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# Materials and Processes

for the

## New Millennium

Materials and Process Engineering

Florida Technical Services

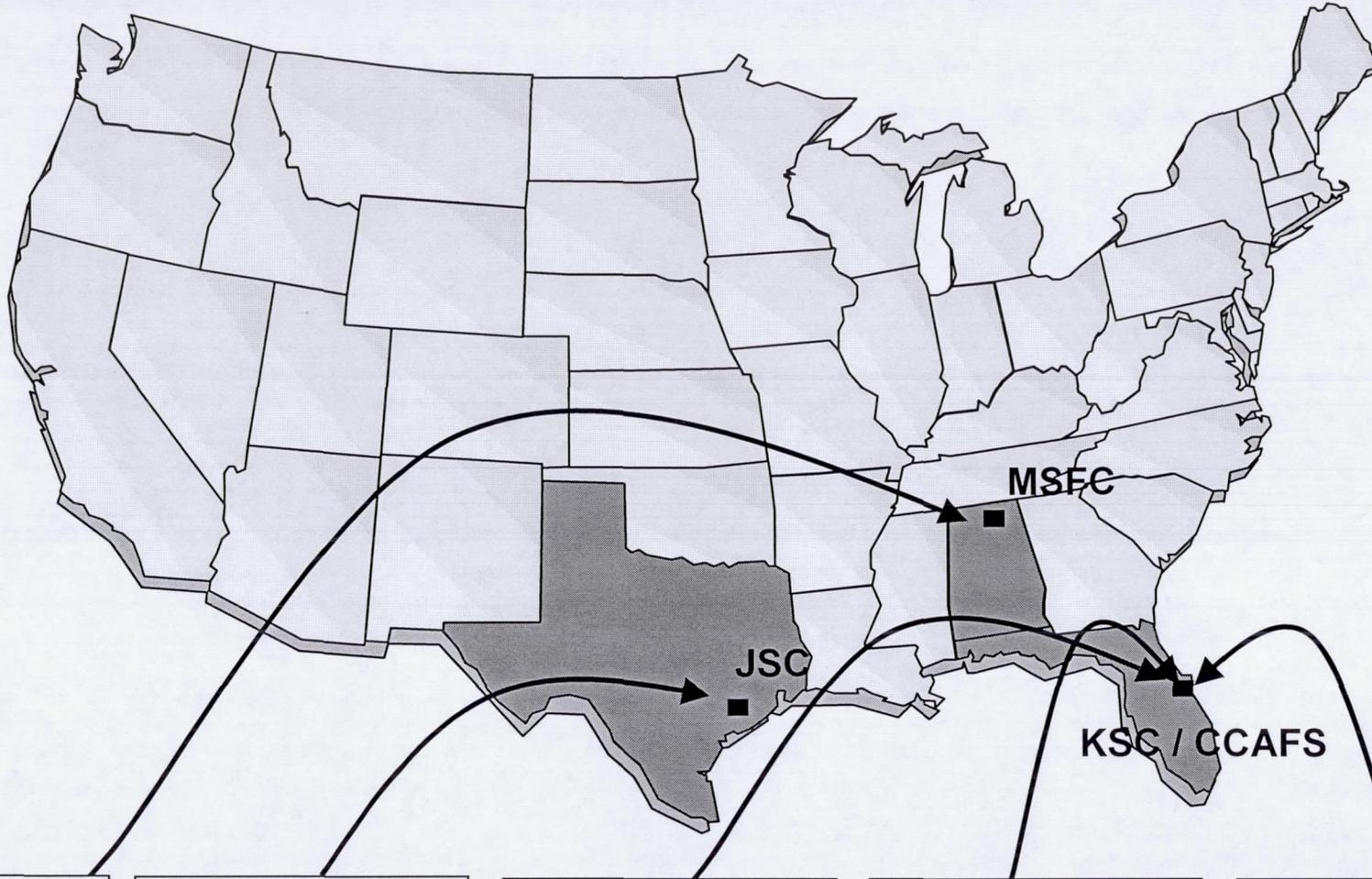
United Space Alliance, LLC

April 16, 2004

Paul W. Hayes

Rod W. Richardson

# USA Materials and Process Engineering



MSFC - PEMD

JSC  
CAU and VHMS

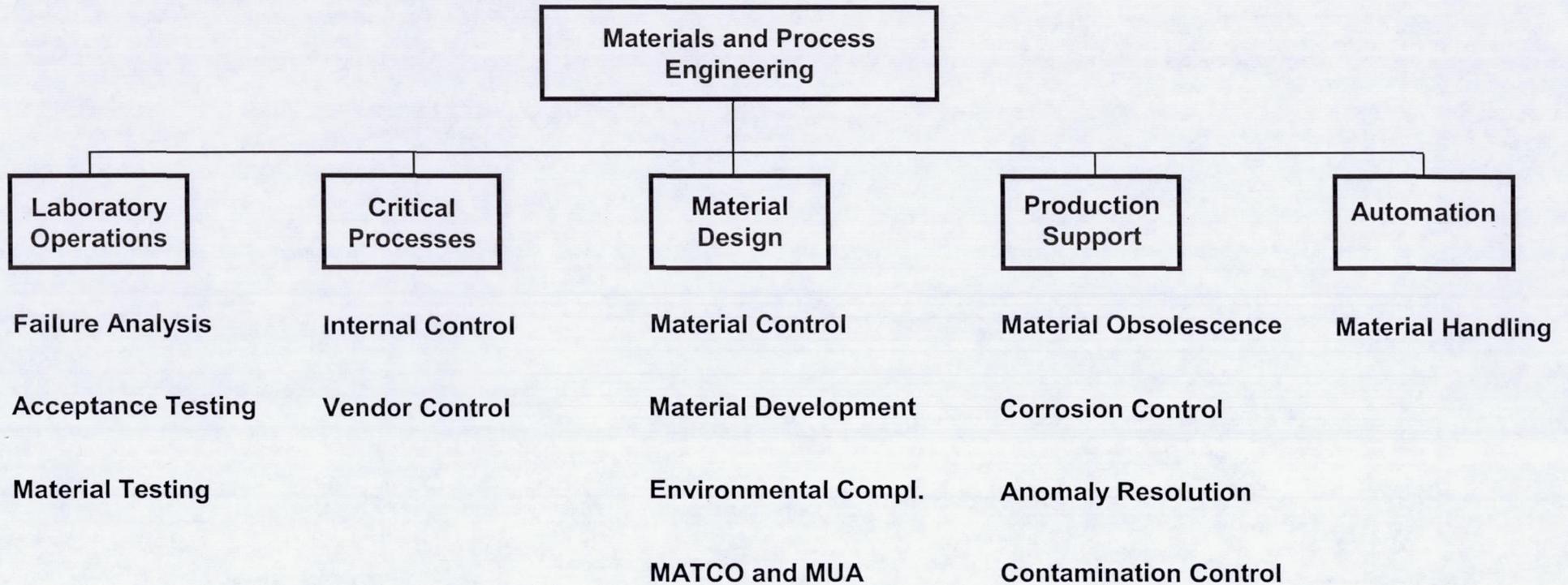
KSC-ARF  
SRB

CCAFS - Hgr N  
M&P Labs

KSC - OPF / VAB  
GO and Orbiter

# Responsibilities and Capabilities

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## **The Last Decade – *Environmental Compliance***

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- ***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***
  - ***Montreal Protocol – 2000 and 2005 end dates***
  - ***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

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- 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*

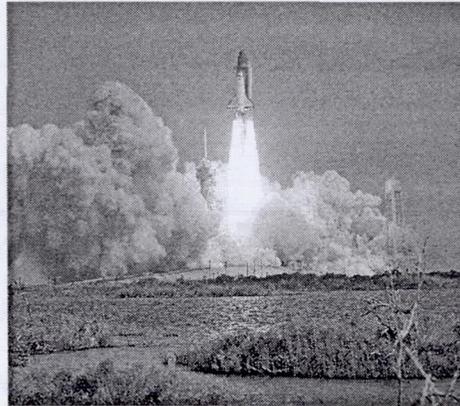
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## Convergent Spray Technology – Marshall Convergent Coating – MCC-1 Patented Process

