For further information or administrative details, costs and bookings for courses and examinations or detailed information packages free of charge, please contact:

Martin Dawson or David Betts on:
Tel: +44 (0)1709 560459 Fax: +44 (0)1709 557705
Email: enquiries@ruanetpo.com
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Technical and eligibility enquiries can be made direct to Dave Griffiths the ICorr Scheme Manager on:
Tel: +44 (0)1709 550999

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The President Writes

Since writing my article for the last issue of Corrosion Management in early January the world seems to have gone slightly mad. In my last article I mentioned the cold weather in the run up to Xmas and that persuaded my wife Marion (who retired just before Xmas) and I that a short break somewhere a bit warmer than the UK would be a good idea and we eventually settled on a week mid February near Dahab on the Sinai Peninsular overlooking the Gulf of Aqaba.

A relatively un-newsworthy incident in Tunisia before Christmas had triggered protests which were in the process of escalating. As the date of the holiday approached the protests started in Egypt and we wondered if things might get warmer than we hoped. In the end we thoroughly enjoyed our holiday and saw no evidence of unrest although several Egyptians we met were happy discuss the situation which was for them devastating. The tourist industry which accounts for 5-10% of Egyptian GDP was decimated with hotels closing and the main Nile destinations out of bounds to all foreigners. Our hotel was less than 10% occupied, nice for us but not for the owner. Where is this leading I hear my early career and sat in a meeting room in a Tokyo skyscraper during an earthquake watching pictures swinging on the walls I can start to understand some of the problems the country and its people faces but the newsreel footage of the tsunami makes one aware of the awesome destructive power of nature and fortunately I have never experienced anything like that. Again our thoughts must be with any members and their families and friends caught up in the present chaos of that country, we can only hope that they reach safe refuge and an early return to normality.

Let us all hope in our various ways that things get better not worse.

LETTER TO THE EDITOR

Dear Sir,

I wish to thank David Deacon for his excellent series of articles on the history of the Institute that have recently appeared in your publication. These have been expertly researched and record many of the events and historical developments which shaped our Institute and helped it to become well established with an International reputation.

It was most interesting to be reminded of long forgotten friends and to learn about the parts that many different people played over the years. Sadly quite a few of these are no longer with us, but it is wonderful to have their efforts officially recognized and documented. I know, from talking to colleagues, that much of this history was not generally known or had been forgotten.

In particular I wish to highlight the fact that David had not included any references to his own considerable commitment to the Institute. I fully understand his humility and any readers that need to be reminded should recall that David was the first and only recipient of the Lifetime Award to acknowledge his invaluable support for the Institute over most of its existence.

A great deal of gratitude is owed by the Institute at large to David. I witnessed his dedication and very much enjoyed working with him when he was President and again whilst he was Chairman of the 50th Anniversary Celebration Committee.

Thank-you David,

Yours sincerely

John T O’Shea, Hon Fellow

NEW SUSTAINING MEMBERS PROFILE:

SPECIAL BLASTING SERVICES

We are a national company providing blasting, cold cutting and re-coating services to the Utilities, Industrial and Marine Sectors. Our new rapid response UHP Vehicles mean that we are able to react to your project demands quickly, we can have men on site within hours rather than days.

We are a family run company and are 100% committed to quality and value for money. We are approved Intersleek applicators and as members of ICATS we are able to train and approve our own coatings applicators.

We are an ISO9001 company, and are SafeContractor approved. Our management system is ISO9001 approved which means that you are guaranteed uniformity in the quality of service that is provided to you. Please see our web site for trade references from within the above industry sectors.
CED WORKING DAY AND SYMPOSIUM ON NOVEL CORROSION PREVENTION TECHNOLOGIES

The Corrosion Engineering Division of the Institute of Corrosion is running a Working Day and symposium on Novel Corrosion Prevention Technologies on Thursday 19th May 2011 at the National Physical Laboratory (NPL), Hampton Rd, Teddington, Middlesex, TW11 0LW. This one day meeting will be the fourth in a series of recent working days of the Institute of Corrosion’s Corrosion Engineering Division (previous meetings were held at Birmingham, Buxton and Warrington). The meeting will start with two plenary lectures on novel corrosion prevention technologies, as shown in the programme below. This will be followed by meetings of the CED working groups (see below for a list of the working groups) combined with a short tour of NPL’s corrosion laboratories, in small groups. Where possible, agendas for the working group meetings will be published separately in advance on the CED web site. These meetings will include separate topical presentations arranged by the chairs of the individual working groups. There will also be time for discussions and formulation of future activities of the groups. The meeting will close with a final plenary lecture on another aspect of novel corrosion prevention technologies. This working day will be a good opportunity to network with other corrosion professionals from different industry sectors. For information on becoming involved with CED working parties please see the CED web site or contact the Chair of CED, Nick Smart (nick.smart@serco.com). For registration to attend the meeting, please complete and return the registration form which can be downloaded from: www.icorr.org/branches/corrosion_engineering_division.phtml

The provisional programme for the meeting is as follows:

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Speaker(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.15-10.00</td>
<td>Registration and coffee</td>
<td></td>
</tr>
<tr>
<td>10.00-10.05</td>
<td>Welcome and Introduction</td>
<td>Nick Smart, Serco</td>
</tr>
<tr>
<td>10.05-10.20</td>
<td>Introduction to NPL</td>
<td>Robin Hart, NPL</td>
</tr>
<tr>
<td>10.20-10.50</td>
<td>Smart corrosion resistant high temperature coating</td>
<td>Nigel Simms, Cranfield Univ.</td>
</tr>
<tr>
<td>10.50-11.20</td>
<td>Developments in water treatment technology</td>
<td>Speaker TBC</td>
</tr>
<tr>
<td>11.20-11.35</td>
<td>Coffee</td>
<td></td>
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<tr>
<td>11.35-12.45</td>
<td>Working Group Meetings / Tour of NPL Laboratories</td>
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<tr>
<td>12.45-13.45</td>
<td>Lunch</td>
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<tr>
<td>13.45-15.00</td>
<td>Working Group meetings / Tour of NPL Laboratories</td>
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<tr>
<td>15.00-15.15</td>
<td>Tea</td>
<td></td>
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<tr>
<td>15.15-15.45</td>
<td>Novel electrochemical treatment for accelerated low water corrosion</td>
<td>Barry Lamb, BAC Corrosion Control</td>
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<tr>
<td>15.45-16.00</td>
<td>Closing discussion</td>
<td>Bob Crundwell, ICorr President</td>
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</table>

The following working groups will be holding meetings on the day.
- Cathodic protection (chair Ross Fielding) / Corrosion in Concrete (chair Ali Sharifi) (WGs merged for meeting)
- Monitoring (chair Bill Cox)
- Nuclear (chair Nick Smart)
- Coatings (chair Brenda Peters)
- Oil-field chemicals (chair Peter Allison)
- Water treatment (chair Pam Simpson)

We look forward to a pleasant, informative and productive meeting.

