

All-in-One Coating
Technology; New and Unique
Fire Retardant Technology;
and the Synergies of the
Technologies

Advanced Coating Technologies that protect against Corrosion and Fire

- **Unique Moisture-cured polyurethane Technology** (Durabak)
- **New & Unique Intumescent Technology** (CeaseFire)

Background

- 1996 Study-DOD Corrosion cost is \$10 Billion per year
- Corrosion cost to the Army is >\$2 Billion per year
- USAF 50% of workload on some aircraft is corrosion related
- AMC charters the US Army TACOM as Executive Agent for its CPC Program

Background

NIST Building Research Laboratory

- Annual losses attributed to fire
 - **3,600 lives**
 - **22,000 serious injuries**
 - **\$10 billion in property loss**
 - **\$128 billion total loss**

NIST Core Research

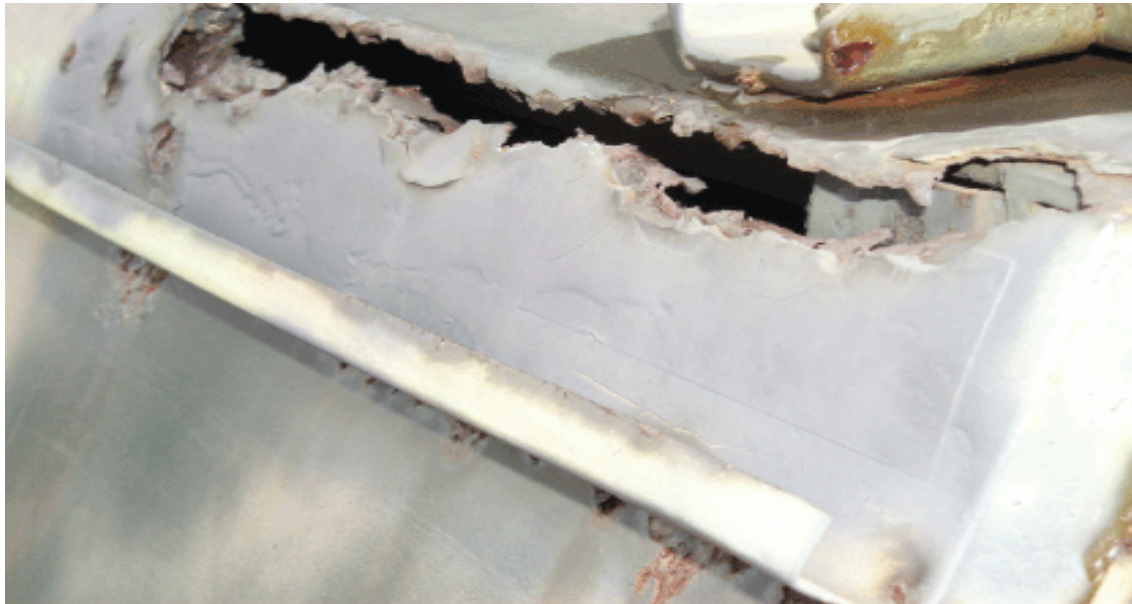
- **Advanced Measurement and Predictive Methods Program**
- ***Reduced Risk of Flashover Program***
- **Advanced Fire Service Technologies Program**

WAR

- War on Corrosion
 - DOD began its coordinated assault June 1997
 - AMC Charters TACOM as Executive Agent for CPC Program
- War on Terrorism
 - September 11, 2001
 - CBR and Fire Threats

One Part Moisture Cured Polyurethane Technology

Corrosion Damage (USAF Ground Support Equipment)



COTE-L's contribution to the fight against corrosion

Durabak technology

- One-Part Polyurethane Coating: No mixing of components
- Totally Flexible
- Freeze-thaw resistant – 60°F to +254°F
- Repairable: Bonds to itself
- Protection:
 - **Water proof**
 - **Resistant: salt water, acid, chemicals, UV**