Only solventless sprayable TPS

First On-Demand TPS delivery system

Utilizes long-proven materials



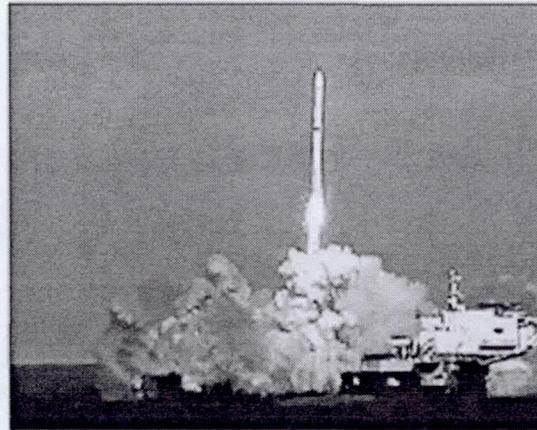
Robotically Applied

Features automated material handling

Recognized industry-wide



Titan IV



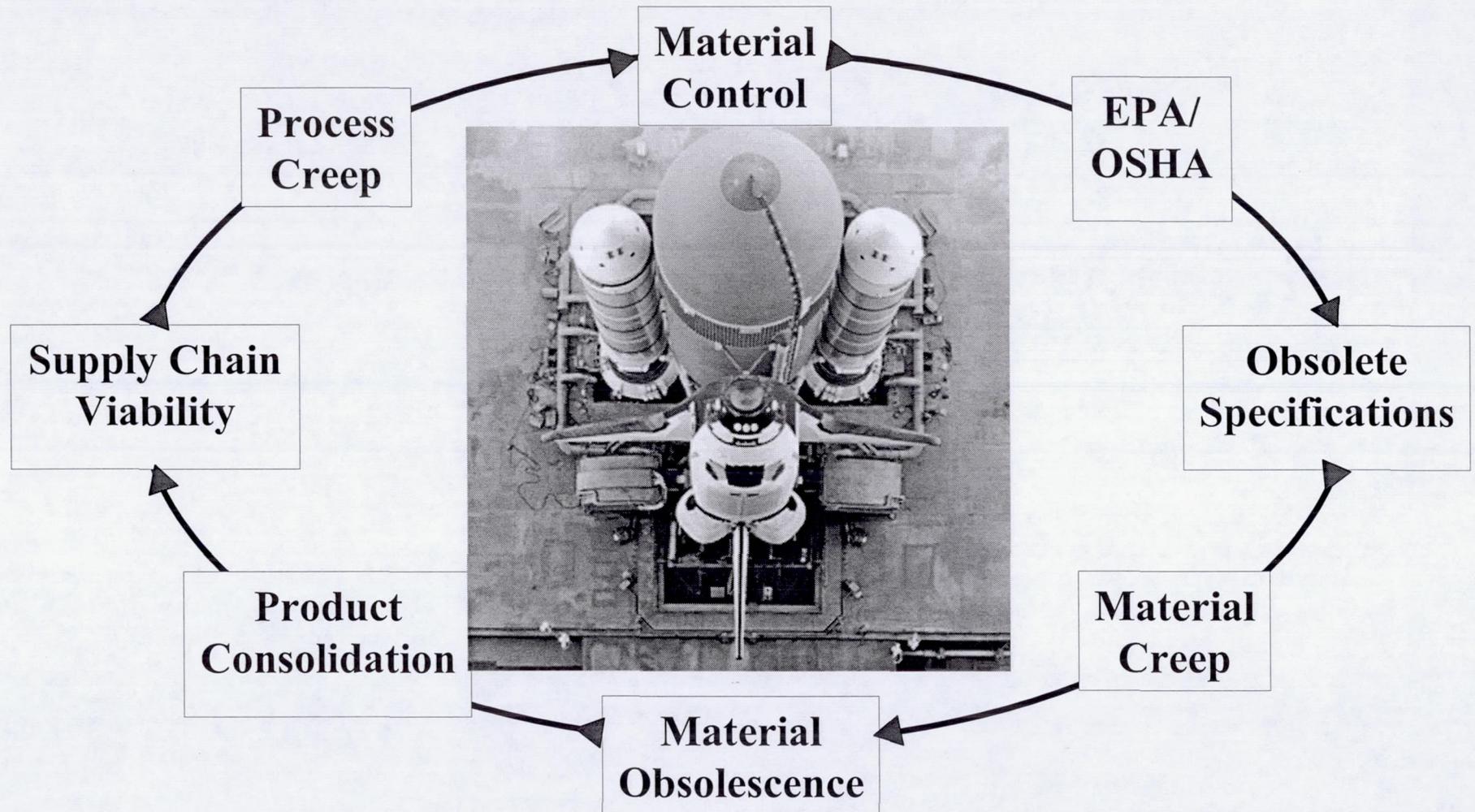
Sea Launch



Delta IV