TITLES & NUMBERS OF ALL PREVIOUS TECHNICAL TOPICS

1. Introduction and Corrosion Engineering Division (July/Aug 05)
2. Corrosion Prevention during Transport and Storage
3. Accelerated Testing particularly of Coatings
4. Zinc Coatings (Jan/Feb 06)
5. Spring Cleaning
6. Electroplating from the Sixties to Today
7. Cathodic Protection of Coated Pipelines
8. Personal Experiences of Statistics & Probability in Corrosion Work
9. Corrosion of Copper & its Alloys particularly in Plumbing Systems
10. Electrochemical Measurements - Are They Any Use? (Jan/Feb 07)
11. Corrosion and Health
12. Corrosion on the Nuclear Power Industry (and of Bells!)
13. Corrosion in Concrete
14. Let It Rust (Sept/Oct 07)
15. Corrosion of Aluminium (Jan/Feb 08)
16. Cost of Corrosion
17. Chemical Analysis in Corrosion Studies
18. Does a Corrosion Engineer or a Corrosion Scientist study effect of Surface Finish on Paint Performance?
19. New Year Thoughts – Conferences etc (Jan/Feb 08)
20. History of the CSD
21. Need for coordination in corrosion research
22. Bimetallic effect - can it prevent as well as protect
23. Selective Corrosion
24. Atmospheric Corrosion
25. CED day and Anodic Protection
27. Dissemination of Corrosion Information: Conferences, Journals, the web etc
28. Dealing with Technical Enquiries
29. Chartership and Cathodic Protection (CP)
30. Review of Technical Topics & extending the life of Bridges & Beams
Technical Topics No 30:
REVIEW OF TECHNICAL TOPICS AND EXTENDING THE LIFE OF BRIDGES AND BEAMS
by Technical Secretary, Douglas J Mills

Well it’s the 100th issue of CM! I work out that it must have started about 1994 ie it was going for 10 years before yours truly commenced his Technical Topics (1st one was July/Aug 05). I will cover some the history of CM and its predecessor Industrial Corrosion (and before that the Bulletin of the Institute of Corrosion Science and Technology) in a subsequent TT. Suffice to say here that we all owe a great debt to Brian Tunnard the Editor for nearly thirty years and a personal friend. Anyway the history of my TT is more modest. I started it at the suggestion of the then President, Stuart Lyon: “you could try something a bit like Jack Harris does in the Materials World” said SL. No question that Jack’s was an excellent column. Many people (including myself) on receiving their MW, turned straight to the back to read his thoughts. And sometimes that was all we read! I was not under any illusion that my column could emulate that of the late doyen of metallurgical matters. However a number of people have indicated that they enjoy reading it. I also have some faithful correspondents who inter alia provide me with photos. There is occasional critical feedback. One person, taking issue with something I had written, wrote to the editor and his letter was published in CM. But most comments (thankfully) are sent to me direct and I generally reply (I may or may not discuss them in the next column).

Writing the TT is relatively relaxing compared with most of the writing that I do. As often as not it is “off the top of my head” and typically it takes about an hour to create (tidying up activities and finding photos may well add another hour or so). However I try not to be inaccurate and when I write about some area of which I lack first hand knowledge, I try to “run it past ” someone I know who has expertise in that area (many thanks to the dozen or more people who have helped in this way). On the previous page you will find a list of the topics that I have covered in all 30 TTs so far. So if anybody is keen to read one in the archive let me know (I am not sure whether all the articles are available as PDFs - but I have the proofs of most of them). How do I decide on the subject? Well normally it is inspired by something that has happened since the last issue: maybe a photo I have taken of a corroded item, maybe a lecture I’ve attended, maybe a technical enquiry. Luckily our subject (corrosion) covers a wide range of technical areas (although not exclusively technical, most articles have some technical content).

Generally the Editor allows what I write to go through (I remember that one section article on “Women in corrosion” didn’t see the light of day in the end (not PC enough!). Anyway I thought I'd include something technical in this 100th CM issue. It’s about painting rusty steel (or iron). This relates to an enquiry from a company involved in the refurbishment of the Polam Bridge, a grade 2 listed footbridge in a park in Darlington. Erected about 120 years ago and made mainly of cast iron, there is much penetration of the iron by corrosion. Luckily the bridge was able to be physically removed and taken into a “shop” where it was dry abrasive blasted (see photo). It proved extremely difficult to get the chloride level down sufficiently low (the Bresle test was used to check this). I suspect not all the rust was (or can be) got rid off. This reminded me of some experience I had at the PRA about twenty years ago, relating to rust converters. We tested a range of such products (I don’t normally advertise but the successful ones were At Rust 50 and At Rust 10 – the two differing in their viscosity) and I subsequently used one of them on a quite severely corroded steel beam under our church -it builds up about a 50 µm layer (note two coats are highly advisable). You can then put a top coat on (although I don’t remember that being done in the case of the church beam). Anyway after some fifteen years, I went recently and inspected it and it was in good condition (see picture). So when significant rust is present, before repainting, even when you can remove the structure to a shop, dry abrasive blasting is not really sufficient on its own. In such cases water blasting with or without entrained abrasive (like garnet) followed by application of a product containing a rust converter would be recommended.

That's probably enough about that. Going back to the TTs how much longer will I go on? Every dog has its day and with retirement in two years, I think another ten TTs might be the maximum (perhaps they may ask me to provide an occasional (annual?) bulletin beyond that!) Anyway I certainly wish Corrosion Management all the best for the future. With luck it should at least hit its quarter century (in 2019) corresponding with the 150th edition.

Any comments or any requests for archived TTs contact Douglas@harbridge.freeserve.co.uk
NIMROD - THE MIGHTY HUNTER

At the London Branch meeting on 10th March the presentation subject was ‘Nimrod – the mighty hunter’. David Roberts, our guest speaker, was an RAF Technician and Marconi Engineer and on the basis that sea water and aeroplanes don’t mix, he mentioned some of the corrosion challenges facing the use of maritime aircraft which operate almost exclusively in such a corrosively aggressive environment. Such were the problems, that upon returning to base, the aircraft would be put through a huge ‘car wash’ of 32 water jets, and the engines were ‘blasted’ with almond nut shells to remove contaminants. Mixed metal corrosion cells were a serious problem – often involving stainless steel and alloys, and corrosion was found in the wing spars when preparing for missile launching capabilities for the Falklands conflict. The history and recent demise of Nimrod as a Submarine Hunter/Search and Rescue aircraft proved very interesting as it began its life as a modified De Havilland Comet (1949) airframe with a shortened fuselage. Rolls Royce Spey engines provided about half as much power again than the Avons originally fitted to the Comet. The idea of such an aircraft for use by Coastal Command goes back before 1942 and the Nimrod MR I was first used as a replacement for the Avro Shackleton. The Mk II was a vast improvement on the original and then further enhancements followed culminating in the ill fated Mk IV, the development of which was cancelled last year. David described some of the military tasks carried out by Nimrod as well as civil rescues undertaken among the many success stories associated with this long-serving aircraft, including the rescue of about 200 people from an earthquake at Darwin, Australia.

VISIT “SARTORIAL, SCIENTIFIC & SEDUCTIVE MAYFAIR” WITH LONDON BRANCH, ON MAY 5TH

This year’s walk will rediscover the Eastern part of Mayfair that so desperately tries to shield itself from the encroaching hubbub of surrounding shops and frenetic street life. However, just a stone’s throw away from the glare of Piccadilly Circus and Regent Street, we escape into quiet back streets that harbour some of Mayfair’s best kept secrets. Here is a world where one can easily imagine fortunate gentlemen strolling along in search of a new outfit or a little adventure!

And of course, no walk would be complete without a scandal – this time involving the wife of a Prime Minister! Royal fashions, art and invention, global journeys, world leaders and money, always money and lots of it make up the stories of this gentle stroll.

Discover all the insalubrious details on this walking tour – only interrupted by the inevitable pause for refreshments. More refreshments and the traditional hot chilli and rice supper will be awaiting us as we return to the Naval Club at the end of the Walk, under the eminent auspices of the Institute of Corrosion.

