Computer-Aided Corrosion Program Management

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Corrosion at the Kennedy Space Center (KSC)
Requirements & Objectives
Program Description, Background & History
Approach & Implementation
Challenges
Lessons Learned
Successes & Benefits
Summary & Conclusions
Corrosion at KSC

- **KSC Corrosive Environment**
  - Launch facilities within 1,000 ft. of Atlantic Ocean
  - Acidic exhaust from launch vehicles
  - Documented highest corrosion rate of any U.S. test site

- **Importance of Protective Coatings**
  - Primary means of protection for critical assets in atmospheric exposure
  - Key role in safety & reliability of facilities & equipment
  - Major factor (direct and indirect) driving maintenance costs
  - Large economic advantage from maximizing service life and reliability of facilities, launch structures, and ground support equipment
Corrosion Program Overview

Interdependent Program Elements
- Accurate Assessment of Conditions
- Understanding of Corrosive Environment
- Knowledge-Based Standards
- Requirement-Based Specifications
- Qualified Materials
- Trained and Qualified Personnel
- Quality Control and Assurance
- **Data Management (Information System)**
Difficult to predict where corrosion will occur
Dispersed throughout facility

Paper Driven
Voluminous Data
Information System Objectives

- Manage & better utilize large amounts of program data
- Increase visibility into corrosion program
- Store & access critical asset data
- Collect, analyze, report & track condition data
- Enable a more proactive approach to corrosion & coating related maintenance
- Create a centralized knowledge base for improved organizational memory
- Facilitate accurate planning & forecasting
• Computer-aided program initiated in 2000 by United Space Alliance (USA) for Space Shuttle Program assets
• Program utilizes commercially available software (information system) developed specifically for coating program management
• Field inspection, data collection, data entry, software and reporting costs less than 4% of annual coating maintenance budget
• Started as a small pilot program and has grown to more than 3,600 critical components & 7,750,000 square feet of surface area

• Data collection team consists of two full-time NACE CIP inspectors who also enter data

• Program data and reports accessible to USA and NASA employees via computer network.
  – Currently more than 70 registered users
• Inventory & Organize Facilities Into Manageable Components

• Hierarchy
  – Level 1: Program
  – Level 2: Facility
  – Level 3: Item
  – Level 4: Component

• Components defined by change in substrate, system, service environment, color, etc.
Component Data

Program: Administrator
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Electrical Sub-Station
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Component Data

- Name: Structural Steel
- Type: Structure Support
- Substrate: Carbon Steel
- Surf Area: 11294.0
- Pipe Length: 0
- CRITICALITY: Level 2
- View: Visible
- Location: Finish
- Input Date: 07/19/2000

Notes:

Optional Components:
- Conduit
- Deck tread
- Ducting
- Fire hose box
- Handrail
- Mixed components -1
- Mixed Components 1-Yellow
- Mixed components -2
- Piping
- Stair tread
- Structural Steel
- Structural Steel
- Structural Steel
- Structural Steel

Delete Record
Condition Data

- Coating Performance Index
- Coating Appearance Index
- Condition Data Points
  - Defects and Cause
- Photos
- Video
- Trending
- Custom Reports
- Export Data
• Three Levels of Work Planning
  - “Hot Spot” Disposition & Tracking
  - Annual Plans
    • Multiple Projects Within Plans
    • Budget Estimate (Present Value & Future Value)
  - Long Range Forecast
Coating Systems

- Manage systems as an asset as opposed to a commodity
- Focus on Life Cycle costs
- Elements
  - Materials
  - Application Method
  - Surface Prep
• Consistent method of rating conditions using multiple inspectors
  – Create and use well defined (ideally visual) rating standards for consistency

• Uniform application of Asset breakdown
  – Determining the “right” amount of detail
  – “Bottom up” hierarchy based on grouping of components
Successes & Benefits

- Increased focus on critical assets and environments
- Improved accuracy of budget requirements needed to maintain required standards of performance
- Optimal use of available funds (prioritization)
- Dramatically increased data collection efficiency
  - Inspection cycle frequency adjusted according to component criticality and corrosive environment
  - Reduced level of data collection (only changes after baseline)
- Reduction of Foreign Object Damage (FOD)
- Performance can be measured & improved
- Overall facility conditions have greatly improved
Summary & Conclusions

- Informed decisions are better decisions
- An "information system" (made possible by software) can be a critical success factor in a large corrosion/coating program
- Added value and cost savings easily justify expense of implementation of a program information system