

Corrosion and Erosion

(Output from ITF Theme Day - May 21st 2009)

A Collaborative Approach to Investment in Technology

The Industry Technology Facilitator (ITF) is a not for profit organisation owned by, and with access to funds from major oil and gas operating and service companies that comprise its membership. ITF has an impressive track record in delivering finance to help develop new initiatives for oil and gas technologies from early stage joint industry projects (JIPs) through to field trials and commercialisation. Since 1999, ITF has supported 140 projects worth in excess of £40 million in funding. ITF's key objectives are to identify technology needs, foster innovation and facilitate the development and implementation of new technologies.

A fundamental element of ITF's role as an internationally recognised champion for facilitating research, development and deployment of technology innovation within the upstream oil and gas industry is to engage with key industry sources. ITF uses a proven process, working in collaborative participation with both its Members and industry to identify technology needs and potential solutions.

The ITF process, illustrated below as a step-by-step course of actions, endeavours to bridge the gap between the industry's large global players and development community with the ultimate aim of implementing new technology solutions:

STEP 1 - Understand and Identify Technology Needs

STEP 2 - Engage the Development Community / Invite Proposals

STEP 3 - Evaluate Proposal Submissions

STEP 4 - Secure Funding

STEP 5 - Assist the Launch of JIPs

STEP 6 - Facilitate the Implementation of Technologies

ITF has contractual confidentiality arrangements with all its Members and will enter into a parallel agreement with all developers submitting proposal applications. Proposals will be submitted to our Members only for the purpose for which they are provided, i.e. assessment for funding support and implementation.

Proposals submitted under this Theme will be reviewed for financial sponsorship by **all ITF Members** therefore this is an excellent opportunity to gain access to a global audience in seeking support for your technology. The focus of all ITF themes is to identify technologies which bring clear benefits to sponsors but which require assistance in **research, development, and / or field trial**.

For details of ITF's full Portfolio of Members, please visit our Website - www.oil-itf.com

Background to the Theme

This Call for Proposals is the collective output of the ITF ‘Corrosion and Erosion’ Theme Day held in Aberdeen on 21st May 2009.

Corrosion and Erosion is a serious problem in the oil and gas industry and a persistent threat to many oil and gas assets. Corrosion can occur in every aspect of the oil industry, from generalized corrosion caused by oxygen rich environments on marine structures, in subsea pipelines under insulation to sulphide stress corrosion in hostile wells.

The cost of corrosion represents a significant share of the Gross Domestic Product for developed countries and high profile incidents can severely impact shareholder value.

The Oil and Gas Industry is continuously facing dilemmas regarding the efficiency and safety of its operations and historically corrosion/erosion has contributed between 15-20% of all hydrocarbon leaks. Corrosion issues have always presented a severe challenge to the oil and gas producing operations with the hazards greater intensified as operations move into deeper waters and into more hostile environments. However the threat of corrosion has not always been treated seriously and as a result many installations require major investment to tackle the legacy of neglect.

The Theme Day included an intensive, facilitated workshop which brought together ITF Members, Operators, Service Companies, Small and Medium-sized Enterprises and research and academia players. Attendees discussed the challenges in the area of corrosion and erosion covering detection and inspection techniques, production issues, and methods of mitigating the risk. The output of these discussions has formed the basis of this Call for Proposals.

Theme Timeline

Each ITF Theme follows a timeline from Theme Day to Theme Completion. The following list of tasks describes the key milestones and their anticipated associated date:

- Theme Start / Theme Day May 2009
- Call for Proposals Issued Aug 2009
- Deadline for Receipt of Proposals Sept 2009
- Publish to Members for Review Oct 2009
- Member Review and Voting Nov 2009
- Technical Clarification Meeting Dec 2009
- Members finalise commitment to sponsor Mar 2010
- Theme Complete Mar 2010

An Open Invitation to Global Technology Developers

This document aims to stimulate proposals from global development expertise which meet the specific requirements for this Call for Proposals. ITF and its Members will jointly assess all submitted proposals and our Members will potentially fund those proposals of greatest interest.

ITF and its Members will not prescribe specific technology solutions, but instead use the output gathered from the Theme Day to stimulate innovative proposals that offer potential solutions to identified needs. Key technology drivers, as identified by ITF Members, are the desire to produce fields in a more cost effective and efficient manner.