This Guided Walking Tour will again be conducted by Ingrid M Wallenborg, a qualified Blue Badge Tourist Guide of London. As usual, this is a free event for members of the Institute and family or friends are most welcome. This year the event is sponsored by two of our Sustaining Members – Quill International and Deepwater Corrosion Services (UK) Ltd.

This event will go ahead whatever the weather conditions. But please note that the Naval Club has a strict dress code which especially excludes jeans or trainers.

We meet at 5.45 on Thursday 5th May outside the Criterion Theatre [facing the Eros Statue] at Piccadilly Circus. The co-ordinator for this event is John O’Shea who can be contacted at johno.shea@btinternet.com
1994 saw the launch of Corrosion Management and the first issue was published in November of that year. Despite this being 'issue Number 1' the publication had already come some considerable distance. David Deacon documented in his recent ‘History of the Institute’ articles that the first incarnation of Corrosion Management was ‘BACE Newsletter’ and was essentially a four page photocopy. It then changed to ‘The Institute of Corrosion Technology – bulletin’ and it adopted some professional printing techniques, most notably incorporating a second colour. The name changed again to reflect the institutes name to the ‘Institute of Corrosion Science and Technology’ maintaining ‘bulletin’ in the title. These ‘Bulletins continued up to 1982 when council decided on a major change which resulted in the launch of ‘Industrial Corrosion’ which was edited by Colin Bryer. ‘Industrial Corrosion’ increased it’s pagination up 8 or 12 pages and ran successfully right up until 1994.

According to David’s article it was felt that ‘Industrial Corrosion’ did not cover the broad corrosion subject matter. Following much deliberation ‘Corrosion Management’ was settled on as a title and the new publication was launched. It continued to be edited by Colin Bryer with Brian Tunnard chairman of the editorial team. Corrosion Management continued to be published by Impact Ltd, Colin Bryers company, until, at their request, a new publisher was sought in 2000. Following a brief and problematic stint with Deeson publications in Kent the existing publishers Square One were approached to start publishing the Journal in 2002. Brian Tunnard also stepped down as technical editor during the launch of ‘Industrial Corrosion’ which was edited by Colin Bryer. ‘Industrial Corrosion’ increased it’s pagination up 8 or 12 pages and ran successfully right up until 1994.

The following four years saw year on year advertising revenue increases across all the new platforms. The next significant milestone was in 2006. Corrosion Management had established itself as a strong advertising platform and its technical content maintained a consistently high standard under the stewardship of Bob Akid. However the look and feel of Corrosion Management had become a little dated. So with the agreement of the then President Stuart Lyon the magazine was given a new facelift which included a new sponsorship opportunity for the front cover.

By 2008 there had been a number of significant increases in the cost of paper, as a result the cost of producing Corrosion Management was set to increase. To avoid this the publishers embraced new digital plate making technology which enabled them to make savings on the actual production process thus offsetting the increases in paper and enabling the publisher to actually reduce the cost of production. 2008 also saw Forestry Stewardship Council (FSC) accredited paper being used in the production of Corrosion Management.

2009 was an important year for both the Institute and Corrosion Management. The institute celebrated its 50th anniversary and there was lots of activity in the magazine including the gold special anniversary edition. There was also a commemorative programme produced which was distributed in the magazine to great acclaim. However even with all this going on the most significant development from a communications perspective was the launch of the new website. It had been a long term goal of Square One to update the Institutes online presence and provide a strong connection between the magazine and its virtual counterpart.

The objectives for the site were to add value to the membership, to provide a good source of information on both the institute and the Corrosion Industry and finally to create new revenue streams by way of advertising. All of these three goals were achieved and the site has been a great success. The main testament to that is the visitor statistics. In 2008 the average visitor numbers were approximately 1000 a month, when the new site launched this increased to just over 4000. March 2011 saw the record number of visitors to site when 11280 people came to www.icorr.org, it now averages 10,000 visitors per month.

2009 also saw the official recognition of Corrosion Management Magazine in BRAD which is the advertising industries bible when it comes to sourcing suitable publications for their clients. It now means Corrosion Management is on the radar of advertising agencies across the world.

So what does the future hold for Corrosion Management? First and foremost the magazine needs to continue the high standards it has now become known for and maintain its steady growth in advertising revenues. More interaction between the magazine and the website is imperative and ultimately they should become one platform across multiple applications, enabling readers to consume their news and information in whichever format they prefer. Social networks such as LinkedIn, Twitter and Facebook are currently being explored to see what benefits can be gained, so if you get tweeted or poked in the next few months please don’t be offended!

In the near future we aim to contact all our readers and website visitors to get their views on the future of Corrosion Management and www.icorr.org. However in the meantime your comments and suggestions are always very welcome.
Surface World 2011 will run alongside Correx - the national corrosion conference and exhibition.

Correx 2011 will be a major event in the UK corrosion industry - aimed at everyone interested in coatings and cathodic protection: engineers, specifiers and practitioners.

Conferences, workshops, courses and seminars will run in tandem with the exhibitions.

It’s the finish that helps sell your product - come and see the UK’s only international showcase for the product finishing, surface engineering and for the first time the corrosion control markets. All the leading surface finishing suppliers all under one roof over 3 days.

All this will ensure that Surface World 2011 with Correx 2011 will be the biggest event in the surface treatment, coatings and finishing industry for many years.

For more information contact Nigel Bean on:
Tel: +44 (0)1442 826826
E-mail: nigelbean1@aol.com
or visit the website at:
www.surfaceworldshow.com

FREE ENTRY
www.surfaceworldshow.com
CORROSION AWARENESS DAY
ABERDEEN 15TH MARCH 2011

The Institute of Corrosion, Aberdeen Branch held its maiden “Corrosion Awareness Day” on 15th March 2011. This coincidentally occurred on the same week as the annual NACE conference. The day was targeted at people with little or no experience in corrosion field and would be looking for an appreciation in to help them with their current roles. Attendees were drawn from each of our branch sponsors (1 each) and a couple of students joined from the two universities in Aberdeen i.e. The Robert Gordon University (RGU) & the University of Aberdeen. A total of 29 people were in attendance.

Various speakers and topics were presented by our able speakers/presenters. The day started by looking at the basics of corrosion by Prof. Paul Lambert (past president of Institute of Corrosion). He presented two interesting topics: “An Introduction to Aqueous Corrosion” and “Development and Application of Corrosion Control Methods”. In his usual self Paul kept the audience captivated and added fun into the presentation. The first presentation was the basics and foundation while the second took us down memory lane on how some of these principles came to be.

A lovely lunch was served by the Palm Court Hotel staff and Martin Mweemba (Subsea7) had the task of keeping people awake with his presentation in the difficult after lunch slot. Martin spoke on “Material Selection” a topic in which he is very knowledgeable in. He gave the practical touch by demonstrating what principles an engineer working for a pipeline contractor will apply to select pipe materials for a project. Most people found this presentation useful and would refer to it during the course of their career.

This was closely followed on by a presentation on “Cathodic Protection” by Tim Queen (Deepwater EU Ltd). The Principles of CP were discussed and several examples and designs of CP were illustrated. This gave the audience a feel of what happens in the CP world. Time was not enough to explain everything; as such references were provided for attendees to reference in their day to day work.

Alison Chalmers (Clariant Oil Services) then presented “Corrosion Inhibitors and Corrosion Inhibitor Selection”. This was an enlightening presentation as most people feel chemicals and inhibitors are shrouded in some form of secrecy and too complex to understand. Alison was able to break it down to the simplest terms for better understanding. The roles, types and application of inhibitors were discussed with an emphasis that in addition to corrosion inhibitor performance, many ‘secondary’ factors need to be considered when designing a corrosion inhibitor.

