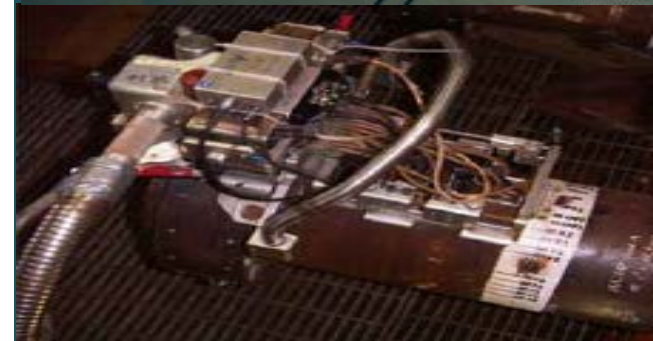
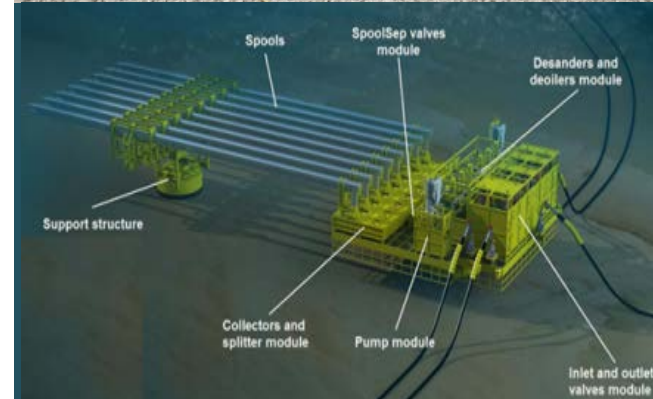
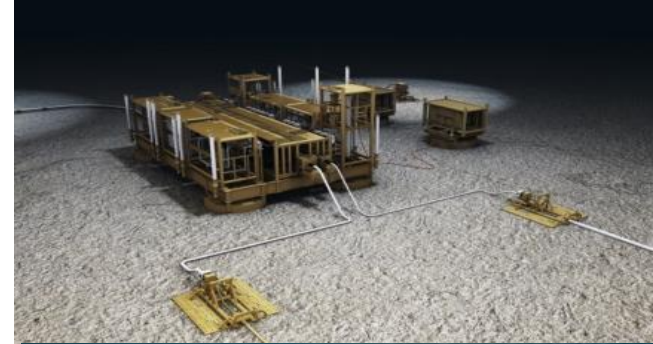


FUTURE OF THE OFFSHORE: TECHNOLOGIES TO ENHANCE LONG TERM COMPETITIVENESS

J.P. Morgan's 'Future of the field' Roundtable Series
14th June 2018



Giovanni Chiesa

Saipem E&C Offshore Division
Head of Subsea Engineering &
Underwater Technologies

