**SCOPE**

Various industries have substantive corrosion-related issues and need to invest in research to understand how to best mitigate corrosion in their assets. Decreased corporate investment in research, however, slows if not halts many from getting this vital information. Consortia can assist organizations, universities, and government entities in funding, administering, and attaining research. By offering innovative research, technology transfer and interaction between organizations, a consortium provides for industry partners to pool their resources to study and share in the results of research pertinent to them.

While other consortia may have a corrosion component, NACE partners uniquely offers a specific, in-depth focus on corrosion science and engineering. With its long history of fostering technical knowledge in corrosion prevention and extending the life of assets, NACE is ideally positioned to lead and broker partnerships for the distribution of new research. As an independent, nonprofit organization, NACE has extensive experience in managing data and sharing information in a fair and unbiased manner.

The industry’s only corrosion-related consortia guided by the premier global corrosion engineering association is seeking corrosion science and engineering experts to collaborate in a high-profile consortium for innovative solutions to key challenges faced by in the marine industry.

Maritime industry growth is projected over the next 30+ years and corrosion will always occur in the marine environments—with the estimated total cost of marine corrosion worldwide to be between $50-80 billion every year. NACE is committed to providing solutions to the maritime industry that reduce costs, maximize asset availability, keep personnel safe, and preserve the environment. The NACE Maritime Consortia continues that commitment providing a forum for those interested in contributing to the research needed for marine asset longevity.

**OBJECTIVE**

The objective of the marine/maritime consortia is to develop novel tools to mitigate marine corrosion by advancing the research into methodologies, materials and approaches to improve and assist in the marine corrosion management and control.

The NACE Maritime Consortia will produce results that can be used by the individual sponsors for leveraging their internal research programs, that will lead in the safe and effective management of the corrosion control technologies to solve individual problems associated with operations susceptible to suffer from corrosion damage accumulation like in storage and transportation facilities located offshore.

**BENEFITS**

The availability of new methods for assessing and mitigating maritime corrosion can be readily used to improve fitness for service assessments and consequently produce a better estimation of asset reliability exposed to extreme or aggressive service conditions. The sponsorship of the research program contemplated in the consortium will also bring the following aspects that improve the return for the investment:

- Leverage a professional research management infrastructure through NACE International, the Worldwide Corrosion Authority® with extensive experience in managing data and sharing information in a fair and unbiased manner.
- Engage in a forum for addressing unique, time-sensitive problems and a cost-effective means to avoid duplicate efforts.
- Gain access to labs, researchers, thought leaders, company campuses beyond your own.
- Decide the path to the solution to industry-wide problems.

The NACE Maritime Consortia will be overseen by an industry steering committee. Dr. Raymundo Case, of the National Corrosion and Materials Reliability Laboratory (NCMRL), will be the Texas A&M University/NACE delegate. The industry steering committee will meet quarterly via teleconference. Milestones will be revised twice a year during the biannual industry steering committee review seminar. The governance of the consortium is administered by both the NCMRL and NACE, the basic guidelines for the consortium are:

- Participation will have different levels per year
- Expected start-up: Q1 2020
- Deadline for Interest in participation: October 2019
- Duration: 3 years with a provision to extend
- A minimum of five (5) companies is required
SCOPE OF WORK

Specific themes with independent milestones will be developed in consultation with the industry advisory board. The proposed areas of work are:

**THEME 1**

**Corrosion Management for Marine Industry**

Corrosion management is not a standard culture for maritime and marine assets. Maritime owners are in the business of moving cargo. Documentation and procedures for corrosion management following in house developed programs and NACE standards.

- Characterization of chemical or precipitates, such as iron sulfite build-up (aggregate containment loads) on the metal surface, which is difficult to remove with traditional surface prep methods, leads to repeat corrosion failures in the same location. Suggested that research in validating this assertion could lead to better methods of assessing surface preparation standards that are not just visual.
- Management plan based on the geographic location and port conditions. Relative to this effort, the research on how determine corrosion rates; how long does it take certain materials/coatings in certain conditions to corrode, could be useful in guiding inspection cycles in the field.
- Industry specific framework of corrosion management is needed, STG-08 is working on this and suggested a proposal for identifying maritime sector as next detailed corrosion management system framework.
- Quantification and methodologies for life cycle of assets and decrease maintenance costs of maritime/marine assets.

**THEME 2**

**Mitigation and Control Actions Based on Marine/Maritime Environments and Conditions**

(corrosion resistant alloys and materials selection, coatings, new materials)

- Research how to prevent microbiologically influenced corrosion, fouling and harsh environments by using coatings for offshore structures.
- Materials selection for offshore applications: hydrogen assisted environmental cracking (HAEC):
  - Research into the relationship of HAEC & microstructure for Ni base alloys.
  - The effect of applied cathodic protection in hydrogen uptake by corrosion resistant alloys.
- Characterization of fracture energy by HAEC for qualification of bolting material (mainly for carbon steels).
- Study the HAEC behavior and its relationship with alloy structure for Ti based alloys and duplex steels.
- Evaluate new type of metallic coatings for bolting materials that help mitigate HAEC.
- Development of testing programs involving field exposure to validate results obtained from laboratory testing, for both materials selection and coating evaluation research.
THEME 3

Coating Technology Development for Maritime Applications

- Characterization of new or current formulations of coatings involving effective raw materials with fast curing times and easy to apply.
- Characterization and the development of lower solvent content coatings and eco or environmentally friendly coatings.
- Development of coatings based on the compatibility between new coatings with existing coatings.
- Development of the self-healing coatings.
- Substrate standardization because the substrate varies based on the manufacturer and also the surface characteristics.
- Development of methodologies for the evaluation of the performance of new type of coatings in relation to their performance to cathodic disbonding.

THEME 4

Inspection and Sensors

The aim of this theme is to develop sensors to improve the monitoring and management of maritime corrosion and extend the service lifetime of relevant assets.

- Development of real time sensors to measure coating decay and corrosion rates associated to protected offshore structures
- Implementation of research program to define suitable KPI’s to provide suitable information for effective corrosion management. The program is to be based on field type testing.
- Evaluation and development in conjunction with the sponsors of the research program of simplified methods to register inspection results and quantification of the corrosion costs. This work is also to include NACE application frameworks.

THEME 5

Technology Transfer

To facilitate the technology transfer to interested sponsors, the NCMRL offers training courses on the following topics.

- Basic corrosion: Fundamentals of corrosion evaluation and testing applicable to both laboratory testing and field evaluation of the impact of corrosion.
- Testing methods: Basic and advanced techniques for evaluating materials and coating performance in laboratory settings. This course can also be custom adapted for the training in the testing methods to be developed within the consortium.
- Laboratory techniques: Training in advanced laboratory techniques for analysis of corrosion related mechanism in maritime environments.
- Corrosion modeling: Introduction and advanced training in the use of the models developed for coating and materials evaluation.

RESULTS / PRODUCTS

Advance reports will be sent to the project sponsors in a timely manner at end of each series of tests according to the described in each of the test matrix for the individual tasks. A final report will be submitted at the end of each project, describing the achievements and the results of the materials evaluation related to the technical findings as well recommendations for further testing.

The reports will be delivered on a time schedule to be arranged with the project sponsors; we propose that each report coincide with the finalization of individual tasks.
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