The benefits of modern Integrated Control and Safety Systems architectures for FPSO facilities.

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Topics

- FPSO - Definition
- FPSO - Features
- Off-Shore Project today’s core requirements
- FPSO customer’s trend requirements
- A real application of ICSS
- Where we can have benefits
- Conclusions
FPSO – Definition

A Floating Production, Storage and Offloading (FPSO) unit is a floating vessel used by the Offshore Oil & Gas Industry for the processing of hydrocarbons and for storage of oil. An FPSO vessel is designed to receive hydrocarbons produced from nearby platform or subsea template, process them, and store oil until it can be offloaded onto a tanker or, less frequently, transported through a pipeline.

(by Wikipedia)
FPSOs can be a conversion of an oil tanker or can be a vessel built specially for the application.

In case of conversion of an oil tanker the following steps are carried out:

- Hull refurbishment
- Topside (process area) implementation
- Turret Implementation

**Process Plants**

Wheel Room, Engine Room, Accommodation

Umbilical Cords and Drilling
Today’s core requirements

>>> Reduction of time to «first oil» = earlier production = earlier ROI

Off-Shore Project Core requirements:
• How to make engineering more cost-favorable with improved quality?
• How to accelerate time to electrical-instrumental installation completion?
• How to accelerate time to production with faster commissioning & start-up?
• How to reduce complexity and interfaces during operational and maintenance activities?

“Suppliers offering a truly integrated offering of process and safety are saving end users substantial project costs in engineering and lifecycle expense.”

Source: ARC
FPSO Customer Requirements

• Actual Trend: Overall costs optimization
  Don’t compromise quality
  Don’t compromise safety
  Time to commissioning reduction
  Use of modern technologies

- Very integrated, that is from the same manufacturer
- F&G Integrity Level SIL 2
- ESD Integrity Level SIL 3
- Accommodation Fire Detection based on addressable system
- Removal of hardwired links between the systems by the replacement with «safety buses» and «certified protocols».

Integrated Control & Safety System

<table>
<thead>
<tr>
<th>PCS</th>
<th>ECS</th>
<th>F&amp;G/ESD Topside</th>
<th>F&amp;G Vessel</th>
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</table>

Reduction of process hardware links and junction boxes by using remote I/O boxes suitable for field installations.
Real application - Control

Process Field Junction Boxes (Ex-d, Ex-i, Ex-p or in Safe Area according Hazardous Area)

REDUNDANT RING TERMINAL BUS ETHERNET 100 MBits/s

AVG DIST = 25 mt

Electrical Cabinets in Safe Room

AVG DIST = 150 mt

2000 I/O

1000 I/O

RIO LCP Module 1
RIO LCP Module 2
RIO LCP Module 3
RIO LCP Module 4
RIO LCP Module 5
RIO LCP Module 6
RIO LCP Module 7
RIO LCP Module 8
RIO LCP Module 9
RIO LCP Module 10
RIO LCP Module 11
RIO LCP Module 12

PCS Panel
ECS Panel
LQ Switchboard
Emergency MCC
MCC Switchboard
L. Q. Switchboard
LV Switchboard 1
LV Switchboard 2
MV Switchboard
Real application - Safety

PROFISAFE DATA EXCHANGE SIL 3 on Ethernet

DIST =100 mt

F&G/ESD Topside (located in LER)

2000 I/Os

ESD SYSTEM SIL3

REUNDANT I/O MODULE (Q.ty Nr. 2+2 Al Module; 1+1 DI Module; 1+1DO Module)

ESD SYSTEM SIL2

SINGLE I/O

F&G SYSTEM

VESSEL

ADRESSABLE F&G SIL2

ADRESSABLE LOOPS SIL 2

800 SW Signals instead of 800 I/O

VESSEL ADRESSABLE F&G SIL2

F&G Vessel (located in CCR)

700 I/Os

300 SW Signals (Shutdown causes) instead of 300 I/O

600 Devices

300 SW Signals

DIST =100 mt

F&G/ESD Topside (located in LER)

2000 I/Os

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Real application - Safety

OMC 2013 – Ravenna – Italy – Workshop ANINP – 21 marzo 2013
Real application – Cabling saving

Cable saving (12 pairs shielded armoured), related cable trays, junction boxes, bulk materials and installations activities.

- **PCS Panel** ↔ **PCS remote rack I/O**
  \[
  \frac{2000 \text{ I/Os}}{12 \text{ pairs}} \times 150 \text{ mt} \approx 25.000 \text{ mt of cable}
  \]

- **ECS Panel** ↔ **ECS remote rack I/O**
  \[
  \frac{1000 \text{ I/Os}}{12 \text{ pairs}} \times 25 \text{ mt} \approx 2.000 \text{ mt of cable}
  \]

- **F&G Topside** ↔ **F&G remote rack I/O**
  \[
  \frac{2000 \text{ I/Os}}{12 \text{ pairs}} \times 100 \text{ mt} \approx 25.000 \text{ mt of cable}
  \]

- **F&G Topside** ↔ **F&G vessel**
  \[
  \frac{300 \text{ I/Os}}{12 \text{ pairs}} \times 100 \text{ mt} \approx 2.500 \text{ mt of cable}
  \]

- **F&G Vessel** ↔ **Addressable Panel**
  \[
  \frac{800 \text{ I/Os}}{12 \text{ pairs}} \times 5 \text{ mt} \approx 300 \text{ mt of cable}
  \]

- **Field Loops** ↔ **Addressable Panel**
  \[
  \text{other saving}
  \]

**Remember also a simpler field engineering!**
Today technologies offers safety software tools able to save costs during the Safety Lifecycle from the engineering to operation and maintenance phases.

**Cause & Effects Engineering, Operations and Maintenance Tool**
- Eliminates translation errors by automatically generating the logics
- Automatically generates HMI faceplate to visualize matrix
- Interface for maintenance overrides and I/O simulation during FAT or SAT
- Automatically generates change the documentation (IEC 61511) and the Events Log
## ICSS FEATURES

<table>
<thead>
<tr>
<th>Integrated Control &amp; Safety System from the same manufacturer</th>
<th>Distributed Remote I/Os on Profibus or High Speed Ethernet</th>
<th>Certified Bus with protocol according IEC61508/61511</th>
<th>Addressable Fire Control Panel according IEC61508/61511</th>
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### PROJECT LIFE PHASE

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<tr>
<th>Engineering</th>
<th>Cabling Material</th>
<th>Installation</th>
<th>Commissioning</th>
<th>Operation</th>
<th>Maintenance</th>
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Where we can have benefits?
Therefore, nowadays, EPC contractors or End-User have new opportunities to optimize the costs of the overall plant lifecycle, taking advantage of the new technologies offered by Control & Safety systems, even though the more difficult barrier to overcome are the old cultural heritages that often we could have, despite we live in the “age of the networks”.

But the most consistent financial benefit, due to an earlier installation and commissioning, is the time reduction of an earlier “First Oil”.

This economical value could be definitely ten times greater than the saving obtained during the project, depending on the expected daily plant production.
Thank you!


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