TODAY'S PRESENTATION

1

STRATEGY AND VISION

2

CAPEX EFFICIENCY

3

EXECUTION EFFICIENCY

4

OPEX EFFICIENCY

5

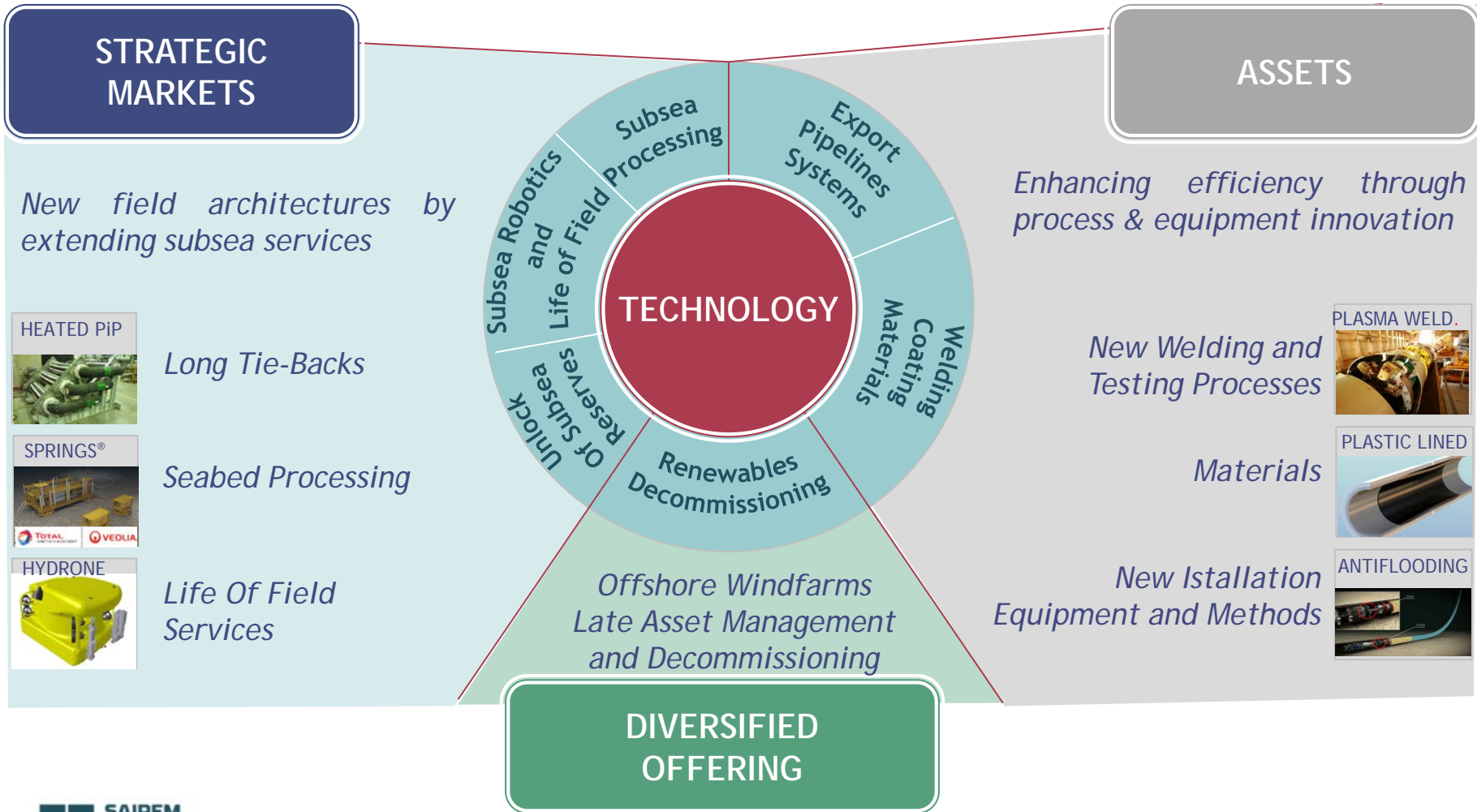
CLOSING REMARKS



STRATEGY AND VISION

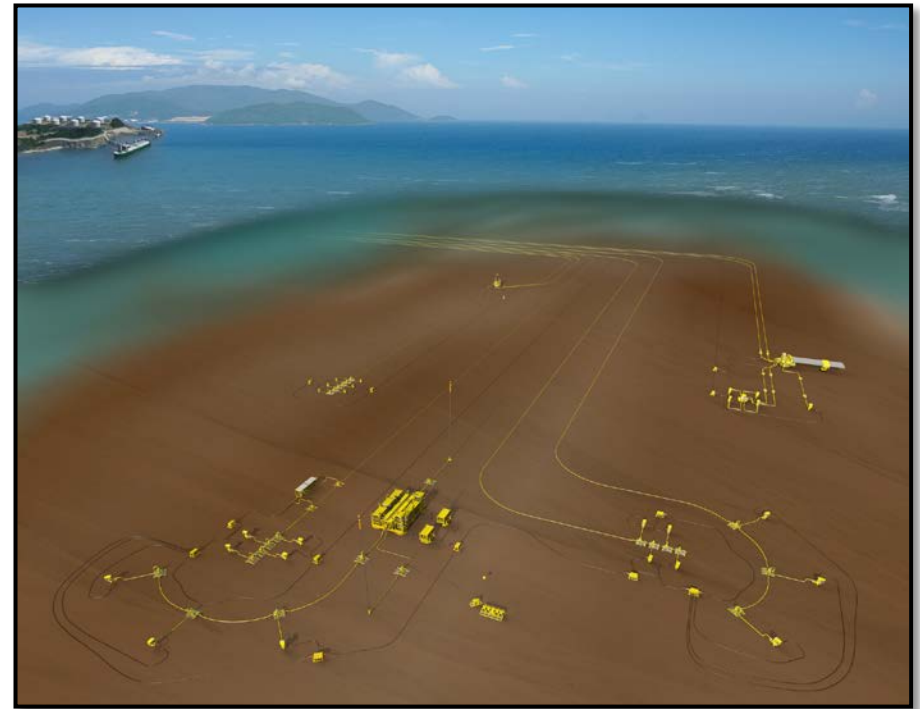
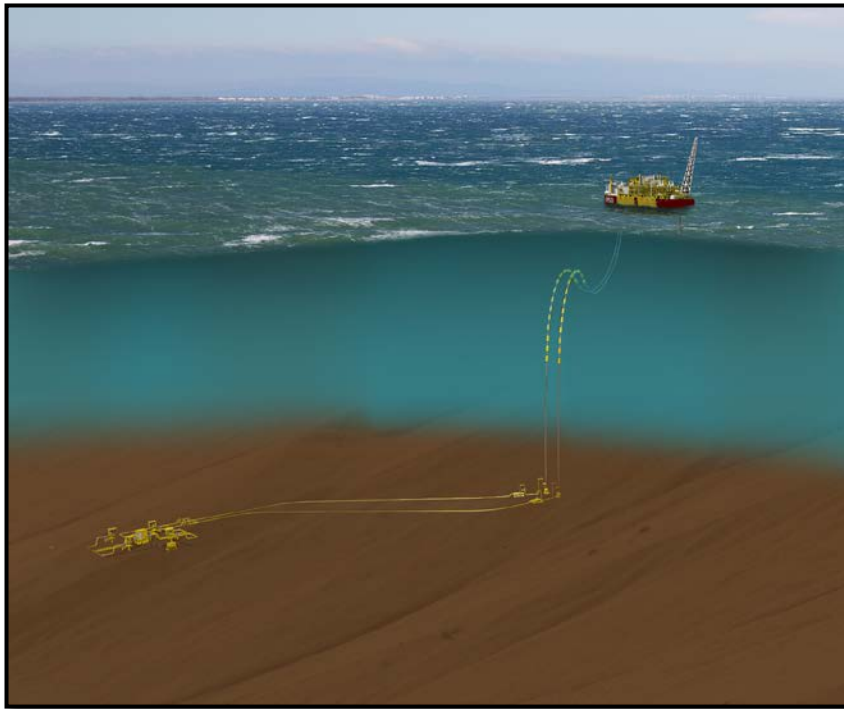
E&C OFFSHORE - STRATEGIC TECHNOLOGY TARGETS

INNOVATION for GLOBAL SOLUTIONS



THE SUBSEA-TO-SHORE LONG TERM VISION

Moving Topside Operations onto Seabed



- Moving Subsea is a Key for Cost Reduction
- Technology Innovation to Enable Seabed Production Operations

THE SUBSEA-TO-SHORE LONG TERM VISION

Opportunities & Challenges

Cost Reduction through Novel Field Development Schemes based on:

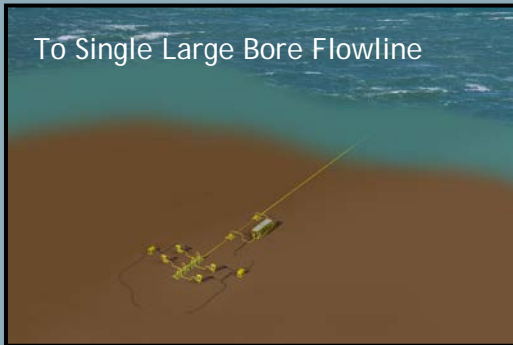
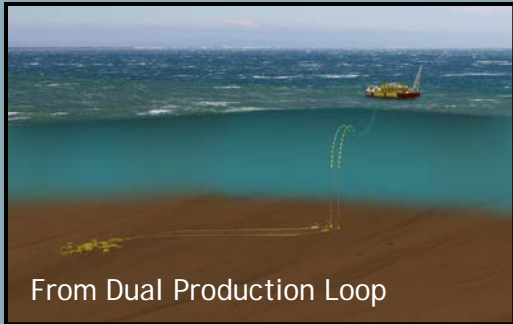
- Longer Tie-backs to Onshore Receiving Facilities or to Existing Floating Hubs with Simplified Gathering and Transportation Systems
- Assurance of Production Delivery over Longer Distances
- No In-Field Surface Support for Auxiliary Functions
- Smarter Subsea Systems for Reduced Communication to/from Shore
- SPS - URF Integration, Standardization of Interfaces and Open Framework Strategy

TECHNOLOGIES ENABLING CAPEX EFFICIENCY

CAPEX EFFICIENCY TECHNOLOGIES (1/3)

Pipelines

NEW PRODUCTION SCHEMES



Maturity: Under Qualification

HEATED PIPE IN PIPE

- Sliding Pipe-in-Pipe (J & S lay)
- Large Bore Flowlines



Novel Development Schemes

LOCAL HEATING

Induction Heating during Production



Maturity: Under Qualification

CAPEX EFFICIENCY TECHNOLOGIES (2/3)

Processing

SPRINGS®

- Development in Partnership with Total and Veolia
- Subsea Seawater Desulfatation



Maturity: Under Industrial Qualification

Novel Development Schemes


SpoolSep Liquid/Liquid Separation

- Horizontal Pipes Working in Parallel
- Gravity Separation
- Produced Water Treatment in Partnership with Veolia



Maturity: Under System Qualification

Multipipe Gas/Liquid Separation

- Vertical Pipes working in Parallel
- Gravity Separation
- Slug Capacity
- Separation of CO2 in Dense Phase
- Hi-SEP Development 



Maturity: Available

CAPEX EFFICIENCY TECHNOLOGIES (3/3)

Controls & Electric

SMART Control

SUBSEA BUS™

SIEMENS DigiGRID

Ingenuity for life

The diagram illustrates the SMART Control architecture. At the top, three boxes represent 'CONTROL LOOPS', 'MONITOR', and 'SAFETY'. These are connected to an 'Eth Switch Managed' unit. Below this, an 'Umbilical' is shown connecting to another 'Eth Switch Managed' unit. This second switch is connected to 'SEMs' (Subsea Electronic Modules) for 'Control', 'Monitor', and 'Safety'. The system also includes 'ProfNet ID realtime', 'ProfSafe', and 'OPC-UA non realtime' protocols. A 3D rendering of a subsea control rack is shown on the right.

- Development and Qualification of a Subsea Control System based on a OPEN FRAMEWORK
- Extendable Platform of Software and Hardware Components
- Completion of System Qualification by End 2018

Maturity: Under Qualification

Novel Development Schemes

All Electric

- Substitute Hydraulic Power with Electric Power for Valves Actuation
- Simplification of Umbilical Cross Section and Integration of Power & Telecommunication

Conventional X-Section
LV Quads/Hydraulics/FO/Chem

All-Electric
LV Quads/FO/Chem

Integrated DC-FO
Chem/FO

Chem / Power Distr.
DC-FO / HV Power

Maturity: Available / DC-FO Offered

TECHNOLOGIES ENABLING EXECUTION EFFICIENCY

EXECUTION EFFICIENCY

Opportunities & Challenges

- Fast Track Shared Approach
- Early Engagement
- Efficient Selection of Technical and Technological Solutions

