Shell UK

Technology Deployment, Communication & Collaboration

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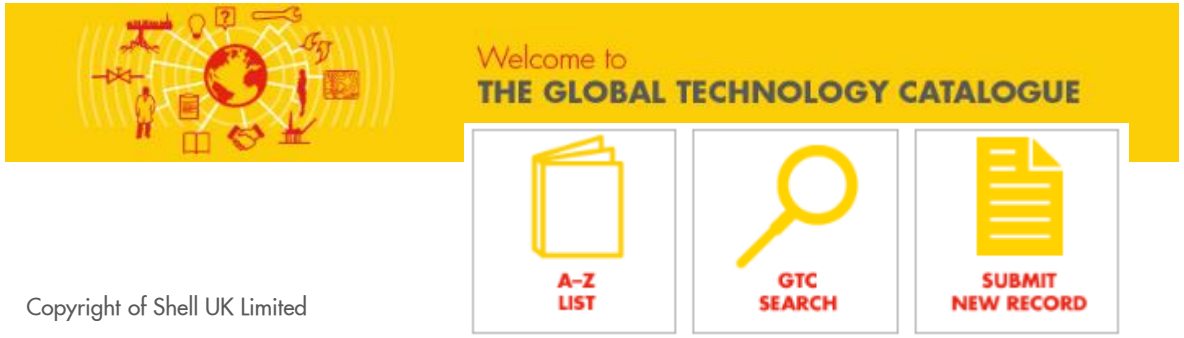
Content

- Technology Strategy
  - Fabric Maintenace Technology Solutions
  - Insulative Coatings
  - Robotic Surface Cleaning Tools
  - Aerolite Hydrophobic Insulation Jackets

Fabric Maintenace Technology Solutions - Visibility

- Shell UK Fabric Maintenace technology deployment is enabled by visibility of technology solutions, supported via
  - Technology Replication Thrusts
  - Facility Optimisation
  - Global Coatings Network
  - Fabric Maintenace Community Blitz
  - A global Fabric Maintenace Technologies Portfolio which Includes:

1. Surface Preparation
2. Surface Tolerant Coatings
3. Insulation Materials including non-metallic cladding.
4. Mobile devices to support FM/CUI work execution management



Introduction Of Insulative Coatings on SUKEP Offshore Assets Reduces Corrosion Under Insulation Integrity Threat

Duncan MacMillan – Fabric Maintenace & Access Team Lead SUKEP Offshore
Offshore & TRT Technical Expert For Fabric Maintenace Technologies

Introduction: Asset / Project description + Business Challenge

Short description of Asset /Project where the technology was deployed

- MASCOAT DTI has been deployed on the Nelson Platform which is located within the Central North Sea as part of Shell's SUKEP assets.
- MASCOAT DTI was optimised as part of a insulation re-instatement process post corrosion Under Insulation inspection.

Business Challenge (addressed by the Technology)

- Complete the scope of work online instead of within a turnaround window.
- Complete corrosion Under Insulation scope of work on 3 vessels within a 63 day time frame.
- Reduce scope duration by 1500 man hours (25%) v traditional insulation methods.
- Reduce bedding allocation from 6 POB to 3 POB to complete the scope within a constrained timeframe.

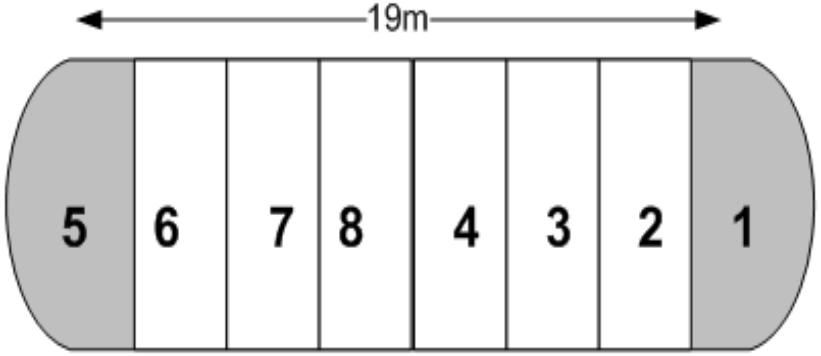
Technology deployed + benefits

Technology Description

MASCOAT Industrial-DTI is a composite ceramic & silica-based insulating coating that provides an insulating barrier, protects personnel and blocks corrosion, all in one application. It's formulated to provide thermal protection for tanks, vessels, boilers, and other facility surfaces up to 190oC.