The last presentation of the day was by Dave Moore (Lloyds Register) who spoke about Integrity Management. Dave has vast knowledge in this area and was able to discuss what is expected from integrity management of an asset. This was an overview and gave some of the graduates among the attendees an idea of career path they might want to know. The importance of Integrity Management could not have been more emphasized during the presentation.

The whole day was successful with attendees requesting it to be annual event.

For details of all the presentations and information or inquiries about the Aberdeen branch activities please visit the micro-site https://sites.google.com/site/icorrabz/home.
GREEN COATINGS FOR INDUSTRIAL APPLICATIONS

R. Akid1 *, H. Wang1, M. Gobara2, T.J. Smith3 & J. Gittens3

Abstract:
Despite their 150 year history, sol-gel coatings have made little impact on the industrial coatings scene largely because of their inorganic nature which has limited systems to the need for very high cure temperatures, ca. 500°C+. Further issues such as; complicated processing, limited shelf life, lack of dry film thickness, restricted methods of applying the sol-gel coating system and poor adhesion to common engineering substrates have further limited the general application of this technology, being largely restricted to optical applications.

This paper describes the recent development of environmentally-compliant 'Green' sol-gel coating systems for industrial applications, examples being; a water-based chrome-free system for coil coatings, aerospace/transportation chrome-free pre-treatment/prime replacements and antifouling coatings. The sol-gel coating systems are based upon an inorganic-organic alkoxysilane precursors formulated to allow the incorporation of additives such as inhibitors, conducting polymers, nanoparticles and in the case of antifouling coating, an active non-pathogenic biological component. The performance of these coating systems has been assessed using standard industrial tests, electrochemical methods and field trials.

1. Introduction
Sol-gel technology originates in the synthesis of inorganic gels, which has a long history dating back to 1846 by Ebelmen [1] who discussed the early developments with publications on the synthesis of silica gels from alkoxides. However, it was not until the 1970s that sol-gel technology began to gain industrial importance when monolithic inorganic gels were formed at low temperatures and converted to glasses without the need for a high temperature melting process. Conventional sol-gel materials are mostly oxides, in particular silica, alumina, aluminosilicates, titanium dioxide, zirconium dioxide and a long list of other oxide compositions. Since the 70’s, the synthetic technique of sol-gel processing has experienced tremendous development [2][3]. With the advent of “Hybrid organic–inorganic” systems, which are made of organic and inorganic components combined over length scales ranging from a few Angstroms to a few tens of nanometres interest has grown considerably. The development of these materials in the early 80’s is mainly due to the development of soft inorganic chemistry processes, especially sol–gel processes, where mild synthetic conditions allow versatile access to chemically designed combinations of inorganic domains obtained via inorganic polymerization reactions with fragile entities such as organic or even bioactive molecules. By far the most extensively studied of these materials is that of the SiO₂-based sol-gel nanocomposites. silica-based corresponding gels can easily be tailored to a large range of porous textures, network structures, surface functionalities and processing conditions. The pH, gelation time, shaping, transparency or hydrophobicity, for instance, can be adapted to a particular dopant or application. Currently the greatest interest in hybrid sol-gels at Sheffield Hallam University is in that of coatings having specific properties for the protection of various metals against harsh environments. Recent environmental legislation has fuelled this interest, particularly given that sol-gels offer an opportunity to eliminate Cr-based pre-treatments and can be used to replace biocide-based coatings. In this paper the following potential application areas are considered:

1) A universal sol-gel pre-treatment or primer coating with the controllable released inhibitor to replace chromium (VI) based pre-treatment or primer coatings;
2) Sol-gel/conducting polymer hybrid coating having self-healing properties.
3) Bio-active functional coatings

2. Sol-gel formulations and coating processes

SiO₂ based sol-gel formulations are typically achieved by the use of functional alkoxysilanes \( R_n\text{Si(OR')}_4 \), \( n = 1–3, \ R' = \text{alkyl} \), in a mixture with a tetraalkoxysilane \( \text{Si(OR')}_4 \) e.g. TEOS, as one or more of the precursors for the sol–gel reaction. The polymerization mechanism involves hydrolysis and co-condensation processes, leading to the following reactions for an initial 1: 1 mixture of alkoxysilane and organoalkoxysilane (eqns. 1–2):

\[
\text{Si(OR')}_4 + R_n\text{Si(OR')}_4 + (8 - n)\text{H}_2\text{O} \rightarrow \text{Si(OH)}_4 + R_n\text{Si(OH)}_4 + (8-n)\text{R'OHH}
\]

\[
\text{Si(OH)}_4 + R_n\text{Si(OH)}_4 + (8-n)\text{H}_2\text{O} \rightarrow \text{Si(OH)}_4 + R_n\text{Si(OH)}_4 + (8-n)\text{R'OHH}
\]

A wide spectrum of materials such as Nanoparticles (e.g. nanotubes), corrosion inhibitors or bioactive materials can be encapsulated, entrapped or embedded in a porous gel network therein creating new functional properties. Fig.1 shows a typical sol-gel network structure showing incorporated functional materials. Further synthesis routes allow modification of the polymer groups to allow changes in the surface properties, such as hydrophobicity.

Figure 1. Schematic of a sol-gel network structure showing incorporated functional materials.
The typical hydrolysis and condensation processes that can take place during synthesis are shown below:

**Hydrolysis:**

\[
\text{H}_2\text{O} + \text{Si}(	ext{OH})_4 \rightarrow \text{Si}(	ext{OH})_3 + \text{H}_2\text{O}
\]

**Condensation:**

\[
\text{Si}(	ext{OH})_3 + \text{H}_2\text{O} \rightarrow \text{Si}(	ext{OH})_2\text{O} + \text{H}_2\text{O}
\]

The sol can be applied onto the metal substrate by dip, spray, roller, or other adaptable techniques used within industry and the coating is subsequently cured at a designated temperature. Removal of volatile compounds such as water and alcohol causes shrinkage of the network until a dry film is formed. This last process has been one of the major obstacles to the development of crack-free coatings.

The chemistry of the sol-gel formulation is critical in determining whether or not the sol-gel reacts with the surface onto which it is applied. In the case of the SHU anti-corrosion systems two layers are formed, see Fig. 2. Here a distinct inner ‘conversion’ layer of nano-size dimensions is formed. Analysis of this has proven that a chemical change occurs at this interface [4]. The total thickness of the coating in Fig. 2 is about 15 microns while the thickness of the inner layer is less than 50nm. Analysis of the EIS data for the Al alloy and the mild steel tests also revealed corrosion protection behaviour consistent with the presence of inner and outer layers within the sol-gel [5-7].

3. Sol-gel systems

A brief discussion on the following specific sol-gel systems being developed at Sheffield Hallam will follow;

a. Water-based pre-treatment/primer
b. Self-healing sol-gel/conducting polymer coating
c. Biocide-free antifouling coating

**Water-based pre-treatment/primer for coil coating applications**

One of the main challenges set in the coil coating industry is to coat and cure the reactive steel, hot-dip galvanized steel or aluminium strip surface at high line speeds. Typically it may be necessary to cure a coating within 10 seconds. This is achieved on a daily basis using solvent-based coating systems. However a future goal of the industry is to use the existing coil coating production lines but replace typical solvent based pre-treatments with water-based Cr-free systems.

