulic signal is then sent from this valve to the relevant pilot valve which in turn is actuated and direct power fluid to its associated BOP function.**

# Subsea Mux BOP Control System

- The time division multiplexing system provides simultaneous execution of commands and results in a relatively compact electrical umbilical is fast compared to hydraulic system.

- The MUX control umbilical consist of four power conductors, five conductors for signal transmission and additional backup and instrumentation lines.

- With the armoured sheath the umbilical has a resulting diameter of some 1.5 inches with a weight of about 3 lbs/ft in air.

**This is the main subject of discussion, we will discuss this in details Shortly.**

# Acoustic System

- In addition to either of the primary control methods mentioned above the Subsea Bop Stack can also be equipped with an acoustic emergency back up system.

- In principle this is similar with the other two systems i.e. hydraulics & electro hydraulics. The main difference is the replacement of the hydraulic or electric commands to the pilot valves with acoustic signals.

**Note:**

**Being a purely backup system the number of commands is limited to those which might be required in an absolute emergency**

# Manufactures of BOP Control System

The main manufacturers of control systems are:

1. Cameron Iron works
2. NL Shaffer
3. Koomey
4. Valvcon Division of Hydril

**Note:**

**In order to interpret the general concept since these are probably the most common, emphasis will be placed on the NL Shaffer and Koomey Systems.**

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