This is an open invitation to any organisation seeking sponsorship for **innovative technologies** in the oil and gas industry to submit proposals for **research, development, and / or field trial** in the following areas, **associated with the identified needs of the Corrosion and Erosion Theme:**

- Corrosion Under Insulation
- Coverage - larger area / localised inspection techniques
- Erosion - Sand Quantification, Management and Mitigation
- Convert Data into Useful Information
- Combined Corrosion and Erosion Modelling
- Novel Inspection Techniques
- Corrosion Mitigation

The list of detailed technology challenges are identified within each area that are of explicit interest to ITF Members in the 'Specific Technology Requirements' below. This information highlights key elements required but allows for innovation and flexibility in interpreting the most appropriate technical solutions.

The method for submitting a proposal is described later in this document but you can also learn how to submit a proposal by going to our website www.oil-itf.com

Specific Technology Requirements

(Any submitted proposal **must** address one or more of the following identified requirements)

CORROSION UNDER INSULATION

Background:

Corrosion under insulation (CUI) refers to the external corrosion of piping and vessels that occurs underneath externally clad/jacketed insulation as a result of the penetration of water. By its very nature CUI tends to remain undetected until the insulation and cladding/jacketing is removed to allow inspection or when leaks occur. CUI is a common problem shared by the refining, petrochemical, power, industrial, onshore and offshore industries. Difficult to mitigate on existing plant where retrofit active protection systems are required. New build design out and guidance required making use of existing knowledge such as European Federation of Corrosion Working Party 15 (EFC WP15)

Requirements:

- CUI detection and screening; especially screening of large areas
- Improved insulation technologies that are 'transparent' or corrosion-sensitive
- Smart, self healing insulation
- Non intrusive inspection
- Radiation is difficult, alternative techniques are required
- Real time corrosion monitoring

COVERAGE - LARGER AREA / LOCALISED INSPECTION TECHNIQUES

Background:

There is a need to cover larger areas for more cost effective monitoring; this may be achieved from the use of lower resolution equipment and supplemented with higher resolution on detection of probable issues (qualitative versus quantitative techniques?). However, it still remains important to have monitoring systems that are comprehensive and can detect localised corrosion faults. Risk Based Inspection (RBI) may offer an approach to gain a better understanding of probable defects to determine the required inspection technique. Such requirements may need to take a smarter more holistic approach that leads to better techniques that are easier to install and interpret, e.g. acoustic techniques are good but implementation is difficult.

Requirements:

- Monitor longer stretches of pipes.
- Increase area coverage of monitoring equipment
- Efficient and cost effective monitoring systems
- Localised pitting and corrosion detection

EROSION - SAND QUANTIFICATION, MANAGEMENT AND MITIGATION

Background:

Produced solids pose significant issues to the cost of production and new methods to improve the reliability of detection, monitoring, and mitigation are welcome. Increasingly as the industry moves to subsea developments novel ways of sand management may offer mitigation solutions.

Requirements:

- Improved and non-intrusive sand quantification
- Accurate readings
- Reliable sand erosion alarm system - AI (Artificial Intelligence) development
- Sand control in high water cut gas wells
- Debris monitoring and its impact on production chemistry
- Non-intrusive monitoring systems
- Improved and novel sand management techniques that reduce erosion, especially for subsea systems

CONVERT DATA INTO USEFUL INFORMATION

Background:

Many current inspection systems are complex and require expert interpretation, and in some instances acquire large volumes of data; the key requirement is to develop systems that convert the data into useful information.

Requirements:

- Systems that give reliable **information** as opposed to large volumes of data
- Make the data easy to understand - interpretation training
- Integration of models and real life data
- Better value of data
- Improved corrosion management training, making effective use of the data collected and insuring data integrity
- Sensitivity of data
- Data validation - testing to prove field relevance

COMBINED CORROSION AND EROSION MODELLING

Background:

Corrosion and erosion which are considered together and it would be an advantage to have modelling techniques that combine these considerations, by possibly merging different measurement principles and real time calibration. Such models need to be user friendly with simple inputs and accurate outputs.