Fig. 3a presents the mechanical (adhesion) properties of a water based sol-gel top coated with polyester, following an Erichson cupping test and exposure to boiling water for 30 minutes. Figure 3b presents the electrochemical impedance spectroscopy (EIS) results of this water based sol-gel coated steel strip cured using infra-red lamps. The time/temperature cure profile is shown in Fig. 4. The coating exhibits good adhesion and high impedance (>10^8 ohms.cm²) for over 1000 hours immersion in the chloride environment.

**Self-healing sol-gel/conducting polymer coating**

Conducting polymers (CPs) such as polyaniline (PANI) and polypyrrole (PP) have been recognised as potential ingredients for anti-corrosion coatings for many years [8]. However, historically, much of the research work has been focused on the protection of mild steel. Although these types of coating offer a number of benefits, notably the ability to form a passive layer and the ability to transfer charge within the coating, there are issues such as lack of coating flexibility and substrate adhesion that have limited their industrial use.

By incorporating a conducting polymer into a sol-gel coating, a novel hybrid coating is formed which has the advantage of flexibility and good adhesion from the sol-gel while simultaneously providing excellent corrosion resistance through the presence of the CP. This type of coating has been applied to the aerospace AA2024 grade. Fig. 5 presents the results of a comparison between sol-gel ‘only’ and hybrid sol-gel/CP coatings that have been scribed and subject to Neutral Salt Spray testing in 5% NaCl at
35°C. As can be clearly seen the sol-gel coating alone offers little corrosion protection, showing extreme pitting and delamination at the scribe. Conversely, little corrosion is observed on the sol-gel/CP coating. Further evidence of the corrosion resistance and self-healing capability of the hybrid system is shown in Fig. 6, which presents a scanning vibrating electrode (SVET) scan over a scribed coating on AA2024. Here it can be seen that there is activity at the scribe in the first few hours of immersion. Eventually this activity ceases after around 16 hours.

A similar self-healing response has been found when using EIS measurements on ‘initially-intact’ and then ‘scribed in solution’ samples. Initially the impedance value drops and then as the CP is activated the impedance value recovers. The self-repair behaviour properties of the coating are based upon the ability of the CP to undergo a reversible redox reaction from the emeraldine base to the lecomeraldine form allowing an electron transfer reaction when N=C is reduced to N-C [9].

### Biocide-free antifouling coating

Subject to the nature and type of nutrients, microorganisms can rapidly colonise a surface which is immersed in an aqueous environment. The attachment of micro/macrofouling has enormous economic consequences for many applications such as marine shipping, oil pipeline structures, heat exchangers etc. For example, 5% biofouling of a ship’s hull can lead to an increase in drag that contributes to a 10% fuel loss, the added frictional forces that contribute to this loss steadily increase in magnitude with an increase in the degree of biofouling.

Furthermore, the development of a bio-film can lead to subsequent colonization of bacterial types that ultimately generate aggressive environments, notably sulphate reducing bacteria (SRB). Here the formation of sulphide and hydrogen sulphide can lead to rapid localised corrosion, especially ferrous-based materials.

As stated, a primary benefit of the hybrid sol-gel system is that it allows a variety of additives to be incorporated into the matrix, therein enhancing the functionality of the coating system. One specific aspect that has been developed at Sheffield Hallam is that of the encapsulation of a bio-active component selected to prevent biofouling and microbially induced corrosion.

Following a ‘proof of concept’ study it was realised that endospores and vegetative cells could be encapsulated within the sol gel matrix [10]. An initial concern was that of maintaining the viability of the endospores when added to the sol-gel, particularly given the high solvent levels (up to 50%) and low pH levels (down to 2) of the sol-gel. To assess the survivability of the endospores a series of experiments was carried out to determine the number of colonies formed on the surface as a function of solvent concentration and pH. Fig 7 presents the results of this study showing high viability of the endospores at different levels of solvent and pH [11].

Further proof of the ability of the spores to survive in the sol-gel environment is shown by evaluating whether or not the bacteria colonise the surface on exposure to suitable nutrients.

Fig. 8 presents fluorescence microscopy images of abiotic (bacteria-free) and biotic (added bacteria) coatings after immersion in

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**Figure 5.** Salt spray test results on scribed AA2024; (a) sol-gel only (168 hrs)

**Figure 6.** SVET area scan over a scratched sol-gel/CP coating. Test conducted in 3.5% NaCl solution.

**Figure 7.** Viability of *Paenabacillus polymyxa* endospores in sol-gel formulations of varying solvent concentration and pH.

**Figure 8.** Images of abiotic (top) and biotic (bottom) sol-gel coating on Al 2024-T3 after staining with BacLight kit following 24 hours immersion in Nutrient Broth. Viable (living) bacteria fluoresce green.
nutrient rich artificial seawater. Here it can be seen that viable (living) micro-organisms are evident in the coating within 24 hours of exposure to the solution.

Effectiveness of the coating to prevent fouling is shown in Fig. 9 which presents images of panels subject to constant immersion over a 29 week period at Whitby Harbour, a site on the east coast of the UK. It can be clearly seen that the surface of the biotic coating is unattractive for the settlement of barnacles.

Figure 9. Comparison of barnacle settlement on sol-gel surfaces, abiotic (left) and biotic (right).

In addition to the antifouling properties of the coating, laboratory and field trials have shown that the bioactive coating has a higher corrosion resistance than that of an equivalent abiotic coating. Figure 10 presents electrochemical impedance data obtained from two different types of biotic coating compared to an abiotic coating.

As can be seen by the size of the semicircles in the Nyquist plot, Fig. 10a, (which represent coating resistance, that is, large diameter equates to high resistance) there is a significant improvement in corrosion resistance when bacteria are incorporated into the coating. Linear polarization resistance, Fig 10b, ($R_p$) data also shows that, compared to bacteria encapsulation in the coating, the corrosion resistance of an abiotic coating, with or without the addition of dead bacterial endospores, was on average lower than the biotic sample.

6. Conclusions

A non-toxic, environmentally-friendly Si-based hybrid sol gel platform coating system has been developed for use as a pre-treatment/primer or as a stand-alone coating for a variety of metal substrates, namely steel, Al, Zn and Mg. These systems are currently showing good corrosion resistance performance and have viable potential to replace traditional chromate pre-treatments/primer.

The sol-gel system has the advantage of variable cure times and temperatures from room temperature up to around 200°C depending upon the sol-gel formulation and type of substrate being coated. A rapid cure system has been developed that can be cured in less than 10 seconds at peak metal temperatures less than 100°C. Coating thickness can vary up to 20 μm, subject to formulation chemistry and multilayer coatings can be applied using these systems. The sol-gel coating system has also proven to be an acceptable surface for subsequent organic topcoat treatments. Self-healing of these coatings can be achieved either by the incorporation of controlled-release inhibitors or by the addition of a conducting polymer. The ability to tailor the chemistry of these systems to allow the incorporation of bacteria, thus providing antifouling functionality and improved corrosion resistance is a unique aspect currently not found with any other sol-gel system. Finally, although not reported here, carbon nanotubes may also be incorporated into the sol-gel to provide the functionality of ‘scratch resistance’ whilst also maintaining high resistance to localised corrosion.

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The authors would like to acknowledge the scientific and technical support of Dr D. Greenfield and Prof. J. Earthman at the University of California, USA. In addition the authors would like to acknowledge funding from the EPSRC and to SHU for providing facilities to undertake this work; Finally we would like to acknowledge the support of Becker Industrial coatings for the development of the fast cure system and Parkol Marine Engineering Ltd, Whitby for assistance with field trials.

