NACE’s Role in the Corrosion Community
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NACE International - Overview

Mission: To protect people, assets, and the environment from the effects of corrosion

Founded in 1943

Not-For-Profit

15,000+ Individual Members in 100 Countries

302 Corporate Members
NACE International – Role in the Corrosion Community

NACE provides the Corrosion Professional with the necessary tools and information to meet challenges and to solve corrosion problems.

- Technology transfer
- Developing standards by which corrosion professionals operate
- Information dissemination
- Member networking
- Corrosion awareness
- Training
Industry Challenges

The primary challenge of the corrosion engineer is similar in the Army, other military services, and industry

- Corrosion is critical to operations
- It is not the core business

Specific challenges are many

- Basic attitude and philosophy
  - Corrosion is a maintenance issue
  - Find it and fix it
  - Failure is not imminent – take care of it later
  - Corrosion is a slow process – wait and it will be somebody else's problem
Industry Challenges

特定挑战很多

财务挑战

- 影响季度回报/当前年度预算
- 生命周期成本/投资回报
  - 选择最经济有效的解决方案
- 腐蚀控制越推迟，问题越严重，修复成本越高
- 腐蚀成本不与其他成本分开
Industry Challenges

Specific challenges are many

- Technical challenges
  - Corrosion rate predictions / mechanism modeling
  - Failure predictions
  - Integrity management
  - Best practice engineering solutions
- Technology improvements
  - Designs
  - Monitoring
  - Mitigation
  - Maintenance
DoD’s Specific Challenges

流れ: The aging of military systems poses a unique challenge
- Often there is no immediate promise of replacement
- There is a need to develop corrosion maintenance and control programs that can carry the various systems well into the 21st century
- To succeed in successfully developing these programs, inter-service cooperation is required
- An optimum approach must be developed that involves inspection, monitoring, and maintenance

流れ: Design and acquisition of new systems
- Use, at a minimum, current industry design practices
- Write specifications based on industry standards and upgrade where necessary to meet unusual DoD requirements and life expectancies
NACE International - Overview

- Forum for Technology
- Technical Activities and Standards
- Public Affairs
- Publications
- Education & Certification
NACE International - Overview

★ Forum for Technology – Conferences / Seminars

★ NACE/2005 Annual Conference – Houston Texas
  ★ 6000+ Participants

★ NACE/2006 Annual Conference - San Diego, CA
  ★ March 12-16, 2006

★ Pipeline Integrity Management & Coatings Seminar

★ Co-Sponsoring with Other Organizations

★ Tri-Services Conference
NACE International - Overview

Technical Activities & Standards

- 350 Technical Committees
- 30 Specific Technology Groups (STGs)
- 60 Current Technical Committee Reports
- 20 Reports (drafts) in progress
- 125 Standards
  - Consensus technology
  - Internationally Recognized [ANSI approved]
- 59 Standards (drafts) in progress
NACE International - Overview

Public Affairs [Government relations / Public awareness]

- A Notice of Proposed Rulemaking (NPRM) was recently released for direct assessment of gas and hazardous liquid pipelines

- NACE Legislative Day - May 2005 • Washington, DC
  - Twenty-two NACE Members & Staff visited Capitol Hill
  - Promoted a tax credit initiative for corrosion maintenance programs
  - RESULT: Congressman Mike Fitzpatrick, Pennsylvania - staff is in the process of developing language for a tax incentive bill
NACE International - Overview

Publications

- Corrosion Journal
- Materials Performance
- Books
- CIP Newsletter
- CorrDefense On-Line
Education & Certification

Courses across a range of industries in 20+ countries

New Courses

- CIP Level 2 – Coating Inspector Program
- NACE Offshore Corrosion Assessment Training (OCAT) – Oct 2005
- CP3 – Cathodic Protection Technologist

DoD Related Activities

- Develop specific DoD related courses
NACE International - Overview

Education & Certification

Courses Under Development

- Pipeline Corrosion Integrity Management Program – TBD
- Pipeline Corrosion Introductory Training (PCIT) & NACE Operator Qualification (OQ) Program
- Shipboard Corrosion Assessment Training – March 2007
- Coatings in conjunction with CP – March 2007
- Advance Internal Corrosion for Pipelines
- CP Interference – March 2007
- Marine CP2 – Cathodic Protection Technician – May 2006
- Marine Coatings Technology - TBA
- NACE/SSPC Joint Applicator Training Program – TBD
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Education & Certification
- 15 Possible NACE Certifications
  - 3 - Generalist Certifications
  - 4 - Specialty Certifications
  - 3 - Coating Inspector Certifications
  - 4 - Cathodic Protection Certifications
  - Internal Corrosion Certification
NACE International - Overview

New Member Benefits
Access to K-NACE – featuring interactive electronic books...
Access to COR*SUR Database