Bombardier SMP 801 Toxic Gas Production Test

**Durabak technology is well below maximum specifications
for:**

- **Carbon Monoxide**
- **Hydrogen Cyanide**
- **Hydrogen Chloride**
- **Hydrogen Flouride**
- **Hydrogen Bromide**
- **Sulphur Dioxide**
- **Nitrogen Oxides**
- **Ammonia**
- **Phosgene**

Intumescent Technology

COTE-L's contribution to fighting terrorism

New CeaseFire intumescent technology

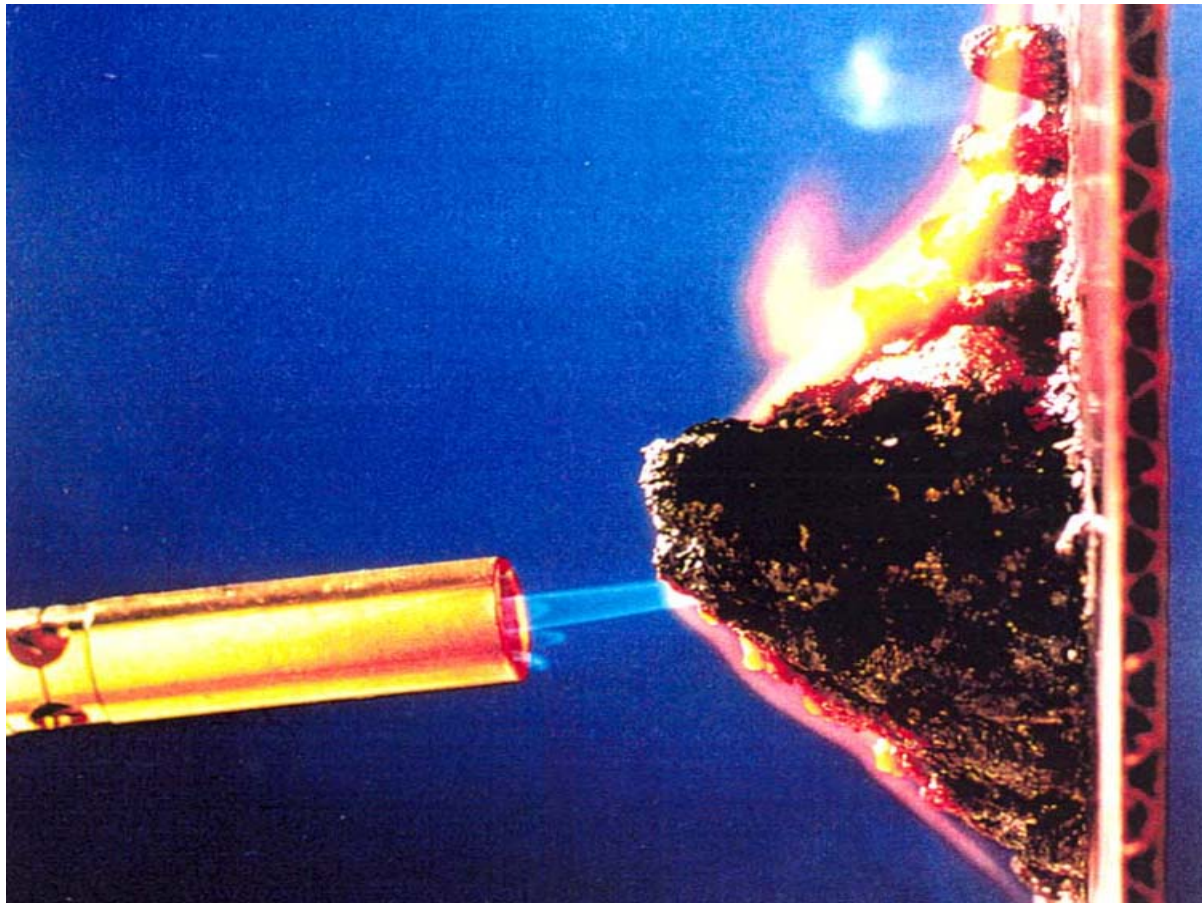
- **Innovative Technology**

- **Coating that provides protection against Corrosion and Fire**

Ceramic Coating *plus* 2-Part Epoxy

- *Proven to protect against burning for 1.25 hr on structural steel at 1700 °F +*