References

WORLD’S FIRST ACADEMY OF JOINT INTEGRITY LAUNCHED BY SEALING INDUSTRY LEADERS

The $100m turnover FDS Group (Flexitallic Group, Novus Sealing, Siem Supranite and Induseal Gaskets), has launched The Academy of Joint Integrity with dedicated facilities in Aberdeen, Teeside/Humberside, West Yorkshire and globally in the US, Australia, New Zealand, Malaysia, South Africa, Nigeria, Thailand, China, Middle East and Kazakhstan.

The Academy’s training programmes address the lack of standardised qualifications for bolted joint assemblers, identified by the industry as a leading cause of joint leakage which can result in personnel injury and, for example, hydrocarbon releases which are viewed as precursors to major accidents.

The FDS Group has created The Academy to provide accredited & awareness training courses in joint integrity and flange management processes, underpinning the importance of certified bolted joint assemblers to achieving and maintaining a leak free bolted connection.

The Academy training programmes recognise the important role sealing technology plays in the safe operation of a bolted joint. Significant advances in gasket technology in recent years have allowed great improvements to be made in the specification of gaskets for industrial applications, minimising the likelihood of joint leakage and resulting in reduced operating costs. Academy courses include modules on sealing technology and also provide practical identification, handling and removal of gasket.

Gary Milne manages the Global Client Training Division of the FDS Group and will head up the new Academy. Gary has extensive technical experience and in depth knowledge of the sealing industry and Joint Integrity Products and Services together with involvement and representation on a number of UK and International Committees. Within these committees he promotes and advises on Industry Best Practice to ensure Joint Integrity Issues and new technical solutions are transparent to end users.

ASME has commissioned Gary until 2012, as an independent consultant providing technical input in the re-write of ASME PCC-1-2010 and formulation of Appendix A which will include Training & Qualification Procedures for personnel assembling and tightening bolted flanged connections.

Gary commented, “Welders are able to train and become certified to industry standards, but bolted joint assemblers have no such system, despite assembling pressure boundary joints on the same equipment as welders.

“This is a great opportunity to introduce much needed symmetry in training and qualifications to ensure personnel are adequately trained, and transparency for the industry. It is a brave move by FDS to introduce an Academy which is not revenue generation led – integrity is central to our mission to deliver quality training.

“We are actually addressing the age-old questions posed by engineers dealing with pressure vessel and piping bolted joints of what assembly bolt load should be used and why the joint leaked, in PCC-1-2010.”

The Academy offers accredited training to International Standards including ASME PCC-1 and the EN 1591 part 4.

DENSO PROTECTS SPACE GUARD TELESCOPE

The Spaceguard Centre at Knighton, Powys, already has a research grade robotic telescope system for tracking Near Earth Objects (NEOs) detected elsewhere. As this has a narrow field of view and other limitations, Spaceguard became involved in the DRAX project to install and operate a 24inch (61cm) Schmidt camera (it is the largest telescope in Wales) which will conduct a wide field sky survey to detect NEOs and other transient phenomena.

With the onset of the winter weather the groundwork for the installation of the dome came to a halt. The new Schmidt telescope was given temporary protection from the environment by first wrapping the base and fork sections in Winn & Coales’ Denso Tape, followed by Denso Clear Outerwrap. In February, the same protection was then applied to the tube section.

Denso Tape is a non-woven synthetic fibre fabric impregnated and coated with an adhesive compound based on petrolatum.

The new telescope will also be available to schools and educational establishments throughout Wales and the West Midlands, as well as to any partners in the DRAX project. The Spaceguard Centre receives no funding from external sources at present and relies on income from visitors. The extra funding required will be sought from National, Regional and local government and commercial sponsors.

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The Industrial Services Division of Gateshead-based Pyeroy has secured more than £14 million of new work after winning a number of major contracts in the UK.

The UK manufacturer of high quality chemicals, Fine Organics Ltd, has awarded a three year framework contract which sees Pyeroy operating on-site at its Seal Sands facility on Teeside providing access, insulation and protective coating services as part of a planned maintenance programme.

The contract, potentially worth £1.5 million, was secured after Pyeroy identified several areas where significant cost savings could be achieved and sees several contractors from the previous arrangement involved on the project over the next few years, many of whom will be transferring across from the previous contractor under TUPE arrangements.

Pyeroy has also recently secured a £10 million contract to provide access, insulation and painting services for a large industrial site in Scotland.

Siemens, the global engineering and technology company, is also among Pyeroy’s key customers. The news comes as Pyeroy reports strong performances across all sectors of its operation this year, which also includes marine, construction and environmental services.

Julian Gammane, director of Pyeroy’s Industrial Services Division, said: “Despite tough times, we have maintained growth in the face of strong competition and decreasing margins to secure these very prestigious contracts.

“Our ability to win this and other work has strengthened our position as a leading provider of specialist industrial services.

“We also have a highly trained and dedicated work force in place, which together with a strategy of adding value, is helping us to emerge strongly from the worst recession in decades.”

The Pyeroy Group is based in Gateshead and employs 1000 people working on industrial, construction and marine projects throughout the UK and Ireland.

The company provides a range of industrial services, which comprise contract scaffolding and equipment hire, surface preparation and application of marine/industrial protective coatings, insulation, civil engineering/building works and environmental management services such as asbestos removal.