Technology Benefit

- Thermal stabilization of the process (thermal barrier)
- Provides an excellent personnel protection against burning
- Reduce CUI from occurring
- Rapid application with minimal manhours
- Reflects heat back into source
- Easy repair of damages
- Can be applied on "hot" surfaces (<150C)
- Low maintenance during life cycle
- No reduction of insulation during the life cycle of the application
- Low VOC % ("green" product)
- Direct application on aluminium, Stainless steel and Galvanized steel



In order to maintain process temperature on the live vessel and to ensure access to the vessel by platform technicians the work scope shall be carried out in non-adjacent sections as per the below diagram.

Lessons learned (+/Δ) + way forward

Lessons learned

- Manufacturers Applicator programme is essential for product awareness.
- Due diligence during project planning phase
- Full asset support both on and offshore
- Strong working collaboration with Fabric Maintenance Contractor
- Spray tips ware easily with the ceramic fillers
- He material pin holes during first application to high temperatures
- Not suitable for lines that have heat trace tape
- Limited inspect ability for internal threats.

Corrosion Under Insulation on Test Separator, had Insulative coatings been used in the first instance the corrosion would have been visible to monitor.

Way forward

- Shell is looking to expand the use of the technology globally on both CAPEX and OPEX projects.
- The Technology Replication Thrust has the technology featured with the Fabric Maintenace Technologies catalogue for future visibility and replication.
- Close working with manufactures to expand the coatings temperature limitations.

Robotic Surface Preparation Reduces Fabric Maintenace Scope By 50% on SUKEP Shearwater Asset.

Duncan MacMillan – Fabric Maintenace & Access Team Lead SUKEP Offshore & TRT Technical Expert For Fabric Maintenace Technologies

Introduction: Asset / Project description + Business Challenge

Short description of Asset /Project where the technology was deployed

- SpiderJet Robotic technology was deployed on the Shearwater Platform which is located within the Central North Sea as part of Shell's SUKEP assets.
- The Spider Jet robotic technology was optimised as part of a deck corrosion and defective coating removal and re-coating project on the Well Heads Jacket

Business Challenge (addressed by the Technology)

- Complete 925m2 Fabric Maintenace scope of work on corroded decks within a 21 day time frame.
- Reduce scope duration by 1400 man hours (50%) v traditional open nozzle blasting methods.
- Reduce bedding allocation from 8 POB to 4 POB to complete the scope within a constrained timeframe.
- Allow simultaneous working operations on a busy deck location.
- Remove the requirement for large encapsulations to contain dust and spent abrasive.

Technology deployed + benefits

Technology Description

- Attaches to the work surface both horizontally and vertically by vacuum (magnetic version also available)
- Vacuum: to 0.8 bar dependant upon work surface
- Suctions off the removed waste material and waste water.
- Operable by Pneumatic and radio controlled systems (as shown)
- Maximum manoeuvrability via two individually pneumatically driven wheels
- Electronically monitored vacuum with automatic UHP water shut off
- Operating pressure: up to 3000 bar
- 16 UHP jet heads on 4 rotating arms

Spiderjet in Operation

Technology Benefit

- The technology provides an asset the flexibility to conduct surface preparation to WJ1 standard and surface cleanliness of SA 2.5 without the requirement for large encapsulations and barriers like traditional open nozzle grit blasting;
- Significant reduction in HSE exposure to the blasting operative and the asset personnel through noise reduction and greatly reduced dust.
- Easily allows simultaneous work operations during scope execution.
- No requirement for descaling or surface cleanining

Lessons learned (+/∆) + way forward

Lessons learned

- Due diligence during project planning phase
- Full asset support both on and offshore
- Strong working collaboration with Fabric Maintenance Contractor
- Large deck space for equipment laydown
- Potable water availability
- Understanding of Coatings that are suitable for Water Jetting Standards.

