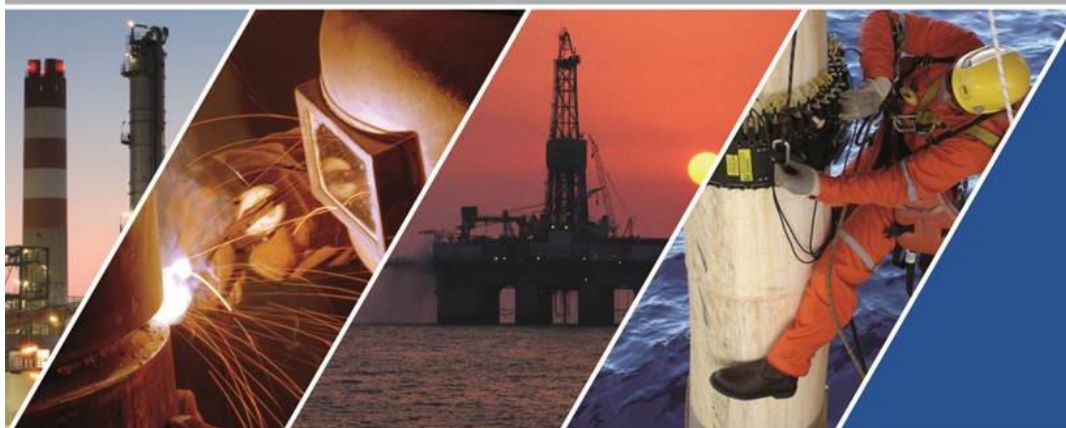




IMPCOAT Improved Splash and Tidal Zone Coatings for a 40-year Design Life



**PUBLISHABLE
SUMMARY**

19792

Background

Offshore operators are currently looking to extend the design life of offshore facilities, structures and components to improve the affordability, and to increase their availability in later years of operation. Whilst maintenance and replacement of topside facilities is possible, critical to this objective is the design and construction of supporting infrastructure and facilities capable of withstanding splash and tidal zone conditions, particularly corrosion, for the lifetime of the structure with the absolute minimum of maintenance.

To reach the above objective, TWI carried out a technology gap review with the help of industrial and academic partners to establish current working practice and experience related to the mitigation of splash and tidal zone corrosion. A number of coating systems (thermally sprayed, organic paints and duplex combined thermal spray and paint) currently used in the splash and tidal zone of offshore structures were identified. Samples based on the chosen coating system were prepared and tested in seawater spray (modified ISO 9227) in alternate and constant immersion tests.

Objectives

The overall objectives of the project were:

- To identify current technology gaps and establish current working practice and experience related to the mitigation of splash and tidal zone corrosion.
- To quantify the corrosion rate of thermal spray coatings and thereby determine which coating systems offer the best long-term corrosion mitigation for splash and tidal zones.
- To produce a specification for a coating (or coatings) with a 40-year design life for the splash and tidal zones.

Project Outcome

WP1 - one final report

WP2 - four progress reports and one final report

WP3 - one final report

The main outputs from the project were:

- Quantitative data (and ranking) of selected thermal spray coating compositions (Al, AlMg, AlZnIn, ZnAl) in laboratory simulated splash and tidal zone service for periods up to 18 months.
- Data benchmarking the performance of 40-year paint coating against thermal spray coatings.
- Assessment of the behaviour of selected sealants (Al-silicone, epoxy and polyurethane) applied to thermal spray coatings for splash and tidal zone service.
- Measurement of the effects of surface chloride contamination and surface roughness profile on coating adhesion.

Benefits

The main benefits of this project were:

- Reduction in life cycle costs through an extension of the corrosion design life of offshore steel structures up to 40 years.
- Elimination or significant reduction in expensive maintenance regimes (eg coffer dams) in the splash and tidal zone.
- Increased confidence in designing for a reduced corrosion allowance, permitting significant reductions in offshore structure weight.

Participants

The Sponsor Group comprised:

- | | |
|--------------------|-----------------------|
| ■ AVIC BIAM | ■ ExxonMobil |
| ■ BG International | ■ GE Energy |
| ■ ConocoPhillips | ■ Petrobras |
| ■ ENI | ■ Single Buoy Mooring |

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Scope of Work

The Project comprised three work packages:

WP1: Technology Gap Review

WP1 focussed on the completion of a review relating to splash zone and tidal zone corrosion mitigation, taking into account technical literature and partner experience. In view of the strong support for this task at the Project Launch Meeting it was agreed that this would be a thorough and extensive review, and the report produced would be one of the key deliverables of the project. The technology gaps identified were used to define the scope and details of WP2 Technical Work Programme. In particular, Sponsors' views were solicited on the scope of work and corrosion test programme methodology to be undertaken in WP2.

WP2: Technical Work Programme

WP2 focussed on addressing the technology gaps identified in WP1. The final selection of coatings reflected the priorities of the Sponsors. Although the emphasis was on thermal spray coatings, selected organic coating systems and duplex systems were also tested to provide where possible an appropriate benchmark. Coatings investigated comprised:

- Thermal spray Al, Al5Mg, AlZnIn, ZnAl, Al-Ti.
- Al-silicone, polyurethane and epoxy-based sealants.
- Leading industrial "40-year coating" i.e. 1.5mm thick marine paint system.

Coatings were initially subjected to laboratory-based, seawater spray tests followed by long-term alternate immersion (AI) cycle testing in artificial seawater solution. Linear polarisation resistance (LPR) electrochemical measurements were conducted on metallic-based coatings and used to calculate corrosion rates. Panels prepared with organic coating systems were evaluated and monitored using an AC electrochemical impedance spectroscopy (EIS) method. In summary, testing in ASTM D1141 synthetic seawater included:

- Salt spray (4 months).
- Alternate immersion (up to 18 months).
- ISO 20340 (6 months).
- Electrochemical evaluation by linear polarisation resistance and electrical impedance spectroscopy

In addition to measuring the electrochemical performance of the selected coatings, appropriate microstructural characterisation was also carried out both before and after corrosion exposure.

Several other variables (surface chloride content, surface roughness, coating adhesion etc.) that are likely to affect the performance of the coatings were also assessed.

WP3: Guidance on Manufacturing and Production Issues

WP3 focussed on the issues relating to the application of coatings and included guidance on thermal spray procedure to give the best corrosion performance, documentation relating to industrial standards, procedure specification, procurement guidelines and HS&E issues. This work package also re-visited the subject of coating system life cycle costs, previously addressed in WP1, benchmarking TSA against other coating systems, taking into account the results of WP2.

Price and Duration

The project had a duration of two and a half years and a budget of £375,000. It was funded by seven Sponsors each making a contribution of £50,000 plus a contribution of £25,000 from one Sponsor in the first year. The fee for additional companies buying-back into the project results is £50,000.

Further Information

For further information on how a Joint Industry Project (JIP) runs please visit:

<http://www.twi.co.uk/services/research-and-consultancy/joint-industry-projects/>

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