Burn Time of 10 mins *at* 3275 °F
with CeaseFire 2-part Epoxy on cardboard



CeaseFire technology

- **State of the Art**
- **Intumescent Technology**
- **Fire Retardant Additive**
- **Current Applications**
 - **Boeing Aircraft**
 - **Marine Vessels**
 - **CNG Automobiles**

CeaseFire intumescent technology

Additive for:

- Epoxies
- Plastics
- Textiles and Fabrics
- Latex house paints
- Polyurethanes
- Phenolics
- Resin systems
- CARC

CeaseFire intumescent technology

Characteristics

- Biodegradeable
- No halogens, sugars, nor starches
- Ten times better than most fire retardants
- Very low flame spread
- Extremely high heat barrier
- Very low smoke toxicity
- Much thinner coatings / better protection
- Indoor and Outdoor Applications
- Insoluble in water

CeaseFire intumescent technology

Extensive Testing

- Provides efficient flame barrier
- Very low toxicity (MSC 41)
- ASTM E84 Flame Spread Test Rating of 5 (Class A rating ≤ 25)
- ASTM E84 Smoke Density Test Rating of 5 (Class A rating ≤ 450)
- Pittsburgh Protocol > 15 minutes
- Certified for ceilings, bulkheads and floors for ships worldwide (DNV and ABS for International Marine Organization (IMO) at 10 mils thick)
- Certified for structural steel beams (ASTM E119).

Fire Tests

CeaseFire technology

HIGH PERFORMANCE 2-PART EPOXY

- **ASTM E84-91a Test**
 - **Flame Spread: Rating of 5**
 - **Smoke Density: Rating of 5**
- **ASTM E162 Surface Flammability Test**
 - **Flame Spread: Rating of 0**
 - **Smoke Density: Rating of 6**

CeaseFire intumescent technology

Heat Transfer Test

Purpose:

- Quantify heat transfer properties of intumescent coating**
- Test conducted at Aberdeen Proving Grounds**