New Model

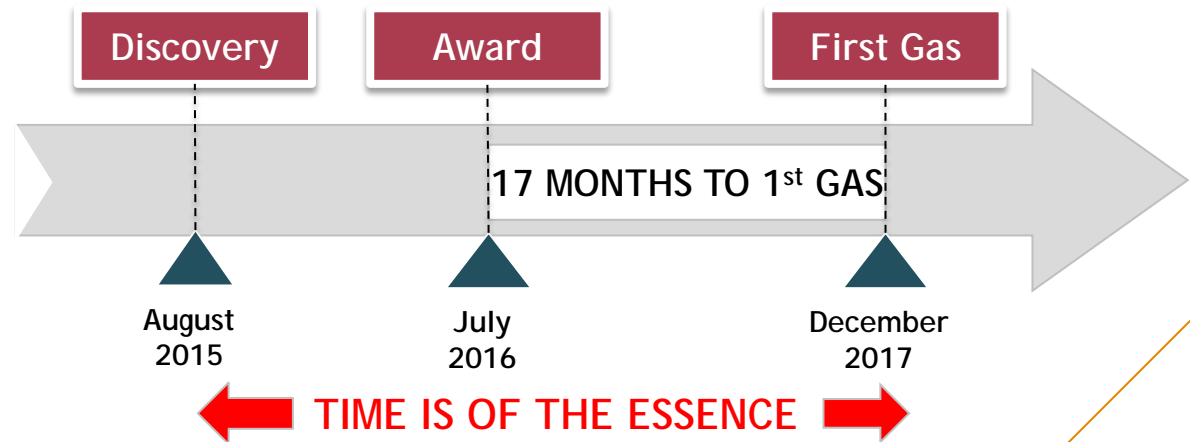
- High Pipelay and Subsea Construction Productivity
- Automation
- De-Risking Offshore Operations



ZOHR: A FIRST TIME EVER



Shortest Ever Time-to-Market



EXECUTION EFFICIENCY TECHNOLOGIES (1/3)

Welding

Internal PLASMA Welding

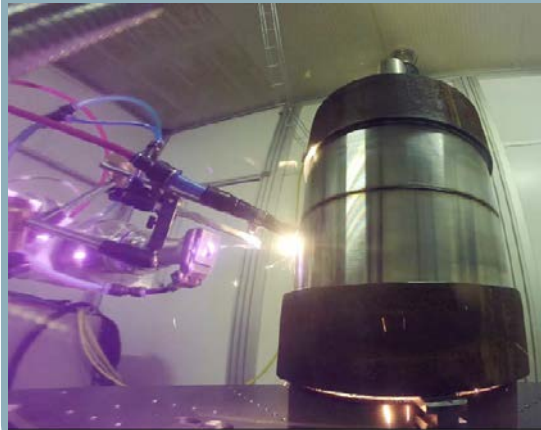
- Proprietary Game Changing Technology for CLAD Pipes Welding
- Internal Welding or Re-Melting of the ROOT Pass. Visual Inspection Capability
- S-Lay and J-Lay Application



Maturity: Available / Applied

LASER Welding

- Single Pass Fully Automatic LASER Welding System
- A Step Change in Productivity, Automation and Repeatability
- Testing Underway

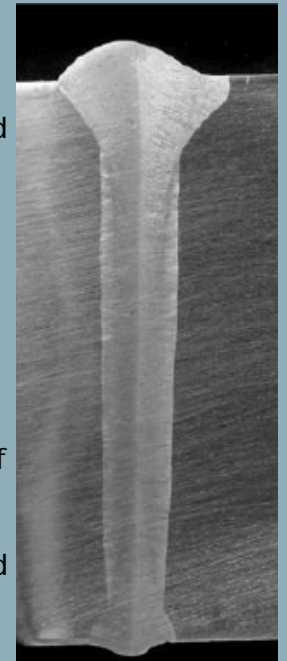


Maturity: Under Development & Testing

Pipe Lay Productivity

Electron Beam Welding

- High Energy Electrons Beamed to Joints to be Welded
- Potential High Productivity
- Technology Assessment and Qualification Ongoing also in the Framework of Technology Cooperation Agreement signed with Woodside



