Performance
THROUGH LEADERSHIP

11th June 2008
Subsea Asia 2008
Experiences in executing the World’s first All Electric Tree Project
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• Subsea Challenges or why do we need All Electric systems

• Introduction to CameronDC™

• Executing K5F for TOTAL E&P Netherlands

• Summary
SUBSEA CHALLENGES

• Deeper
• Further
• Better
• Added value
• Environment
MAJOR SHORTCOMINGS – Current Technology

COST
- Large Umbilicals
- Complex Equipment
- Control Fluid Management

RELIABILITY
- Complex System
- Moving Parts / Seals

EFFICIENCY
- Response Time / Start-up
- Inadequate Condition Monitoring

LIMITED
- Step Out Constraints
- Deepwater Functionality

GREATEST SHORTCOMING
- Dependence on Hydraulics
Gate Valve Actuators

- Used with Standard Subsea Gate Valve
- Electrically opened, with Low power to hold open
- Failsafe close using standard Spring Return
- Redundant
- Direct position indication (@ actuator stem)
Choke Actuator

- Used with standard Subsea Insert Choke
- Electrically functioned; Infinitely adjustable (no ‘stepping’)
- Fail “as is” design
- Redundant
- Direct position indication (@ actuator stem)
- < 2 minute from full open to full close (variable)
- Continuous operation (flow control)
SUBSEA CONTROL

Electric Subsea Control Module (ESCM)

• Power Communication Distribution
• Actuator Control Unit.
• Motor control Unit
• Interface module for third party sensors.

Power Regulation and Communication Module (PRCM)

• Communication module.
• Power Regulator for converting transmission voltage to actuation voltage.
How does it work over long distances?

Power

- Topside unit supplies 3kV DC to each subsea PRCM
- On demand (Actuator open) the current will be increased to the required level
- PRCM will provide the required power to the eSCM and will command Valve to open
- Once Actuator is open - power is only needed to hold it open (50 – 100 Watts)
- Topside Unit will reduce the current via Power Management Software
How does it work over long distances?

Signal

- System is designed to use subsea LAN – protocol TCP/IP
- Shore to Subsea via Fiber Optic with Repeaters – min. 100 Mbit/s
- Seabed communication is high speed DSL – min. 192 kBit/s on twisted pair – or fiber optic
- Remote manageable switches subsea
- All applicable units are selectable via IP address

Topside → 640 km → FO w/ Repeater → < 15 km → Subsea end

Diagram: Topside connection to Subsea with FO w/ Repeater and Highspeed DSL.
Redundancy Concept

Currently Maximum 16 Functions, this includes Sensor readbacks.
Environment & Safety

Environment

- Zero discharge policy means no fluid discharge
  - Closed return needs extra line
- Short Times for Start-up and ESD

Safety

- No pressure system
- No gas bottle handling
- No precharging
- No accumulators
K5F Project

Scope:
2-off Mudline Style X-Mas Trees
Production Control System
Installation & Workover Control system (*rental*)
K5F Project

System Application, Challenges

Bring Product from R&D into Industrial Environment
- Know-how transfer
- Lock-in Vendors and develop
- Repeatability

Product Qualification and Project Execution in Parallel
- Assembly in a step by step approach
- Focus on Long Lead items first
- Management of Change
K5F Project

FIT/SIT Set-up

2-off X-Mas Trees
Topside Controls
Distribution, incl.
• 5 Km Umb. Redundant
• Seawater tank w/ PRCMs, Anodes and Cathodes
IWOCS
K5F Project

FIT/SIT Set-up

2-off EPCU’s
MCS

2-off 5 Km Umbilical

Seawater Tank

PRCM
Cathode
Anode

E-Actuator
eSCM

X-Mas Tree, top view

Coax Cable
K5F Project
System Application, Installation

EPCU’s installed on TOTAL’s K6 Platform

Operation of Tree during Well Test, using the DC-IWOCS System

First X-mas Tree being installed on K5F2
Conclusions
or why **Cameron**DC™

- DC power mandatory
- Truly environmental friendly
- High Reliability and Availability through Design & Concept
  - Redundancy
  - Network concept
- Umbilical/Fluid Savings
- Efficient System Startup
- ESD execution time
Thank you

Questions?