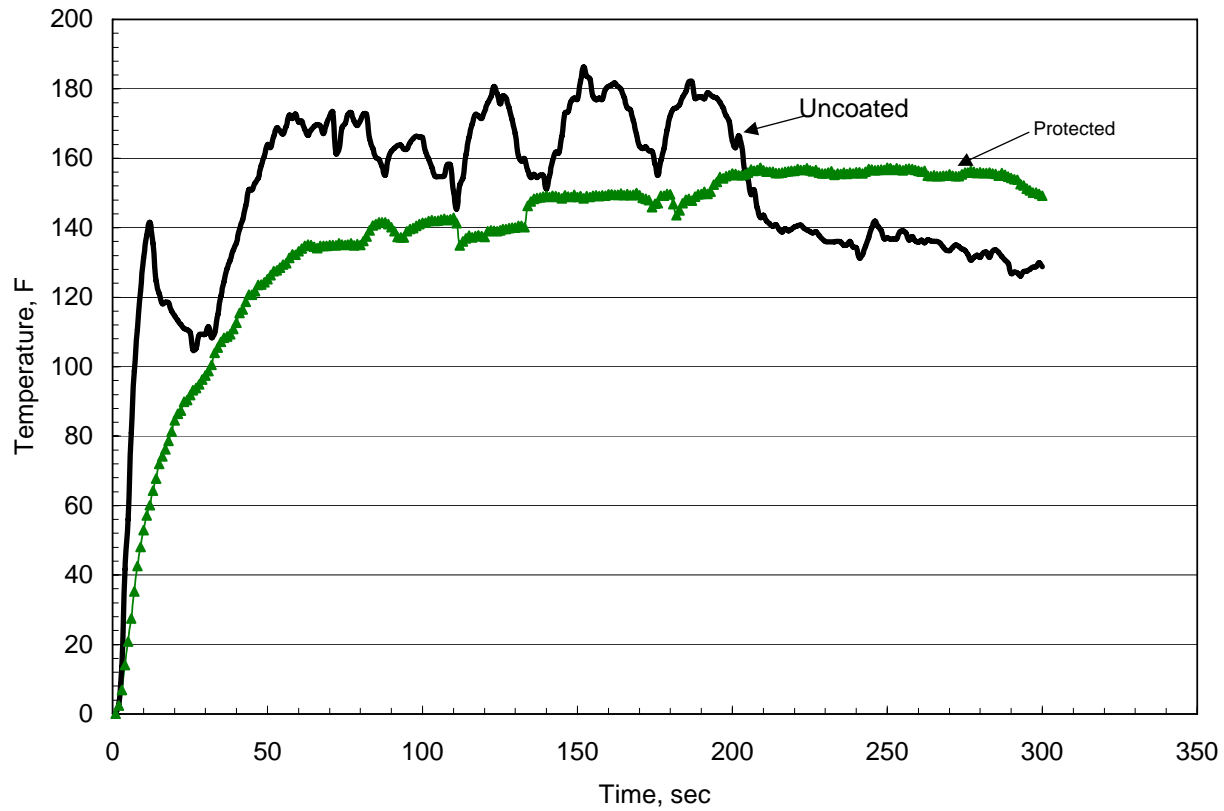
CeaseFire intumescent technology

Heat Transfer Test

Procedure:

- **Heat applied to 6''X6'' (1/16'' thick) A1 panels**
- **6'' focal length infrared thermocouple**
- **Heat transfer measured at a distance of 6'' behind panel back surface**
- **Propane torch at 3'' distance from panels**
- **Panel surface monitored every second for 300 seconds**
- **Three trials (Average Profiles)**

Evaluation of Heat Transfer



CeaseFire intumescent technology

Heat Transfer Test

- **Rate of heating Results**
 - **Uncoated panel-**
 - **7.38°F/sec**
 - **CeaseFire coated panel-**
 - **3.49°F/sec**
- **Almost 50% reduction in heat transfer**

CeaseFire intumescent technology

ASTM E662 Smoke Generation Tests

- **Flaming Mode**

- **Optical Smoke Density at 1.5 min**

- **Average 6**
- **Specified Max 100**

- **Optical Smoke Density at 4.0 min**

- **Average 116**
- **Specified Max 200**

- **Non-flaming Mode**

- **Optical Smoke Density at 1.5 Min**

- **Average 1**
- **Specified Max 100**

- **Optical Smoke Density at 4.0 min**

- **Average 5**
- **Specified Max 200**

Ford Motor Company's CNG Car Program

- Needed a fire barrier between the trunk and the passenger area
- Required 20 minute protection against flame at 1700 °F
- Result: a woven fiberglass flexible material coated with a flexible epoxy (14 mils thick) containing CeaseFire technology, which performed at 3200°F+ for 45 minutes.

DOT MVST 302 Flammability of Interior Materials

DOT MVST 302

Test Results

Burn Time (Seconds)	Burn Distance (Inches)	Burn Rate (In./Min)
229.6	10.0	2.6
161.0	10.0	3.7
166.4	10.0	3.6
176.2	10.0	3.4

IMO A.653 (16) Test

- **CeaseFire's Epoxy Technology is the only coating to pass the test on flammability of bulkhead, wall, ceiling linings at 10 mils thick.**
- **Tough test on flammability characteristics**
 - **Vertical orientation when exposed to graded radiant flux field**
 - **Observes time to initiation, spread and suppression of flame**
 - **Measuring amount of heat released by the specimen when burning**

ASTM E119 Test

- CeaseFire Technology attained a rating of 74 minutes on structural steel with ceramic based coating and an Epoxy coating, in preliminary tests.
 - 80 mils thick (wet) Epoxy based coating
 - 20 mils thick (wet) Ceramic based coating

Cotel's Contribution to the War Effort

- **War on Corrosion - Durabak Technology**
 - User friendly
 - Tough and flexible
 - Protects in the worst environments
- **War on Terrorism - CeaseFire Technology**
 - Thoroughly tested and validated
 - Very versatile
 - Under evaluation by: USA SmartTruck program, FCS
- **Synergies of the technologies**
 - ◆ Currently being evaluated by USN for use and storage onboard ships.