Fabric Structures for Corrosion Prevention

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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**Fabric Structures for Corrosion Prevention**

**ABSTRACT**

2010 U.S. Army Corrosion Summit, Huntsville, AL, 9-11 Feb

**SUBJECT TERMS**

**SECURITY CLASSIFICATION OF:**

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**LIMITATION OF ABSTRACT**

Same as Report (SAR)

**NUMBER OF PAGES**

25

**NAME OF RESPONSIBLE PERSON**

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Purpose

To provide information about the Shelter Technology, Engineering and Fabrication Directorate (STEDF) & PM Force Sustainment Systems (FSS), prototype fabric structures and currently available shelters that will assist the Warfighter with Corrosion Prevention and Control in specific corrosive environments.
Outline

• Overview of STEFD & PM FSS
• Corrosive Environments
• Protection from Weather
• STEFD Textile Technology and Prototyping
• Fabric Structures available and the protection they provide
• Conclusion
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Shelter Technology, Engineering & Fabrication Directorate

- Collective Protection Team
  - Development of Collective Protection Systems
  - Engineering Support to Fielded Systems
- Composite Structures Team
  - Shelter Development & Integration
  - Transportability Certification
- Design, Engineering & Fabrication Team
  - Rapid Prototyping & Mechanical Assemblies
  - Engineering Design & Reverse Engineering
  - Test & Analysis
- Fabric Structures Team
  - Collective Protection Technologies
  - Advanced Textile Materials & Structures
- Special Projects Team
  - Ballistic Protection for Shelters
  - Energy Management Technologies
STEFD Facilities

Tentage Prototype Shop
- Design and fabrication of tentage prototypes, accessories, special purpose covers and C/B resistant liner systems

Mechanical Fabrication & Assembly Shop
- Full service machine shop capable of fabricating prototype systems, refurbishing equipment degraded in the field, and modernizing and upgrading equipment

CAD & Rapid Prototyping Cell
- Creates 3-D CAD models, conducts engineering studies, finite element analysis and produces 3-D rapid prototypes from CAD data

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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
• PM FSS has life cycle management responsibility for more than 45 ACAT III programs with a total budget in excess of $0.5B over the POM.

• These programs provide direct and indirect life cycle support to soldiers in virtually any environment to include training, contingency and combat operations.

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Fabric shelters provide protection against a number of environments that can accelerate metal corrosion

- Moisture: greatest contributor to deterioration of metals
- Temperature: corrosion rates increase as temperature rises
- Sand, coral and mud: abrasion and wear of moving parts and coatings
- Sunlight: breaks down coatings that leave metallic surfaces unprotected
Protection from Weather

• Protection of the equipment from weather is one way to prolong its service life and cut back on the amount of maintenance required.

• Keeping vehicles or equipment stored under simple open-sided covered structures can reduce exposure to rain and direct sunlight.

• Completely enclosed structures are even better, and the best is a structure with a dehumidification system.
Textile Technologies

• Environmental Protection
  – Moisture, Sand/coral/mud, Sunlight
• Selectively Permeable Materials
  – Controlled air permeability
• Chemical & Biological Protection
• Reactive Materials
Fabric Structure Design & Prototyping

- Structural Textile Design
  - Military technical performance
- Specialty Material Expertise
- Tailored for Various Customer Needs & Applications
- Machine Shop
- Rapid Prototyping

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Fabric Structures

• There are many prototype fabric structures and standard shelters available to provide protection to military equipment and facilities
  – Airbeam Technology
    • Medium Airbeam Shelter (MASTER)
    • Aviation Inflatable Maintenance Shelters (AIMS)
  – Ultra-Lightweight Camouflage Net System (ULCANS)
  – Lightweight Maintenance Enclosure (LME)
  – Large Area Maintenance Shelter (LAMS)
  – Advanced Solar Cover (ASC)
Fabric Structures
Airbeam Technology