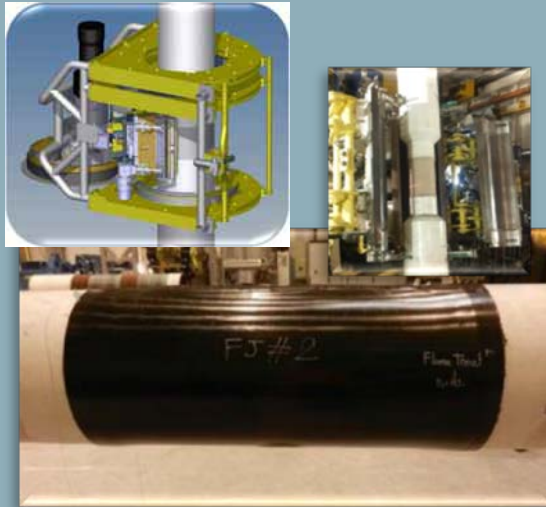
Maturity: Under Development

EXECUTION EFFICIENCY TECHNOLOGIES (2/3)

Remote Controls

Field Joint Coating

- M1 Proprietary Technology & Equipment
- FJC Manipulators Equipment Remote Operation from Shore



Maturity: Available, Applied

Automation

- Real Time Productivity Monitoring and “Engineered” Supervision onboard and from Shore of Pipelaying, Welding and FJC Operations

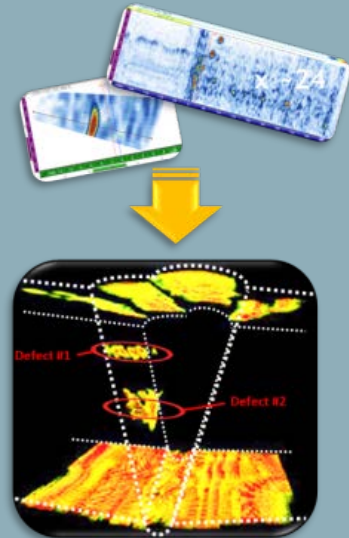


Maturity: Available, Applied

Automation

Digitalization

- Digitalization of NDT Inspection Analysis



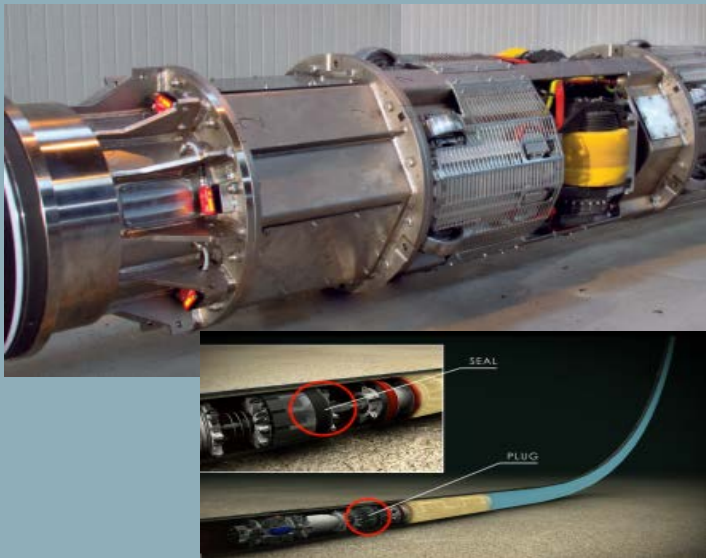
Maturity: Available, Applied

EXECUTION EFFICIENCY TECHNOLOGIES (3/3)

Integrity Tools

Anti-Flooding System

- Plug prevention pipe flooding
- Autonomous system
- Wireless real time communication



Maturity: Available

De-Risking

IAU Integrated Acoustic Unit

- Non intrusive pipeline integrity monitoring during installation
- Real time localization of water & buckles using acoustic reflectometry



