Materials and Processes
for the
New Millennium

Materials and Process Engineering
Florida Technical Services
United Space Alliance, LLC

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Responsibilities and Capabilities

Materials and Process Engineering

- Laboratory Operations
  - Failure Analysis
  - Acceptance Testing
  - Material Testing

- Critical Processes
  - Internal Control
  - Vendor Control

- Material Design
  - Material Control
  - Material Development
  - Environmental Compl.
  - MATCO and MUA

- Production Support
  - Material Obsolescence
  - Corrosion Control
  - Anomaly Resolution
  - Contamination Control

- Automation
  - Material Handling
The Last Decade – Environmental Compliance

- The single greatest threat to material availability over the last decade has been Compliance to New Environmental Regulations

- Federal Regulations
  - Clean Air Acts Amendments – 1990
    - Titles I, III and VI
  - NASA Interim Policy – 1995 end date
  - Industrial Toxics Project – HAP emissions by 1995
  - Florida DER – VOC limits by 1995 (CA)
  - OSHA Health Related Regulations
    - Carcinogens
    - Mutagens
    - Toxins

- Material availability complicated by local and state regulations and their own compliance schedules
The Last Decade – *Major SRB Environmental Initiatives*

- Replacement of Booster Close-out material with a trowellable ablator – Eliminated human mutagen

- Replaced lead based paint system with a water based paint system – Eliminated lead, Hazardous Air Pollutant (HAP) and VOC content

- Qualified Tric-Free Paint – Eliminated 1,1,1-Trichloroethane

- Qualified and Implemented environmentally friendly cleaners – Eliminated hazardous solvent

- Qualified foam blowing agent replacement

- *Replaced MSA-2 with Marshall Convergent Coating (MCC-1) – Eliminated methylene chloride, perchloroethylene and hazardous waste*

- Replaced insulation on USAF Titan IV – Eliminated Freon agent

- *Replaced hazardous metal pretreatment process with non hazardous pretreatment – Eliminated large volume hazardous waste*
The Last Decade – *Thermal Protection System (TPS) Materials*

**Convergent Spray Technology – Marshall Convergent Coating – MCC-1**

*Patented Process*

- Only solventless sprayable TPS
- First On-Demand TPS delivery system
- Utilizes long-proven materials

Robotically Applied

Features automated material handling

Recognized industry-wide

Titans IV

Sea Launch

Delta IV
The Next Decade – Managing Material Change and Obsolescence

Material Control

Process Creep

EPA/OSHA

Obsolete Specifications

Material Creep

Material Obsolescence

Product Consolidation

Supply Chain Viability
The Next Decade – *Managing Material Change and Obsolescence*

- *Over the past decade, managing compliance with environmental regulations and supply chain viability has been the greatest challenge*

  1999  *Rustoleum to Briner product (Carboline product as alternate)*

  2000  *Carboline buys Briner, eliminates Briner product*

  2000  *Briner product to Rustoleum*

  2001  *Carboline reformulates the alternate material*
The Next Decade – *Managing Material Change and Obsolescence*

**Threats**
- Gov. Regulations (EPA, OSHA)
- Vendor Economics
- Obsolescence
- Single Source
The Next Decade – *Material Fingerprinting*

- Objectives of Chemical Fingerprinting
  - Enhanced understanding of material composition
  - Reduced probability of unexpected and unrecognized changes to critical materials
  - Enhanced ability to detect changes in a material due to vendor or subtier supplier changes
  - Improved understanding of how a material works, ages, degrades, etc.
The Next Decade – *De-Coating Technology*

**Water Based De-Coating System**
- Existing De-Coating operation uses high pressure water
- Results in corrosive environment for metallic hardware
- Waste stream significantly increased by water content
- Disposal costs increased proportionally

**High Pressure LN2 De-Coating System**
- Patented Process
- Creates No Secondary Waste Stream
- Hazardous Waste Reduction
- Commercially Available Components
- Insulated Components Protect From Low Temperature Contact
The Next Decade – *New Materials and Technology*

**Thermal Management Coating**

**Cold Spray**

**Laser-based Corrosion Mapping**

**Corrosion Inhibiting Paint Additives**
The Next Decade – Space Shuttle to CEV

• The challenge is not identifying “New” materials and technology – the challenge is managing our existing materials such that a viable “material base” exists for the next generation vehicle.

• The next generation vehicle will no doubt use the same families of materials, in largely the same environments.

• Control and management of our existing materials and processes offers the only cost and schedule effective means by which to address the requirements of next generation vehicles.