...and the COR*SUR database
a collection reporting the effects of exposing 87 metal and nonmetal materials to over 1500 different exposure media at various temperatures and concentrations resulting in 28,000 pairs of exposed material and medium.
Complimentary Admission to NACExpo at Annual Conference

Look for it in February 2006 MP magazine!
Access to technical online discussion boards
As a NACE Member – you receive:

Unlimited FREE downloads of

• All Standards
• Technical reports
• Conference papers (6 months old and older)
NACE International - Overview

Cost of Corrosion

Coatings

Membership

Public Awareness

Strategic Plan
Economic Impact of Corrosion

Cost of Corrosion Study in the USA

- Funded by Federal Highway Administration – DOT
- Performed by CC Technologies
  - Gerry Koch, Ph.D. – Manager
- Cooperation with NACE International
- www.CorrosionCost.com
Corrosion Impacts all Industry Sectors

5 Categories

- Infrastructure: B $23
- Utilities: B $48
- Transportation: B $30
- Production and Manufacturing: B $18
- Government [DoD]: B $20

- GAO Report stated B $10 to B $20 Annually
- Corrosion effects troop readiness
- Corrosion effects troop safety
26 Industry Sectors Examined
$276 Billion
The United States Cost of Corrosion Study

CC Technologies
A DNV Company
INNOVATIVE SOLUTIONS

NACE INTERNATIONAL
Leaders in Corrosion Control Technology
Economic Impact – **3 Percent of the GDP!**

Extrapolated Corrosion Costs:
$276 billion, 3.1%

- Services, 20.9%
- Finance, Insurance and Real Estate, 19.2%
- Manufacturing, 16.3%
- Retail Trade, 9.1%
- State and Local Government, 8.5%
- Transportation and Utilities, 8.3%
- Wholesale Trade, 7.0%
- Construction, 4.3%
- Federal Government, 4.1%
- Agriculture, 1.5%
- Mining, 1.2%
- Federal Government, 4.1%

Extrapolated Corrosion Costs: $276 billion, 3.1%
## Cost of Corrosion Worldwide

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>TOTAL ANNUAL CORROSION COST</th>
<th>PERCENT OF GNP</th>
<th>YEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A.</td>
<td>$5.5 billion</td>
<td>2.1</td>
<td>1949</td>
</tr>
<tr>
<td>India</td>
<td>$320 million</td>
<td>–</td>
<td>1960</td>
</tr>
<tr>
<td>Finland</td>
<td>$54 million</td>
<td>–</td>
<td>1965</td>
</tr>
<tr>
<td>W. Germany</td>
<td>$6 billion</td>
<td>3.0</td>
<td>1967</td>
</tr>
<tr>
<td>UK</td>
<td>£1.365 billion *</td>
<td>3.5</td>
<td>1970</td>
</tr>
<tr>
<td>Japan</td>
<td>$9.2 billion</td>
<td>1.8</td>
<td>1974</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>$70 billion</td>
<td>4.2</td>
<td>1975</td>
</tr>
<tr>
<td>Australia</td>
<td>$2 billion</td>
<td>1.5</td>
<td>1982</td>
</tr>
<tr>
<td>Kuwait</td>
<td>$1 billion</td>
<td>5.2</td>
<td>1987</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>$276 billion</td>
<td>3.1</td>
<td>2002</td>
</tr>
</tbody>
</table>
The Nature of Corrosion Engineering

• The Economic Impact of Corrosion is Tremendous!
• The critical question is:

Why is there not a greater focus on savings through best practice engineering?
The Nature of Corrosion Engineering

Corrosion

- Not core to any industry
- Critical to many industries

Industry / Public / Government broadly affected

- Maintenance and repair costs
- Infrastructure / asset preservation
- Safety and environment
- Failures of critical components

The Corrosion Engineer’s dilemma

- Improve performance and reduce maintenance costs
- Don’t interfere with core business
Corrosion – Safety / Environmental / Economics
Corrosion – Safety / Environmental / Economics
Corrosion – Safety / Environmental / Economics
Corrosion – Safety / Environmental / Economics
Aircraft Components
Corrosion – Safety / Environmental / Economics
Corrosion – Safety / Environmental / Economics
Cost of Corrosion – Preventive Strategies

- Increase awareness of the large corrosion costs and potential savings
- Change the misconception that nothing can be done about corrosion
- Change policies, regulations, standards, and management practices to increase corrosion savings
- Improve education and training of staff
- Advance design practices for better corrosion management
- Advance life prediction and performance assessment methods
- Advance corrosion technology through research, development, and implementation
Savings Due to Corrosion Control

- Obviously system specific
- Life cycle costing is the best (maybe only) way to evaluate in detail
  - Life cycle costing can be applied at any point in the system life
  - Evaluate different maintenance options
  - Evaluate maintenance versus replacement
Highway Bridges