Rio Tinto Alcan’s Lynemouth site is among those Pyeroy is working on as it wins millions of pounds of new work.
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<td>Austin Hayes Ltd</td>
<td>Carlton Works, Cemetery Road, Yeadon, Leeds, LS19 7BD, UK</td>
<td>0113 250 2255</td>
</tr>
<tr>
<td>Beever Limited</td>
<td>Little Coldharbour farm, Tong Lane, Lamberhurst, Kent, TN3 8AD, UK</td>
<td>01892 890045</td>
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<tr>
<td>Briton Fabricators Ltd</td>
<td>Watnall Road, Hucknall, Notts, NG15 6EP</td>
<td>0115 963 2901</td>
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<tr>
<td>Cameron Limited</td>
<td>Queen Street, Stourton, Leeds, LS10 1SB, UK</td>
<td>0113 276 4389</td>
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<tr>
<td>Cape Industrial Services</td>
<td>Cape House, 3 Red Hall Avenue, Paragon Business Village, Wakefield, WF1 2UL</td>
<td>01224 215800</td>
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<tr>
<td>Celtic Painting Consultancy Ltd</td>
<td>Rosedale, Carelicken Lane, Langstone Newport, Gwent, NP18 2JZ</td>
<td>01633 400194</td>
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<tr>
<td>Cleveland Bridge UK Ltd</td>
<td>Cleveland House, Yarm Road, Darlington, DL1 4DE</td>
<td>01325 502345</td>
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<tr>
<td>Coating Services Ltd</td>
<td>Partington Street, Mumps Bridge, Oldham, OL1 3RU, UK</td>
<td>0161 665 1998</td>
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<tr>
<td>Coastline Preservation Ltd</td>
<td>Tredegraw Wharf, Marine Parade Southampton, Hants, SO14 5JF</td>
<td>02380 221480</td>
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<tr>
<td>Collis Engineering Railway Contracts</td>
<td>Salcombe Road, Meadow Lane Industrial Estate, Alfreton, Derbyshire, DE55 7R</td>
<td>01773 833255</td>
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<tr>
<td>Community Clean</td>
<td>11 Old Forge Road, Ferndown Industrial Estate, Ferndown, Wimborne, Dorset, BH21 7RR, UK</td>
<td>0845 6850133</td>
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<tr>
<td>Concrete TS Ltd</td>
<td>Unit B2 (2), Moss Industrial Estate, Leigh, Lancs, WN7 3PT, UK</td>
<td>01942 261909</td>
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<tr>
<td>Corrocoat</td>
<td>Forster Street, Leeds, LS10 1PW</td>
<td>01132760760</td>
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<tr>
<td>Denholm Industrial</td>
<td>21 Boden Street, Glasgow, G40 3PU</td>
<td>0141 445 3939</td>
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<tr>
<td>Dyer &amp; Butler Ltd (Rail)</td>
<td>Mead House, Station Road, Nursling, Southampton, SO16 0AH, UK</td>
<td>02380 667549</td>
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<tr>
<td>ENC (Yorkshire) Ltd</td>
<td>Unit 3B Rotherham Road, Dinnington Sheffield, S25 3RF</td>
<td>01909 567860</td>
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<tr>
<td>F A Clover &amp; Son Ltd</td>
<td>Bardolph Road, Richmond Surrey, TW9 2LH</td>
<td>0208 948 6321</td>
</tr>
<tr>
<td>Forth Estuary Transport Authority</td>
<td>Forth Road Bridge, Administration Office South Queensferry, EH30 9SF</td>
<td>0131 319 1699</td>
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<tr>
<td>Harrisons Engineering Lancashire Ltd</td>
<td>Judge Wilmey Mill, Longworth Road Billington, Clitheroe, Lancashire, BB7 9TP</td>
<td>01254 823993</td>
</tr>
<tr>
<td>H&amp;H Painting Contractors Ltd</td>
<td>4 Hamilton Gardens, Mutley, Plymouth, PL4 6PQ</td>
<td>07837 382619</td>
</tr>
<tr>
<td>Hyspec Services Ltd</td>
<td>Unit 3 Meadowfield Industrial Estate, Cowdenbeath Road, Burntisland, Fife, KY3 OLH</td>
<td>01592 874661</td>
</tr>
<tr>
<td>Industrial Coating Services</td>
<td>5 Danesbury Crescent, Kingstanding, Birmingham, B44 0QP</td>
<td>0121 384 2266</td>
</tr>
<tr>
<td>Industrial Painting</td>
<td>48-49 RCM Business CENTRES, Sandbeds Trading Estate, Dewsbury Road, Ossett, WF5 9ND</td>
<td>01924 272606</td>
</tr>
<tr>
<td>Interserve Industrial</td>
<td>Unit 2, Olympic Park, Poole Hall Road Ellesmere Port, Cheshire, CH66 1ST</td>
<td>0151 3737660</td>
</tr>
<tr>
<td>Company Name</td>
<td>Address</td>
<td>Phone</td>
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<tr>
<td>Jack Tighe Coatings</td>
<td>Sandall Lane, Kirk Sandall, Doncaster, DN3 1QR</td>
<td>01302 880360</td>
</tr>
<tr>
<td>Jack Tighe Ltd</td>
<td>Redbourne Mere, Kirton Lindsey, Gainsborough, Lincs, DN21 4NW, UK</td>
<td>01652 640003</td>
</tr>
<tr>
<td>Lanarkshire Welding Co.</td>
<td>82 John Street, Wishaw, Lanarkshire, ML2 7TQ</td>
<td>01698 264271</td>
</tr>
<tr>
<td>Maclean and Speirs</td>
<td>Unit D, East Fulton Farm, Darluith Road, Linwood, PA3 3TP</td>
<td>01505 324777</td>
</tr>
<tr>
<td>Matatec Ship Repairers</td>
<td>MacGregor House, Seaton Delaval, Tyne &amp; Wear, NE25 OPT</td>
<td>0191 2379900</td>
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<tr>
<td>Merseyside Coatings Ltd</td>
<td>Pickerings Road, Halebank Industrial Estate, Widnes, Cheshire, WA8 8XW</td>
<td>0151 423 6166</td>
</tr>
<tr>
<td>Northern Protective</td>
<td>16 High Reach, Fairfield Industrial Estate, Bill Quay, Gateshead, Tyne &amp; Wear, NE10 0UR</td>
<td>0191 438 5555</td>
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<tr>
<td>Nusteel Structures</td>
<td>Lympe Industrial Estate, Lympe, Hythe, Kent, CT2 1LR</td>
<td>01303 268112</td>
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<tr>
<td>Orrmac Coatings Ltd</td>
<td>Newton Chambers Road, Thorncliffe Park Estate, Chapeltown, Sheffield, S35 2PH</td>
<td>0114 246 1237</td>
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<tr>
<td>P&amp;R Engineering Ltd</td>
<td>Unit 50/51 Cable Street, Wolverhampton, WV2 2HX</td>
<td>01902 870637</td>
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<tr>
<td>Paintel Ltd</td>
<td>26 St George’s Road, Saltash, Cornwall, PL12 6EH</td>
<td>07730 691227</td>
</tr>
<tr>
<td>Palmers Ltd</td>
<td>1120 Elliot Court, Herald Avenue, Coventry Business, Park, Coventry, CV5 6UB</td>
<td>02476 710294</td>
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<tr>
<td>Port Painters Limited</td>
<td>Unit 3, Ringside Business, Hoel-Y-Rhosog Cardiff, CF3 2EWx</td>
<td>02920 777070</td>
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<tr>
<td>Pyeroy Limited</td>
<td>Kirkstone House, St Omers Road, Western Riverside Route, Gateshead, Wear, NE11 9EZ</td>
<td>0191 4932600</td>
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<tr>
<td>Roy Hankinson Limited</td>
<td>Alexander House, Monks Ferry, Birkenhead Wirral, CH41 5LH</td>
<td>0870 7892020</td>
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<tr>
<td>Rowecord Engineering</td>
<td>Neptune Works, Usk Way, Newport, South Wales, NP20 2SS</td>
<td>01633 250511</td>
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<tr>
<td>Shutdown Maintenance Services Ltd</td>
<td>Kingsnorth Industrial, Hoo, Rochester, Kent, ME3 9ND</td>
<td>01634 259699</td>
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<tr>
<td>South Staffs Protective Coatings Ltd</td>
<td>Bloomfield Road, Tipton, West Midlands, DY4 9EE</td>
<td>0121 522 2373</td>
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<tr>
<td>Supablast (1984) Ltd</td>
<td>Jubilee Estate, Cosrey Lane, Coleshill, Birmingham, B46 1JU</td>
<td>01675 464446</td>
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<tr>
<td>T I Protective Coatings</td>
<td>Unit 6, Lodge Bank, Crown Lane, Horwich, Bolton, Lancs, BL6 5HU</td>
<td>01204 468080</td>
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<tr>
<td>Walker Construction</td>
<td>Park Farm Road, Folkestone, DA9 9RR</td>
<td>01322 387000</td>
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<tr>
<td>Wardle Painters Ltd</td>
<td>Unit 5, Wimborne Building, Atlantic Way, Barry Docks, Glamorgan, CF63 3RA, UK</td>
<td>01446 748620</td>
</tr>
<tr>
<td>William Hare Ltd</td>
<td>Brandleholme House, Brandleholme Road, Burys, Lancs, BL8 1JJ, UK</td>
<td>0161 609 0000</td>
</tr>
<tr>
<td>Abrasion Ltd</td>
<td>1 Montague House, 74 Bryantwood Road, London, N77B</td>
<td>07949 130168</td>
</tr>
<tr>
<td>Fairhurst Ward Abbotts</td>
<td>225 London Road, Greenhithe, Kent, DA9 9RR</td>
<td>01322 387000</td>
</tr>
<tr>
<td>Gemini Corrosion</td>
<td>Broomhill Road, Spurryhilllock Industrial, Stonehaven, Aberdeenshire, AB39 2NH</td>
<td>01569 765488</td>
</tr>
<tr>
<td>Hill Price Associates Ltd</td>
<td>Hill Price Associates Ltd, 3 Prospect Place, The Maritime Quarter, Swansea, SA1 1QP</td>
<td>01792 544255</td>
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<tr>
<td>JPV (Painters) Ltd</td>
<td>Unit 8 Prospect Way, Hutton Industrial Estate, Brentwood, Essex, CM13 1XA, UK</td>
<td>01277 201515</td>
</tr>
<tr>
<td>Matthew James Services</td>
<td>Unit 4, Shibdon Business, Cowen Road Blaydon, Newcastle-Upon-Tyne, NE21 5TX</td>
<td>0191 414 5700</td>
</tr>
</tbody>
</table>
Offshore Marine Services Ltd
Brumby House, Jalan Bahasa, PO Box 80148, 87011 Lubuan F.T. Malaysia
T: +356214244410