Pre and Post Spiderjet

Magnified view of WJ-1 Standard post Spiderjet

Way forward

- Shell is looking to expand the use of the technology to Storage vessels (internals & Externals), Blast walls and wind walls to name but a few opportunistic areas.
- The Technology Replication Thrust has the technology featured with the Fabric Maintenace Technologies catalogue for future visibility and replication.
- Engage With Manufacturer to understand a way forward with a micro unit for pipework and platform legs.

Mossmoran Storage Tank Scope to be completed 2019

Introduction of Aerolite Hydrophobic Insulation Jackets Reduces Insulation Scope by 40% SUKEP Gannet Asset

Duncan MacMillan – Fabric Maintenace & Access Team Lead SUKEP Offshore & TRT Technical Expert For Fabric Maintenace Technologies

TECHNOLOGY NETWORK
HIGHLIGHTS

Gannet have introduced Acoustic Insulation Jackets to reduce high noise within process modules.

A simple insulation system that has resulted in a reduction in man hours, installation time and HSE exposure.

See Yammer for the full highlight and for further information contact Duncan MacMillan

Jackets installed on the Gannet Asset in U4

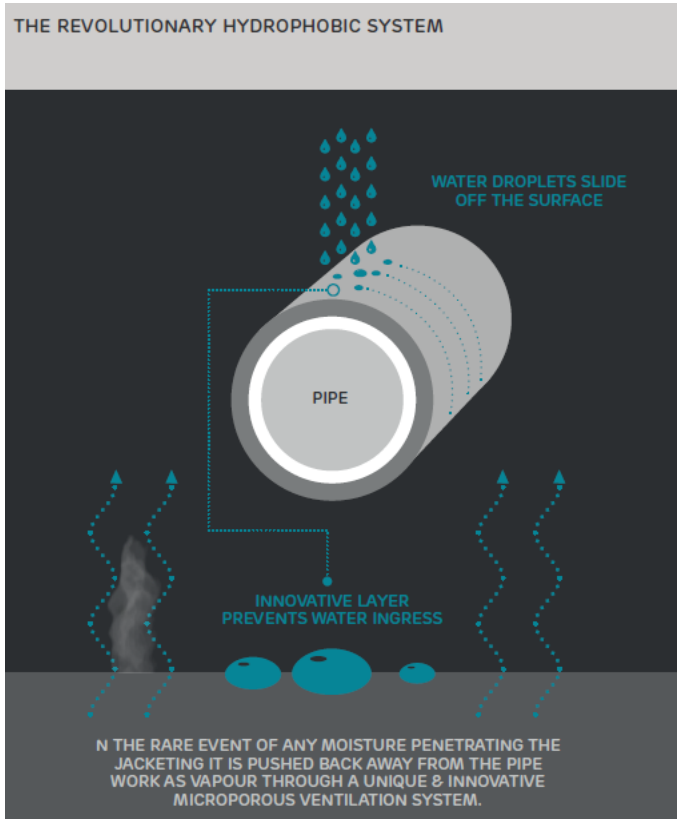
Jackets fit around complex configurations

Aerolite Hydrophobic Insulation Jackets – AIS

- Removes scope from Turnarounds, provides effective CUI management
- Collaboration; Advanced Industrial Solutions (AIS), Stork technical services & Shell teams; 6-12 months to develop/onshore test, campaigns in 2017/18 on Shell assets
- Reduces installation time by 40%, reduction of 1400hrs on 2 main platforms
- A step change in how we approach insulation re-instatement and CUI campaigns

Gas Compression system pipework, completed on-line

Heating Medium pipework



Q&A