National Aeronautics and Space Administration (NASA)

AFSPC/NASA Completed and On-going Test Projects

C3P/NASA International Workshop
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NASA Technology Evaluation for Environmental Risk Mitigation Principal Center (TEERM)

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Low Emission Depainting on Steel

Complete

Description:

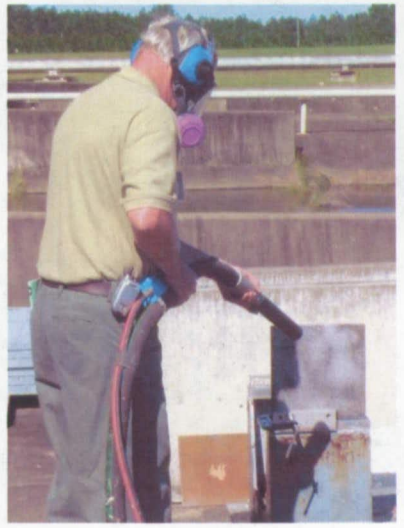
- Goal was to validate alternative low emission surface preparation/ depainting technologies for structural steel.
- Current methods involve high-dusting abrasive blasting which result in large amounts of waste.
- Applicable regulations: CAA, CERCLA, RCRA, OSHA, NIOSH, ACGIH.

Stakeholders:

- Kennedy Space Center, Stennis Space Center (SSC), Glenn Research Center (GRC) and HQ AFSPC.

Benefits:

- Improved corrosion protection of critical systems.
- Reduced risk associated with hazardous waste.
- Reduced costs associated with current maintenance activities.
- In-kind contributions from vendors and team members.



Preparation of test panel using Sponge Media at SSC, Apr 05

Low Emission Depainting on Steel

Achievements:

- Completed field testing and laboratory evaluation of panels depainted at SSC and GRC.
- Discussed implementation & follow-on projects with team.
- Incorporated portable laser technology findings from GRC.

Results:

- Sponge Media, Hard Abrasive Media, and Plastic Blast Media technologies performed best for large areas.
  - ✓ Reduced particulate emissions.
  - ✓ Recyclable media results in less waste; Two technologies (Hard Abrasive and Plastic Blast Medias) result in zero waste.
- Mechanical Removal with Vacuum Attachments performed well for small areas.
  - ✓ Practically zero emissions.
  - ✓ No secondary waste.

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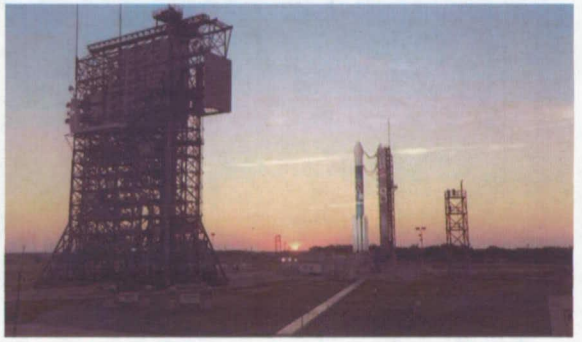
Space Launch Complex Depainting PPOA

Complete



CCAFS Space Launch Complex (SLC)17

Description

- Depainting Pollution Prevention Opportunity Assessment (PPOA) at SLC 17, Cape Canaveral Air Force Station (CCAFS).

Stakeholders:

- NASA, CCAFS, AFSPC, and AF 45th Space Wing.

Benefits:

- Reduced environmental impact from maintenance operations.
- Reduced time and labor resulting in quicker maintenance operations.

Results:

- Due to the quick turn-around times required by the schedule of launches and the relatively environmentally benign effects of the current process at CCAFS, it was difficult to identify alternatives that would improve upon productivity or reduce environmental impact.
- Identified alternatives can be examined for other locations across AFSPC and NASA where environmental considerations are more stringent.

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Alternatives to Isocyanate Urethanes

Complete

Description:

- Goal is to validate environmentally preferable alternatives to isocyanate urethane coatings currently used across NASA and AFSPC on structural and non-structural elements.
- Applicable regulations: CAA, OSHA, NIOSH, ACGIH.

Stakeholders:

- NASA, CCAFS, AFSPC, and AF 45th Space Wing.

Benefits:

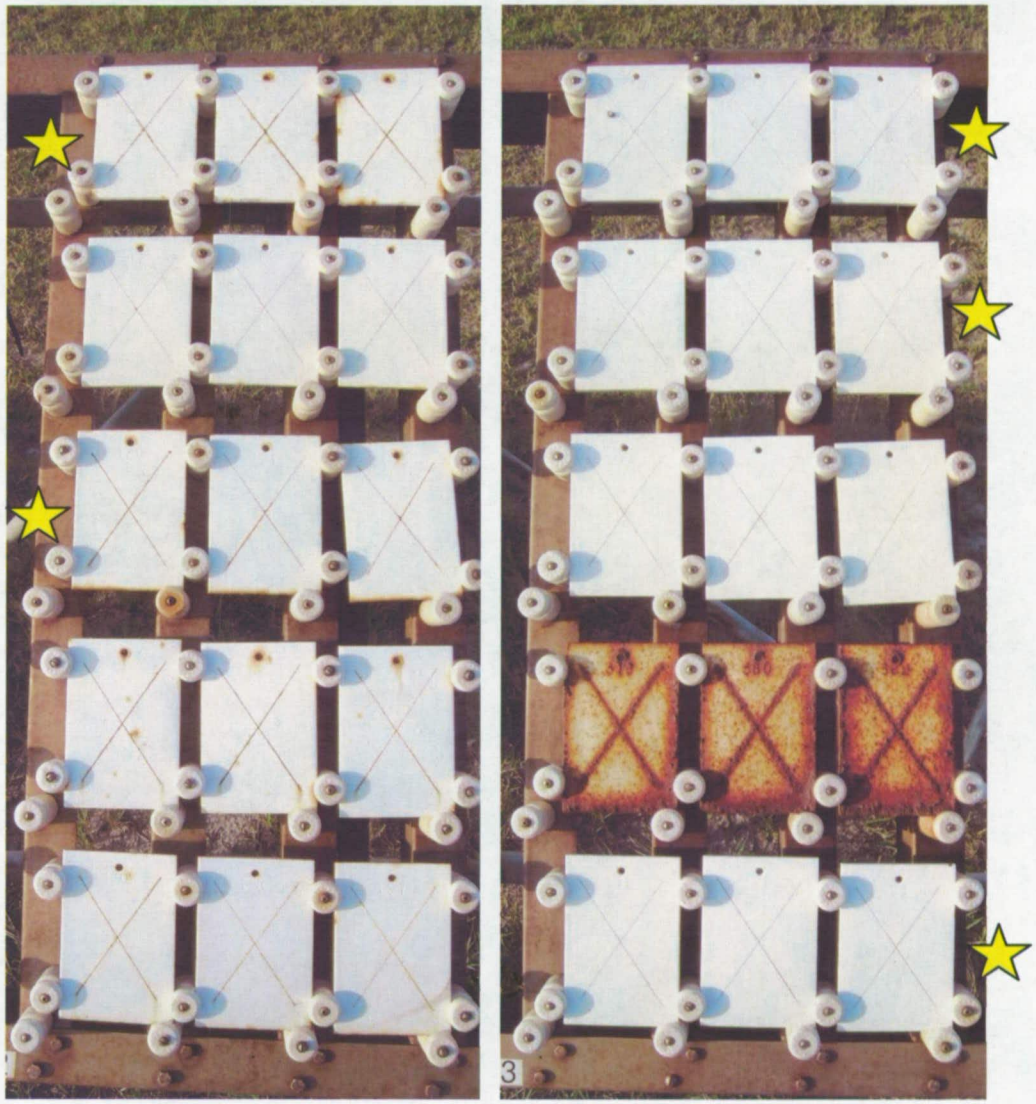
- Reduced risk associated with environmental, safety, and health concerns that come with the use of isocyanates, VOCs, and HAPs.
- Reduced material obsolescence risk due to environmental and safety regulations.

Flame Bucket of Engine Test Stand at SSC

Alternatives to Isocyanate Urethanes

Results:

- Five alternative coating systems were approved for the Qualified Products List in the NASA technical standard NASA-STD-5008A, *Protective Coatings of Carbon Steel, Stainless Steel, and Aluminum on Launch Structures, Facilities, and Ground Support Equipment* (currently under revision).



18-Month Beach Exposure Testing Results

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Low VOC Coatings-Depainting Field Testing

On-Going

Description:

- Test and qualify low-VOC, non-hazardous materials and processes for large-area painting and depainting maintenance operations of structures across NASA and AFSPC.
- Applicable regulations: CAA, CERCLA, RCRA, OSHA, NIOSH, ACGIH.

Stakeholders:

- KSC, CCAFS, AF 45th Space Wing, and HQ AFSPC.

Benefits:

- Eliminates risk associated with environmental, safety, and health concerns with use of paints and coatings of high VOC content and particulate emissions from depainting operations.
- Reduced material obsolescence risk and ideally reduced labor costs.
- Project is a continuation of previous studies conducted by NASA TEERM and AFSPC (AIU Coatings, Low Emission Depainting, Vandenberg demos) thus reducing duplication of effort and costs

Low VOC Coatings-Depainting Field Testing

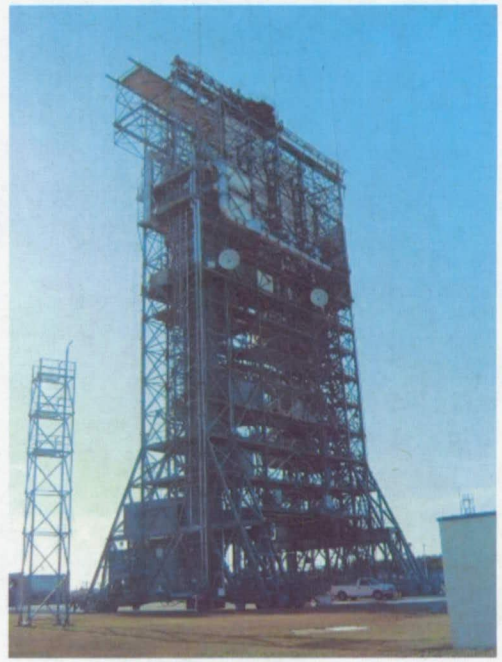
Achievements:

- Conducted field demonstration at Space Launch Complex 17, Pad A, Cape Canaveral Air Force Station, FL – Jan 07.
  - ✓ Depainting alternatives were demonstrated:
    - o Two types of media.
    - o A blast and vacuum system.
  - ✓ Fixed Umbilical Tower Coatings:
    - o Applied to areas that are subjected to extreme heat and exhaust gases during a launch.
    - o Two thermal spray coatings (Zn and Al-Mg).
    - o Ablative coating (currently used on Pads 39 A & B).
  - ✓ Mobile Support Tower Coatings:
    - o To be evaluated at 6, 12, and 18 months.
    - o The two thermal spray coatings were applied and topcoated with a low VOC waterborne coating.
    - o Three liquid coating systems that are low VOC were applied.

Low VOC Coatings-Depainting Field Testing

Achievements:

- Conducted 6-, 12-, and 18-month evaluation of coatings placed on the SLC 17, Pad A, Mobile Support Tower.
  - ✓ All six coating systems are performing well with no signs of corrosion present.
    - ❖ Surface Rust Ratings per ASTM D 610: All systems "10".
    - ❖ Scribe Ratings per ASTM D 1654: All systems "10".
    - ❖ Color and Gloss measurements also taken.



CCAFS SLC 17 Mobile Support Tower

Low VOC Coatings-Depainting Field Testing

Achievements:

- Conducted evaluation of TSC and Ablative Alternatives placed on the Space Launch Complex 17, Pad A, Fixed Umbilical Tower after each of **four** successive launches:

✓ 1st - "Phoenix" mission (Aug 07).
✓ 2nd - GPS Satellite (Nov 07).
✓ 3rd - GPS Satellite (Dec 07).
✓ 4th – GPS Satellite (Mar 08).

CCAFS SLC 17 Fixed Umbilical Tower

Application of Thermal Spray Coating

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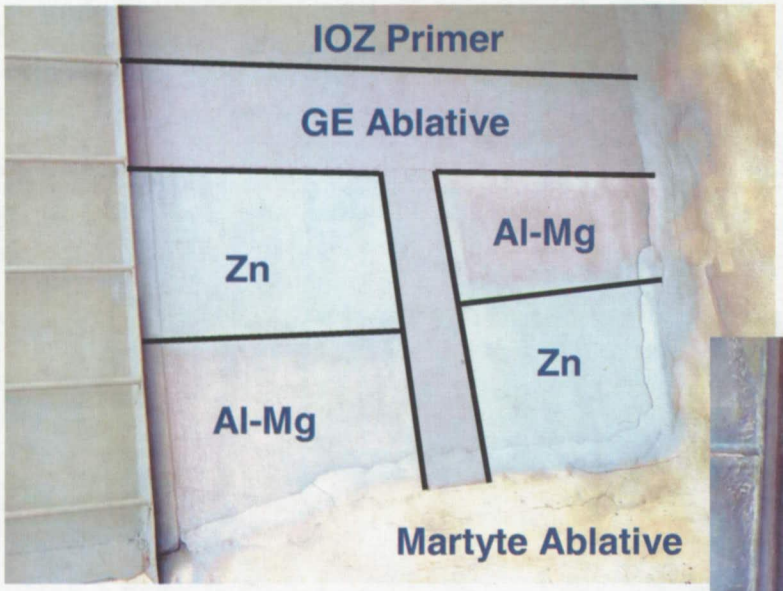
Low VOC Coatings-Depainting Field Testing



After coating application
(Jan 07)

After fourth launch (Mar 08)

Low VOC Coatings-Depainting Field Testing

Achievements:

- Observation summary to date:
  - ✓ Thermal Spray Coatings:
    - ❖ Excellent heat and chemical resistance.
    - ❖ Little coating thickness loss.
    - ❖ Acceptable adhesion performance.
    - ❖ Left on for a fifth launch.
  - ✓ The ablative coating alternative performed as expected, but it was determined that a thicker layer than that applied during this demonstration is required.
- Based on the favorable results of the TSCs on the FUT, additional field testing is planned for other heat resistant coatings.

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Gas Dynamic Spray Technology Demo

On-Going

Description:

- Unlike conventional thermal spray processes, Gas Dynamic Spray (GDS) can deposit metallic and non-metallic materials onto a diversity of surfaces at much lower temperatures, thus avoiding any thermal effects such as oxidation, metallurgical transformations, or residual stresses.

Benefits:

- Contains no VOCs.
- Anticipated reduction in labor and maintenance costs.
- Many possible applications yet to be determined.

Achievements:

- Test plan developed that focuses on the use of GDS as a repair for thermal spray coatings.
- Coupons are being prepared.

Demo showing GDS technology being used to fill in a hole