$8.3 Billion - Annually

$276 Billion
The United States Cost of Corrosion Study

Leaders in Corrosion Control Technology
Study Focus

Focus on New Construction Options

Variables

- Rebar materials
  - Black steel
  - Epoxy-coated rebar (top mat only)
  - Stainless-steel rebar (both mats)

Corrosion Management Alternatives

- Information-based practice
- Experience-based practice

User Costs

- Three traffic loading levels
Life Cycle Costing for Bridge Decks

The Annual Direct Cost of an Average Bridge at a 5% Rate-of-return

<table>
<thead>
<tr>
<th>Bridge Scenario</th>
<th>Annualized Cost</th>
<th>Cost of Corrosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Corrosion-free” black steel</td>
<td>$15,700</td>
<td>$0</td>
</tr>
<tr>
<td>“Poor practice” black steel</td>
<td>$22,000</td>
<td>$6,300</td>
</tr>
<tr>
<td>“Best practice” black-steel</td>
<td>$18,000</td>
<td>$2,300</td>
</tr>
<tr>
<td>“Best practice” epoxy coated</td>
<td>$16,800</td>
<td>$1,100</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>$18,400</td>
<td>$2,700</td>
</tr>
</tbody>
</table>
Life Cycle Costing for Bridge Decks

- Approximately 500,000 Bridges to be Maintained
- Corrosion Savings due to “Best Practice” is $4,000 Annually per Bridge or $2.0 Billion
  - Represents a 62% decrease in the Cost of Corrosion due to “Best Practice” Maintenance
- Starting with “Best Practice” for Black Steel Rebar, Utilizing Coated Rebar Saves and Additional $1,200 Annually per Bridge or $0.6 Billion
  - Represents a 19% decrease in Cost of Corrosion due to Materials Selection even after “Best Practice” Maintenance
Savings Due to Corrosion Control

-On the average, assume:
  - 33% of total cost of corrosion can be saved utilized current technology
  - It costs 10% of savings to implement better practices
  - 30% net savings is possible
    - U.S.A. economy can save B$83 annually
    - DoD can save B$6 annually
  - Additional long-term savings possible due to implementation of new technology
Industry, Government, and Public Must Act

- Change policies, attitude, culture in how we deal with corrosion
  - We are wasting $Billions annually
  - Waste in not recovered
  - Affects US industry competitive edge in world market place
NACE & DoD Partnership

DoD took initiative

- Designated a DoD Corrosion Executive - Principal Undersecretary of Defense for Acquisition, Technology and Logistics
- Established a Corrosion Control and Oversight Office, headed by a Special Assistant for Corrosion Control Policy and Oversight
- Formed the Corrosion Prevention and Control Integrated Product Team (CPCIPT) – 7 Working Integrated Product Teams (WIPTs) to address important corrosion focus areas
- OSD Formed the Corrosion Control Task Force of the Defense Science Board
NACE & DoD Partnership

DoD Accomplishments

- The CPCIPT and the Corrosion Forum
  - Investment in science and technology to leverage downstream savings
  - Developing methods for reducing the impact of corrosion and extending the service life of our systems and facilities
  - Improving our predictive techniques in order to avoid failures and reduce costs

- Another important strategy streamlines and standardizes the application of specifications, standards, and qualification processes

- The DFAR (Defense Federal Acquisition Regulation) requires corrosion planning in all programs that must have acquisition plans
NACE & DoD Partnership

NACE Involvement

- Strengthening Interaction & Communication between DoD & Industry:
  - C/2006 Session on DoD Standards and Specifications
  - C/2006 Session on How Project or Product Proposals to DoD Are Evaluated for Acceptance
  - Industry Presentations at Future DoD CPCIPT Meetings
  - Organization of 2005 and Future 2007 Tri-Service Conferences with Industry Participation
  - DoD CPCIPT Is Now a NACE Platinum Member to Enable Wider Access to Corrosion Information and Networking Opportunities
  - FACA [Federal Advisory Committee Act] Charter
    - Formalize NACE – DoD Partnership
    - Easy for NACE to respond to DoD requests
NACE & DoD Partnership

NACE Involvement

- Strengthening Inter-DoD Awareness of Corrosion Successes and Projects
  - Scheduling Regular WIPT Meetings with Representatives from All Services
  - Publishing CorrDefense On-Line, Focused on Corrosion Successes That Can Be Used Across the Services
NACE & DoD Partnership

NACE Involvement

Training:

- Development of Corrosion 101 On-Line Course – Awareness Level Covering Technology and Acquisition Policy; for Use in Defense Acquisition University Curriculum
- DoD Personnel Enrolling for Existing NACE Coating Inspection and Cathodic Protection Programs
- Development of Marine Edition of NACE CP-2 Course (NAVSEA)
- Development of Course on Corrosion of Water Systems (Facilities)
- Development of Course on Corrosion Assessment for Ships (NAVSEA)