Maturity: Available

TECHNOLOGIES ENABLING OPEX EFFICIENCY

OPEX EFFICIENCY

Opportunities and Challenges

Lifecycle Support to Subsea Systems with Increased Functionalities through:

- Production Support
- Asset Integrity Assessment
- Condition Assessment
- Planned Maintenance and Intervention
- Emergency Intervention
- Take over of End of Life Operations as Duty Holders
Decommissioning Plug and Abandonment, Facilities Removal and Disposal

Emergency Intervention



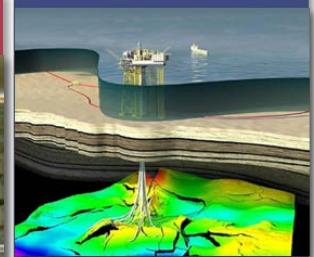
- Pipeline Repair
- Cargo recovery
- Damage containment
- Oil Spill Response
- Offset Well capping

Asset Integrity



- Inspection
- Maintenance
- Life Extension
- Decommissioning

Production Support



- Reservoir surveillance
- Production monitoring
- Operations support

Environmental

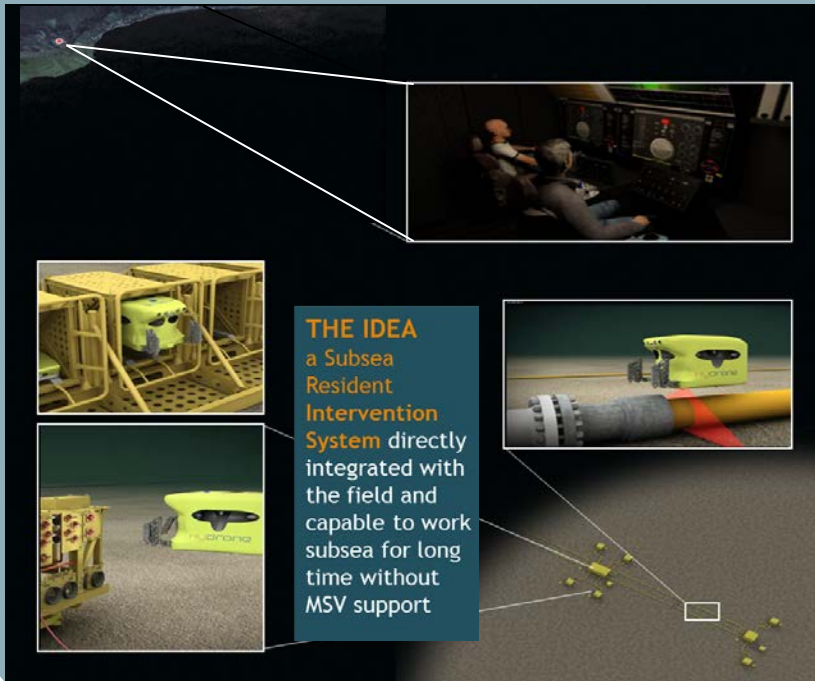


- Site Remediation
- Fauna preservation
- Seawater monitoring
- Env. data acquisition
- Geo- monitoring

OPEX EFFICIENCY TECHNOLOGIES (1/3)

