In-situ FPSO deck repair
Project lessons learnt from a world first deepwater West Africa

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Outline

• **A midship** FPSO deck repair campaign

• **ColdShield™**, a structural repair and reinforcement for hull girder strength

• Focus : Fatigue

• Offshore lessons learnt
Many African FPSOs are entering a mature age and suffer from **corrosion**

Due to permanent mooring, **FPSOs are to be maintained offshore** which raises several challenges in terms of:

- **Safety**
- **Economics**
Business Case – Deck Repair West Africa

→ Need to repair
Localized corrosion identified in main deck on top of COT & SWBT exceeding acceptance criteria as per IACS (Midship section).

→ The Challenge
How to avoid:

• production disruption
  (~150 kb/d at stake)

• risk related to a weather window
  if deck is cropped

How to repair it safely?
A structural repair and reinforcement for hull girder strength

**Functions:**
- Restore Initial Structural Capacity
- Protect Against Further Corrosion

**Durable Enveloppe**
- Compressed seal (Fluorosilicon)
- Protection plate (super duplex)

**Structural Reinforcement**
- Top plate (super duplex)
- Intermediate Deformation Layer
- Structural Polymer
From 4 brackets to a large deck repair

**First job**

- 4 brackets into a void
- Small pads (~1m long)
- Local reinforcement

**Deck repair**

- Large surface (100-150m²)
- Large pads >5,5m long
- Hull girder strength (midship)
- Tripping hazard?

Is Coldshield Scaleable?
Offshore Productivity

Offshore installation:
- Midship
- >70m² of pads
- Largest area: 4 x 7m long pads (21m²)

Operational impact:
None

Results
Typical Productivity per Area (10-30m²):
2-3 days
this excludes surface preparation

POB
Dedicated:
4 COLD PAD
+ 2 Surf Prep
FPSO core team
2 Surf Prep
+ 6 fabric maint
Stress Transfer

ColdShield ➔ Standard Design ➔

Plateau = reinforcement fully mobilized
Development or Anchorage Length
Development or Anchorage Length

Load in Reinforcement
Stress in the Structural Polymer

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Stress Transfer

ColdShield → Standard Design

Compatible with Stress Based Approach
Fatigue S-N curve based on ISO12107:2012

- Cyclic loads for a FPSO based in West Africa (midship)
- Derived fatigue life of the reinforcement: > 700 years (with D.F.F. = 1.00)

Fatigue test at 530MPa stress range (530 kN, 1.6 Hz)
Overall lesson learnt

Through that project, **COLDSHIELD™** proved to

- Reduce exposure to HSE risks for offshore personnel
- Maximize FPSO uptime
- Low POB
  - Dedicated:
    - 4 COLD PAD + 2 Surf. Prep FPSO core team
Client feedback

“It will never work... our forklift will destroy it”
Fabric Maintenance Manager

“The Job was done and well done”
Client Head of Project

“it was quite an intense campaign”
Client Project manager

“COLD PAD equipment is quite impressive”
Client technical expert

- 43t of pads
- 6t of equipment
Way Forward

• **SAFETY WISE:** ColdShield™ is an important improvement → No hot works

• **COST PERSPECTIVE:** ColdShield™ is an attractive solution if hot works result in production disruption or use of cofferdams

• **ASSET INTEGRITY:** ColdShield™ allows a very light footprint onto existing structure (non intrusive) and can be installed during normal operations

• **Next job:** side shell
To know more about us:

Website: [https://www.cold-pad.com/](https://www.cold-pad.com/)
LinkedIn: [https://www.linkedin.com/company/cold-pad/](https://www.linkedin.com/company/cold-pad/)