# The Next Decade – *Managing Material Change and Obsolescence*

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## **The Next Decade – *Managing Material Change and Obsolescence***

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- ***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)***

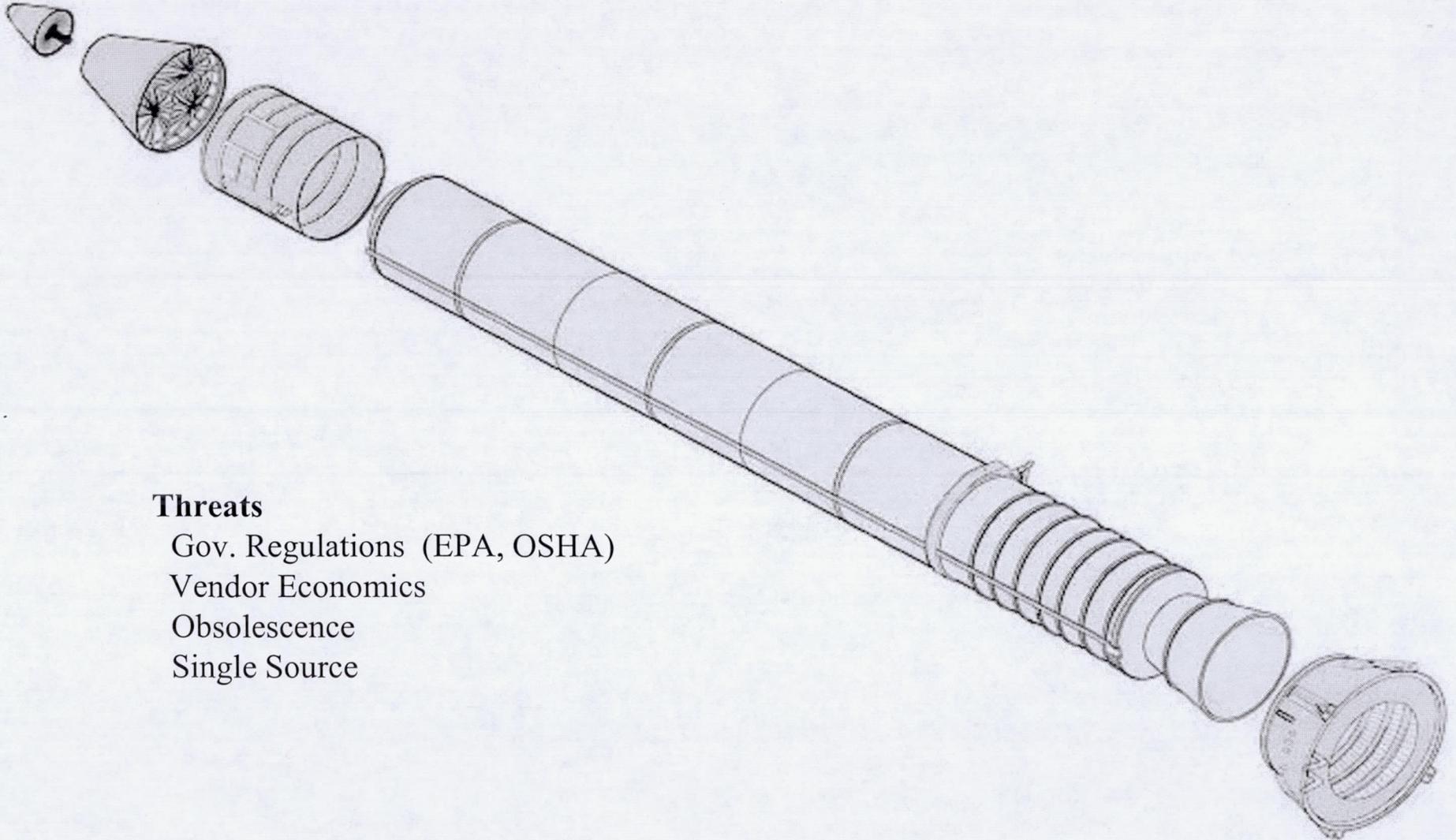
**2000**     ***Carboline buys Briner, eliminates Briner product***