Robotics

HyDrone Technology Platform for Subsea Resident ROVs



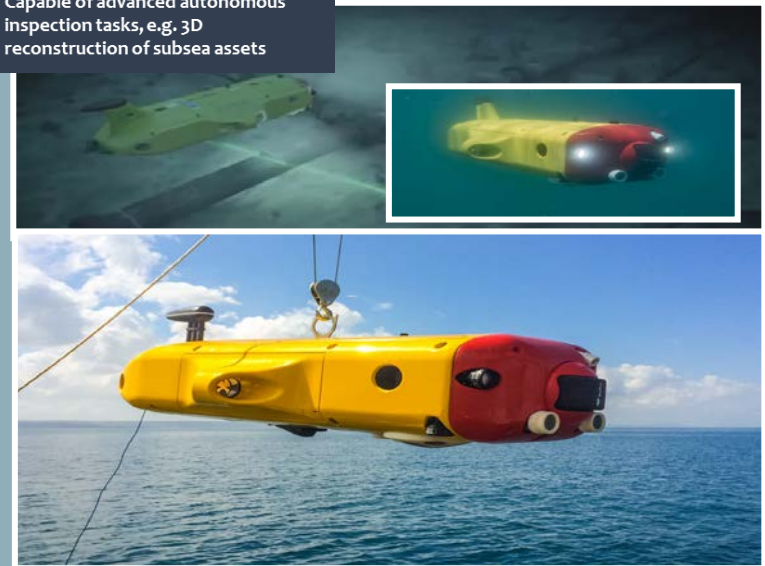
Life of Field

FLATFISH Technology

An innovative AUV designed to provide efficient and continuous Life of Field support to subsea field operations

Capable of advanced autonomous inspection tasks, e.g. 3D reconstruction of subsea assets

FlatFish
JDA



OPEX EFFICIENCY TECHNOLOGIES (2/3)

Sensing

Subsea Sensing Pods

DEMONSTRATED TECHNOLOGY

- In-situ Chemical Analysis
- Mass Spectrometry
- Trace Metals

UNDER DEVELOPMENT

- Bioacoustics
- Magnetometry
- Sediment Sampling
- Real time Pipe Tracking
- 3D Sonar
- Riser Inspection
- Data Harvesting



Life of Field

Condition Monitoring Technologies



Scarabeo8 (2017)
Monitoring of
Drilling Riser stress
(retrofitted).

Saipem1000 (2012)
Monitoring of
Drilling Riser stress
(retrofitted).

Sapinhoa Norte (2015)
Monitoring of 8 off Production
Risers and 2 off Gas Injection
Risers on the top section



OPEX EFFICIENCY TECHNOLOGIES (3/3)

Emergency Intervention

OIE (Offset Installation Equipment)





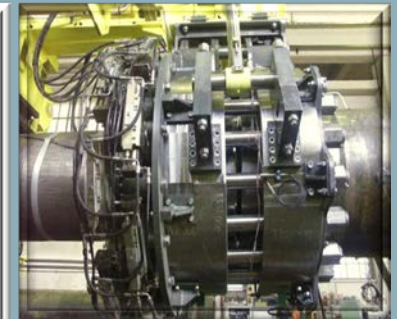


Life of Field

SIRCOS Pipeline Repair System






| | |
|-------------|----------------|
| DOLPHIN | Qatar |
| NORDSTREAM | Baltic Sea |
| GREENSTREAM | Lybia-Sicily |
| TRANSMED | Algeria-Sicily |
| SAKHALIN | Russia |



CLOSING REMARKS

CLOSING REMARKS

- New field architectures that combine different “building blocks”, some new and some existing
- To provide new added values to Clients, as the reduction of CAPEX and/or OPEX costs
- Early engagement with Clients is the way to exploit all the potential of such as architectures

| WORK ON COSTS REDUCTION BY... | ...changing Field architecture | | ...adopting new technologies | |
|--|--|--|---|---|
| <p>... bringing the surface equipment to seabed</p> |  | <ul style="list-style-type: none"> ■ SPRINGS™ ■ Multipipe ■ Spoolsep ■ Hisep™ |  |  |
| <p>... introducing new fluid transport & preservation techniques and/or eliminating some fluid transport/control lines (e.g. for long-tie backs)</p> |  |  | <ul style="list-style-type: none"> ■ EHT-PiP ■ Local Heating ■ DePressuRiser ■ Subsea Chemicals ■ All-Electric Field |  |
| <p>... introducing new products and materials for pipes</p> |  | <ul style="list-style-type: none"> ■ Single Independent Riser ■ IPW for Clad pipes ■ FBJ for Plastic Lined Pipes ■ TCP pipes |  |  |
| <p>... imagining new ways to manage field operations</p> |  | | <ul style="list-style-type: none"> ■ HyDrone platform ■ Asset Integrity Management ■ Production Monitoring |  |