Requirements:

- Reliable modelling of corrosion fatigue
- Erosion prediction models for unstable flowing conditions (e.g. temporary well test)
- Multi-hazard selection for erosion / corrosion conditions
- Efficiency for inhibitor erosion / corrosion conditions
- Dynamic modelling with multiple variable dependence
- Validation of model under field conditions
- Link between modelling and coverage

NOVEL MONITORING AND INSPECTION TECHNIQUES

Background:

The industry is always interested in new integrity monitoring ideas; however, novel inspection and monitoring systems need to be reliable, cost effective and simple to use and interpret. Increased development of reliable smart systems that are based on an automated approach with less reliance on human intervention, perhaps even systems that learn from the data it is collecting would be an advantage. Also wherever possible systems need to non-intrusive and retrofit for existing use.

Requirements:

- Fibre optic technology
- Remote leak detection systems
- Inspection technique for internally lined pipe
- Change from spot inspection to larger coverage
- Inspection technique for composite pipes / risers
- Alternative to In-line inspection (e.g. pigs)
- Cost effective retrofit of sensors to brown field
- Non intrusive sensors which do not interfere with production or other processes

CORROSION MITIGATION

Background:

The industry is interested in seeing new ways in which corrosion can be mitigated from surface treatment technologies to chemical and other non-chemical alternatives. Corrosion mitigation should also be perceived for all possible causes, including corrosion mitigation for other purposes than just the harsh seawater environment, e.g. carbon dioxide injection. Corrosion mitigation is required in expandables, for example, to eliminate leaks & avoid changing out equipment.

Requirements:

- Surface Coating
 - Cost effective and reliable coating solutions or alternative external preservation techniques
 - Novel, reliable internal and external coating systems
 - Automated coating monitoring systems
 - Increasing resolution and accuracy of inspection technology where coatings and cladding are present
 - Composite repair technology
 - Possible use of 'intelligent' chemicals/coatings
- Improved Chemical Treatments
 - Inhibitors for corrosive / erosive conditions
 - Debris monitoring: impact on production chemistry
 - Improved effectiveness of corrosion inhibitors
 - Intelligent chemicals
 - PWC versus corrosion
 - Use of "tags" to monitor effectiveness of chemical inhibition
 - Alternatives to chemicals
- Bio Corrosion Management
 - Prediction, detection and mitigation
 - Improved monitoring systems for bacterial count (MIC)

Process for Submitting a Proposal

1. Register Interest with ITF

Register your interest as early as possible by sending an email to Keith Mackie at k.mackie@oil-itf.com

2. Visit the ITF Website - www.oil-itf.com

On the ITF Home page, click on the "How to Submit a Proposal" button or follow [this link](#) to access all the information required to submit a proposal.

3. Read the 'Project Application Guidance' Document

This document is available to view or download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website. Reading this document prior to submitting a proposal is essential. If you require further clarification or are unsure if your proposal is suitable for submission, please call ITF (ITF Contact Information appears later).

4. Download and Complete the 'Project Application Form'

This form is available to download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website.

5. Download and Complete the 'Project Presentation Template'

This template is available to download from the 'ITF Downloads' / 'Proposal Submission' section of the ITF Website.

6. Email the Completed 'Project Application Form' and 'Project Presentation Template' to ITF

Email the Completed 'Project Application Form' in Microsoft Word format (not PDF) and the 'Project Presentation Template' in Microsoft PowerPoint format (not PDF) to Keith Mackie at k.mackie@oil-itf.com by **no later than 25th September 2009**. Proposals received after this date may not be processed.

Qualifying Technologies

In order to qualify for potential sponsorship, technologies submitted in response to this Call for Proposals must:

- be applicable to at least one of the identified requirements
- be novel or innovative
- demonstrate a clear business case for support
- have a clear and demonstrable path to commercialisation and implementation

Note: Proposals submitted to any other ITF Call in the past nine months or any previously unsuccessful applications should not be resubmitted without first consulting ITF (contact information provided later in this document).

Qualifying Organisations

Proposals are invited from any organisation including SME's, academia, research institutions, large organisations, consortiums or alliances. Proposals may be submitted by a national or international organisation, and equal opportunities will be extended to all proposers. Please keep in mind however that should your proposal be taken forward, you will be required to participate in meetings and make presentations to interested parties in the UK and in the English language (teleconference and video conference are acceptable).

ITF Contact Information

If you would like to discuss any matters related to this call or any other issue related to ITF, please contact any of the following people:

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