**2000**     ***Briner product to Rustoleum***

**2001**     ***Carboline reformulates the alternate material***

# The Next Decade – *Managing Material Change and Obsolescence*

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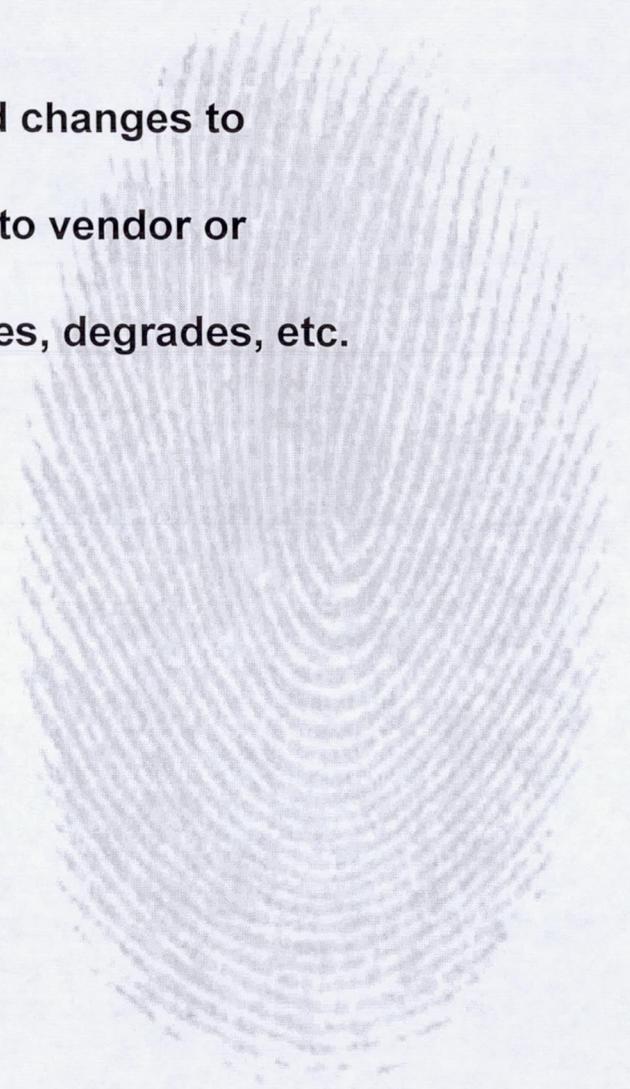
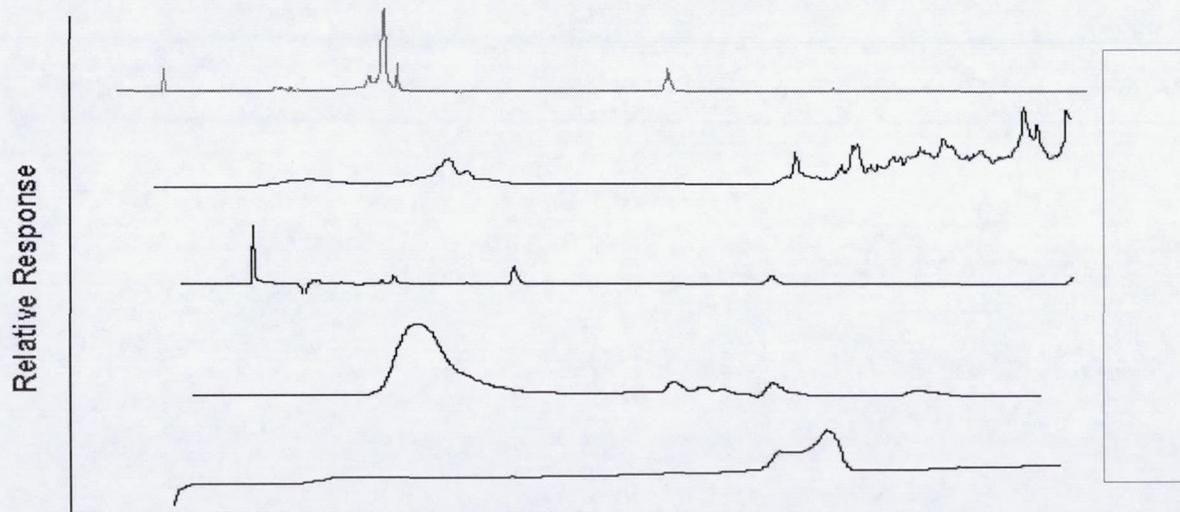
## **Threats**