- Load Bearing Pressurized Fabric Structures
- Outstanding Strength to Weight Ratio
- Rapid Deployment with Reduced Time & Personnel
- Deflect Without Damage When Overloaded
- Advances Over Commercial Inflatables
  - Seamless Tubular Fabrication
  - High Pressure → Reduced Diameter & Surface Area
  - Optimized Design through Modeling and Simulation

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Fabric Structures
Medium Airbeam Shelter

- Ground vehicle & small aircraft maintenance
- 52 ft. by 40 ft.
- 14-in. diameter high pressure airbeams
- 463L pallet compatible
Fabric Structures
Aviation Inflatable Maintenance Shelter (AIMS)

First Generation Prototype, 2001

CH-47 Chinook

F-22 Raptor

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Fabric Structures
Aviation Inflatable Maintenance Shelter (AIMS 2G)

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• Protects ground tactical vehicles and aviation assets from multiple corrosive environments (moisture, sand, and sunlight)

• Designed for extreme environments
  – 10 psf snow load
  – 65 mph winds

• Tents can be closed providing the protection to internal vehicle parts as they are exposed during maintenance operations
• Provides multi-spectral cover, camouflage, concealment and deception
• Reduces visual, thermal, infrared and radar signatures
• Rhombus and hexagon shapes, can be connected to form nets for larger positions. 1-1.5 systems per HMMWV, 2 per 5 ton, 2-3 per medium-large tent etc.
• Special mission configurations can be made to accommodate unique sizes and/or mission profiles, large scale sizing etc.
• Many secondary benefits
  – 80%-90% reduction in solar load demonstrated
    • reduces environmental control unit (ECU) demands
    • Recent tests reflect a 22% average reduction in ECU power requirement and improved ECU efficiency
  – Protects equipment (tactical vehicles, structures, etc) from corrosive environments (sunlight and temperature)
    • Testing being conducted on the protection being provided from UV exposure on fabric (ie fuel and water bags)
A frame supported lightweight shelter designed to provide units with a covered facility to conduct tactical maintenance operations.

It is a modification of the Tent, Extendable, Modular, PERsonnel (TEMPER) where extensions are added to the tent frame to add the height needed for enclosure of tactical vehicles and equipment.

The end walls have been modified with sliding fabric doors permitting total enclosure during conditions of extreme weather or blackout.

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**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

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• Protects tactical vehicles from multiple corrosive environments (moisture, sand, and sunlight)

• Tent can be closed providing the protection to internal vehicle parts as they are exposed during maintenance operations
Fabric Structures
LAMS

- Large Area Maintenance/Repair Shelter for Helicopters, Tanks, and Wheeled Vehicles
- 75' W × 190' L × 31' H; Length is Modular in 12.5-ft. Increments
- Floor Area: 12,500 sf; Shelter Weight: 26,700lbs; Cube: 797 cu. ft.
- Set Up: Trained Crew is required. Typical set up time is 6-10 days by 10 person team.
- Features:
  - Lighting and Electrical Distribution System
  - Electric Winches for Endwall Doors - Manual back up

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TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.
• Protects tactical vehicles (helicopters, tanks and wheeled vehicles) from multiple corrosive environments (moisture, sand, and sunlight)

• Tent can be closed providing the protection to internal vehicle parts as they are exposed during maintenance operations
Fabric Structures
ASC Type I and Type II

• Protects Warfighters, equipment and supplies from harsh solar loading
• Lightweight fabric, open weave material, allow hot air to escape
• Complexible side to side & end to end to cover multiple shapes and sizes
• Pole supported (aluminum, telescoping)
• Reduces solar effects by 60%

Vehicle drive through capability

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Technology Driven. Warfighter Focused.
Conclusion

- STEFD has the facilities, expertise and experience to combine textile technologies and user requirements to produce shelters that assist with CPC
- PM FSS manages may standard fabric shelters that are available today to assist with CPC
- There are many fabric shelters available that provide protection against the many corrosive environments that exist
  - Airbeam Technologies (MASTER, AIMS)
  - ULCANS
  - Shelters (LME, LAMS)
  - ASC
- All of these shelters are available to assist the Warfighter with Corrosion Prevention and Control