Opus Industrial Services
Ethan House, Royce Avenue, Cowpen Industrial, Estate, Billingham, TS23 4BX, UK
T: 01642 371850

P C Richardson & Co
Courville House, Ellerbeck Court, Stokesley Business Park, Stokesley, TS9 5PT, UK
T: 01642 714791

Standish Metal
Potter Place, West Pimbo, Skelmersdale, Lancs, WN8 9PW, UK
T: 01695 455977

TEMA Engineering Ltd
5-6 Curran Road, Cardiff, CF10 5DF, UK
T: 020 920 344556

Tees Valley Coatings
Riverside Park Road, Middlesborough, Cleveland TS2 1UT
T: 01642 228141

ICATS REGISTERED COMPANIES

Abbey Gritblasting Services
Unit 13, Clifton Commercial Park, Clifton, Woodbridge, Suffolk, IP12 3TP
T: 0191 262 0510

Barrier Ltd
Stephenson Street, Wallsend, Tyne & Wear, NE28 6UE, UK
T: 0191 262 0510

Carrodus Contractors Limited
Unit 134, Medway Enterprise Centre, Enterprise Close, Strood, Kent, M62 4SY
T: 01634 271786

Coastground Ltd
Morton Peto Road, Capton Hall Industrial, Great Yarmouth, Norfolk, NR31 0LT
T: 01493 650455

E & P Painting Contractors
Rossfield Road, Rosmore Trading Estate, Ellesmere Port, Cheshire, CH65 3AW
T: 0151 9558141

Forward Protective
Vernon Street, Shirebrook, Mansfield Notts, NG20 8SS
T: 01623 748323

GABRE (UK) LTD
9 Holme Road, Dromore, Omagh Co Tyrone, BT78 3BX
T: 02882 897950

G W Burton Ltd
New Court, Wooddalling, Norwich, Norfolk, NR11 6SA
T: 01263 584203

GPS Services & Distribution Ltd
Alexandra Business Park, Riverside South, Pallion, Sunderland, Tyne & Wear, SR4 6UG
T: 01753 654123

H & S Decorating
Administration Building, Forth Road bridge, South Queensferry, Edinburgh, EH30 9SF
T: 01753 654123

Hempel UK Ltd
Llantarnam Park, Cwmbran, Gwent, NP44 3XF
T: 01633 874024

Leighs Paints
Tower Works, Kestor Street, Bolton, Lancs. BL2 2AL
T: 01698 264271

Malakoff Limited
North Ness, Lerwick, Shetland, ZE1 0LZ, UK
T: 01595 695544

Metal Cleaning UK Ltd
Randles Road, Knowsley Business Park, Knowsley, Merseyside, L34 9HX
T: 0151 5492449

MIS Services Ltd
Unit 12 Laurence Industrial, Eastwoodbury Lane, Southend-On-Sea, Essex, SS2 6RH
T: 01702 520400

Prize Spraying
Easdale, Carlton Colville, Lowestoft Suffolk, NR33 8WL
T: 01502 564437

R A Materials & Foundries
Unit 19, Heysham Business Park, Middleton Road, Heysham, Lancs, LA3 3PP
T: 01606 723426

R L P Painting
Heathfield House, Old Bawtry Road, Finningley, Doncaster, DN9 3DD, UK
T: 01302 772222

Steel Protection Consultancy Ltd.
7a High Street Mews, High Street, Leighton Buzzard, Beds, LU7 1EA, UK
T: 01525 852500

Sussex Blast Cleaning
Unit 35-37 Station Road, Hailsham, East Sussex, BN27 2ER
T: 01323 849229

The Renovate Services Co.
Amlwch Industrial Estate, Anglesey, LL68 9BQ
T: 01407 831331

Watson Steel Structures
Lostock Lane, Lostock, Bolton, BL6 4BL
T: 01204 699999
DIARY DATES 2011

5th May 2011
London Branch Guided Walkabout
Sponsored by Quill International and Deepwater Corrosion Services (UK) Ltd.
Meet outside Criterion Theatre opposite to Eros statue at 17.45 and return to the Naval Club for chilli supper. Please note strict dress code required to enter the Naval Club, trainers and jeans are not allowed.
Co-ordinator is John O’Shea
Email: john.o.shea@btinternet.com
Please note that smart dress code is required at the Naval Club - gentlemen shirt and tie please. Jeans and trainers are not allowed.

5th May 2011
London Branch Sustaining Members’ Evening
Please note that smart dress code is required at the Naval Club - gentlemen shirt and tie please. Jeans and trainers are not allowed.

19th May 2011
Corrosion Engineering Division (CED) Working Day/Seminar
Venue: The National Physical Laboratory (NPL), Teddington
We are looking for offers of lectures on novel corrosion prevention technologies, please contact Nick Smart, nick.smart@serco.com or Douglas Mills, douglas@harrbridge.freeserve.co.uk.
(see page 5).

31st May 2011
Midlands Branch Meeting
At The University of Nottingham, Calling Notices c/w all details shall be sent out during 1st Week in May 2011, to be included please contact Ross Fielding, ross.fielding@cathodic.co.uk or alternatively barry.lamb@bacgroup.com

1st June 2011
London Branch Golf Day
Venue: Silvertree G.C., Surrey
Team applications to: Mike Moffat at: Michaelmoffatt@aol.com or Derek Hoskins at: Dhoskins@waitrose.com
Arrangements have been made for special rates at the nearby Hilton Hotel for teams wishing to stay over and make an evening of it.

1st - 3rd November 2011
The Surface World Show 2011 with Correx
Venue: Pavilion NEC, Birmingham CORREX 2011 will be a major event in the UK corrosion industry aimed at everyone interested in coatings and cathodic protection: engineers, specifiers and practitioners. Conferences, workshops, courses and seminars will run in tandem with the exhibitions. For more information contact Nigel Bean on: Tel: +44 (0) 1442 826826 Email: nigelbean1aol.com
Web: www.surfaceworldshow.com

27th November - 1st December 2011
Fray International Symposium
Venue: Hilton Cancun, Cancun, Mexico
Honoring the distinguished work and lifetime achievements of Prof. Derek Fray. The symposium will be based in the equally important three topical areas: principles, technologies and industrial practice with special emphasis to a globally sought clean environment of 21st century.
For further details contact Dr. Florian Kongoli
Email: fkongoli@flogen.com
www.flogen.com/FraySymposium

Details of all Branch activities, dates and venues can be found at www.icorr.org