- Gov. Regulations (EPA, OSHA)
- Vendor Economics
- Obsolescence
- Single Source

# The Next Decade – *Material Fingerprinting*

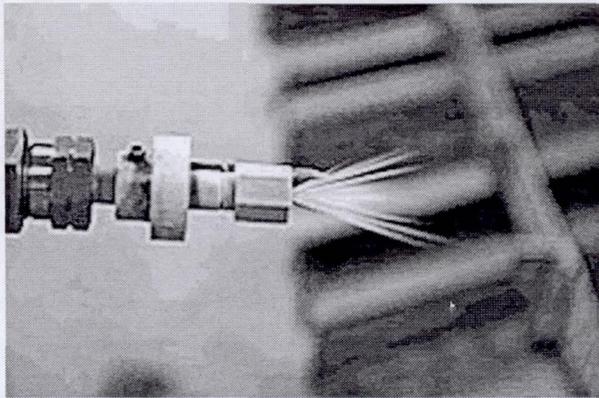
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- Objectives of Chemical Fingerprinting
  - Enhanced understanding of material composition
  - Reduced probability of unexpected and unrecognized changes to critical materials
  - Enhanced ability to detect changes in a material due to vendor or subtier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



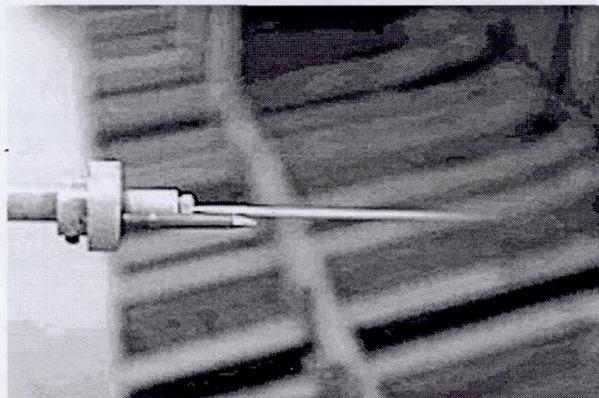
## The Next Decade – *De-Coating Technology*

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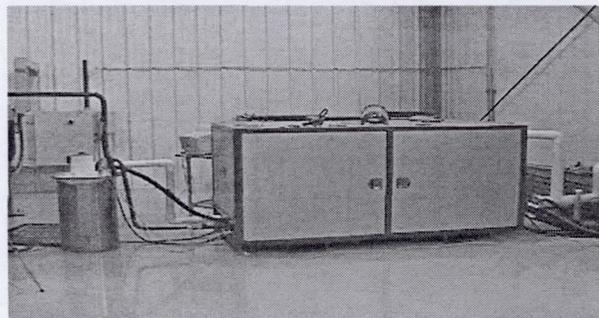
### *Water Based De-Coating System*

- 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



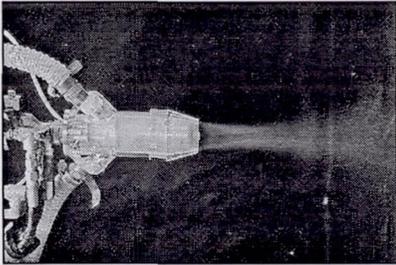
### *High Pressure LN2 De-Coating System*

- Patented Process
- Creates No Secondary Waste Stream
- Hazardous Waste Reduction
- Commercially Available Components
- Insulated Components Protect From Low Temperature Contact

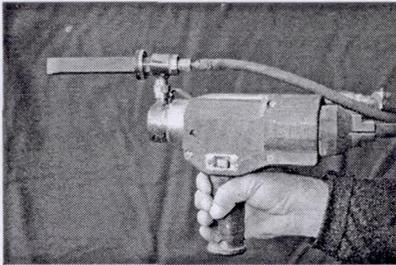


# The Next Decade – *New Materials and Technology*

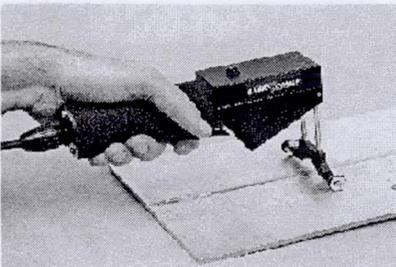
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*Thermal Management Coating*



*Cold Spray*



*Laser-based Corrosion Mapping*

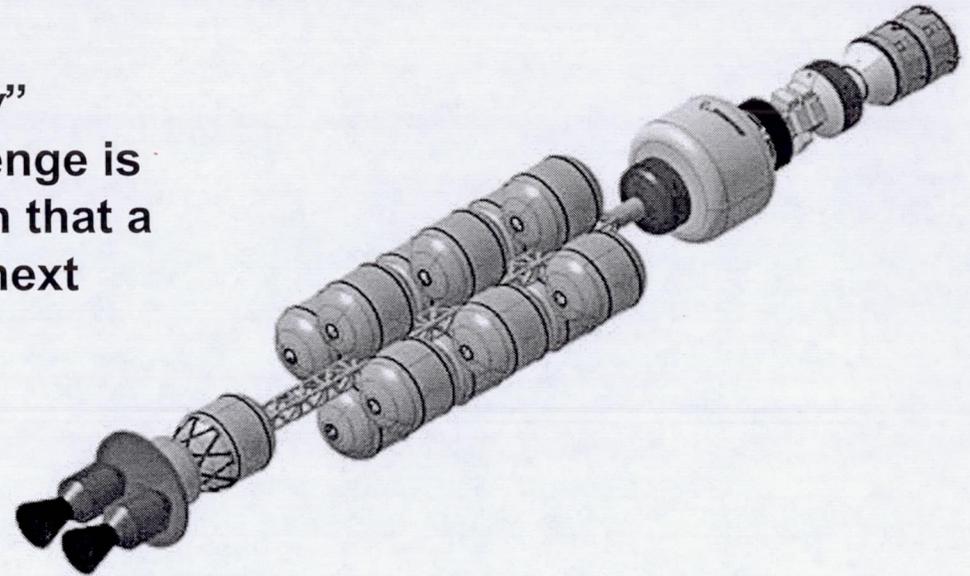


*Corrosion Inhibiting Paint Additives*

## The Next Decade – *Space Shuttle to CEV*

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- 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